Lake Hayward

2020 Aquatic Plant Management Final Report

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1.0 INTRODUCTION

The Property Owners Association of Lake Hayward hired SOLitude Lake Management to perform an aquatic plant management program for the summer of 2020. For over a decade, Lake Hayward has managed the non-native, invasive species, Fanwort (*Cabomba caroliniana)*. In addition, Lake Hayward has experienced growth of variable watermilfoil (*Myriophyllum heterophyllum*) and cyanobacteria/filamentous algal blooms.

The report below details the results of the early-and late season point-intercept surveys, algal sample analysis, dissolved oxygen and temperature profiles, and clarity readings. 2019 was the first year the point-intercept technique was instituted in the Lake Hayward management program. From 2003-2018, a transect survey was performed pre-and post-management to determine the density and distribution of invasive species, as well as the native plant assemblage. Due to improved techniques, it was agreed upon by Solitude Lake Management and the Property Owners Association of Lake Hayward that a point-intercept survey would be more appropriate to determine the complete distribution of submersed aquatic vegetation, with special regard to invasive species. 2020 marks the second year of point-intercept data collection. The report below outlines those results.

2.0 HERBICIDE APPLICATION

Multiple areas of the lake were treated with the Clipper (flumioxazin) and Reward (diquat) herbicides. Treatment was completed on June 23rd by SŌLitude Lake Management's licensed applicators. The treatment proceeded smoothly and with no observed adverse effects or difficulties.

Overall, the treatment worked well within the treatment areas and only a few areas of late growth were observed. Fanwort was observed primarily along the north-eastern and north-western shoreline; however, a single site on the south-western shoreline displayed presence of trace fanwort.

3.0 POINT-INTERCEPT SURVEYS

The pre-management point-intercept survey was conducted on May 28th and the post-management point-intercept survey was conducted on August 10th by a SOLitude biologist. These surveys were conducted by a 14-ft skiff along the established series of data points created in 2020. Refer to Figures 1-9 for point-intercept survey result maps. The raw data table (Appendix A) provides the actual data collected from each point.

A. Survey Methodology

Point Intercept Method

Solitude Lake Management's biologists surveyed the water body using the aforementioned survey points uploaded to a GPS unit. Please refer to **Figure** 1 for locations of data points. The following data will be collected at each of the survey points:

Species Identification

The rake toss method, based on protocols developed by Cornell University, was used to retrieve submersed aquatic vegetation from either side of the survey vessel. Two rake tosses will be carried out at each point; one on either side of the survey vessel. Each species found on the rake will be identified and recorded. Plant species

observed in the immediate area, but not found on either rake toss was also recorded. Any species not readily identified *in situ* was placed into a plastic bag labeled with the data point number and preserved for further analysis. Once all species were recorded, the most prevalent species was noted as dominant for later use in presence/absence maps.

Water Depth	Species Present
Relative Abundance of each species	Total Percent Cover of All Species
Biovolume Index	Total Percent Cover of Target Species

Relative Abundance

The abundance scale, developed by the US Army Corps of Engineers and modified by Cornell, was used to categorize total growth.

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: handful on rake
D	Dense: difficult to bring into boat

Percent Cover

Percent cover was defined as the percent of bottom sediments obscured by vegetation. In general, an area in which no sediments are visible was classified at 100% cover; at times, bottom sediments are not visible due to water clarity, regardless of vegetative growth. These points will be given a null ( ) designation, for data recording purposes.

Notation	Description
0%	No plant growth observed
1-25%	Little to no plant growth obscuring bottom layer
25-50%	Sparse patches of bottom cover
50-75%	Much of the bottom obscured by plant growth
75-100%	Little to no bottom coverage visibly

Percentage of Target Species

The immediate area around the boat was observed for growth of C. caroliniana and M. heterophyllum, and any other target species that potentially could be present. Each point will be assigned the appropriate percentage as seen in the list above.

Biovolume Index

The biovolume for each data point indicates the approximate height that plants are present in the water column. Each plant species is recorded on a scale from zero to four:

0	No biovolume	No plants
1	Low biovolume	Very low growth
2	Moderate biovolume	Growth extending up, into water column
3	High biovolume	Growth in water column and possibly to surface, may be considered a recreational or habitat nuisance
4	Very high biovolume	Growth filling the water column and covering the surface

B. Early-season Survey Results

A total of twelve native aquatic species, two invasive aquatic submersed species (fanwort and inflated bladderwort) and a single macro-alga (*Nitella spp.)* were identified during the May 28, 2020 survey (Table 1). Stonewort (*Nitella spp.)* was the most common species, present at 60% of the survey points, followed by fanwort (*Cabomba caroliniana, 21%)* and inflated bladderwort (*Utricularia inflata, 21%*). Spikerush (*Eleocharis spp.*) was present at 15% of survey points. All other species occurred at less than 10% of the survey points. Aquatic plant growth was still minimal at the time of the survey indicated by the low average biomass (1.54) and percent cover of all species (28.7%)

Fanwort was observed in nuisance densities in three coves; the western cover near Forrest Way, the eastern cove between the two ends on East Shore Drive, and the northern-most cove near Lake Shore Drive. Non-nuisance abundances were located along the shoreline throughout the lake.

C. Late-season Survey Results

A total of twelve (12) native aquatic species, two invasive aquatic submersed species (fanwort & inflated bladderwort), a single macro-alga (*Nitella spp.),* and filamentous algae were identified during the post-survey (Table 1). Stonewort was the most common species at this time, observed at 35% of survey points. Fanwort and inflated bladderwort were observed at 14% and 8% of survey points, respectively. Both invasives have seen a decrease in occurrence since the 2019 survey where they were collected at 22% and 20% of sites. Spikerush was present at 19% of survey points and can be found along the shallow shelf on the western shoreline. All other species occurred at less than 10% of the survey points. The average biovolume index remained low and submersed plants covered roughly 11% of the bottom at each survey point.

Fanwort was primarily observed in the shallow areas of the northern and southern ends of the lake; however, it was also observed in a few deeper areas and scattered along the shallow shoreline and south-western cove. It is likely that the spread of fanwort in the northern section, as well as the southern-most end, is due to the plant's ability to spread via fragmentation and the shallow nature of these two areas. In addition, the eastern wetland has an established populace of fanwort and is not allowed to be treated with herbicide due to sensitive species; therefore, this inlet remains a constant contributor to the fanwort present in the lake.

Table 1: Submersed aquatic vegetation found in Lake Hayward

		2020		2019	
Common Name	***Scientific Name***	**Pre (%)**	**Post (%)**	**Pre (%)**	**Post (%)**
Fanwort	*Cabomba caroliniana*	21	14	19	22
Water Starwort	*Callitriche spp.*	1	0	3	1
Spikerush	*Eleocharis sp.*	15	19	16	15
Pipewort spp.	*Eriocaulon spp.*	3	2	0	3
Quillwort	*Isoetes sp.*	0	0	22	0
Whorled Watermilfoil	*Myriophyllum verticillatum*	0	0	0	2
Southern Naiad	*Najas guadalupensis*	0	0	0	8
Stonewort	*Nitella sp.*	60	35	49	62
Yellow waterlily	*Nuphar lutea*	3	3	2	3
White waterlily	*Nymphaea odorata*	6	1	2	6
Floating Heart	*Nymphoides sp.*	3	1	0	3
Large-leaf Pondweed	*Potamogeton amplifolius*	1	0	0	1
Snail-seed Pondweed	*Potamogeton bicupulatus*	4	0	0	4
Ribbon-leaf Pondweed	*Potamogeton epihydrus*	2	0	0	2
Leafy Pondweed	*Potamogeton foliosus*	4	1	4	5
Thin-leaf Pondweed	*Potamogeton pusillus*	0	0	0	0
Spiral-fruited Pondweed	*Potamogeton spirillus*	8	0	0	8
Marsh Mermaid-weed	*Proserpinaca palustris*	1	0	0	1
Arrowhead	*Sagittaria sp.*	4	4	5	4
Floating Bur-reed	*Sparganium fluctuans*	6	0	0	7
Humped Bladderwort	*Utricularia gibba*	3	1	10	3
Inflated Bladderwort	*Utricularia inflata*	21	8	0	21
Purple Bladderwort	*Utricularia purpurea*	0	0	21	0
Common bladderwort	*Utricularia vulgaris*	3	3	0	3

*n=100; Red indicates invasive species

3.0 WATER QUALITY

During the May and August surveys, secchi disk transparency readings, dissolved oxygen, temperature readings, and phytoplankton (algae) samples were taken in two locations (Site #1 – South End & Site #2 – North End) on the lake. Tables 2 & 3, split into sample location, present this data.

Dissolved oxygen and temperature readings for May and August are average for this region of Connecticut. Dissolved oxygen remained stable throughout the water column in both the north and south locations. Secchi clarity at more than 4 feet in depth is desirable; any less than 4 feet may indicate an algae bloom. Both locations displayed desirable clarity during both visits.

Table 2: Water quality data for the south end of Lake Hayward

South						
Depth (Meters)	**Dissolved Oxygen (mg/L)**		**Temperature (°C)**		**Water Clarity (Feet)**	
	5/28	**8/14**	**5/28**	**8/14**	**5/28**	**8/14**
SW	8.67	7.89	22.2	29.05	6	11
1	8.72	7.81	21.9	28.65		
2	8.89	7.86	20.8	28.35		
3	9.01	8.02	19.2	27.60		
4	9.06	8.05	18.2	27.28	**pH**	
5	9.08	8.08	17.0	27.15	7.5	7.0
6	9.27	7.91	14.6	26.88		
7	9.03	6.84	14.0	26.65		
8	8.36	5.31	13.4	26.24		
9	7.73	2.00	13.2	22.91		
10	7.20	1.83	12.9	19.85		
11	5.60	1.81	12.8	17.65		

Table 3: Water quality data for the north end of Lake Hayward

North						
Depth (Meters)	**Dissolved Oxygen (mg/L)**		**Temperature (°C)**		**Water Clarity (Feet)**	
	5/28	**8/14**	**5/28**	**8/14**	**5/28**	**8/14**
SW	8.80	7.45	22.00	28.2	11.5	11.0
1	8.76	7.09	22.1	27.5		
2	8.75	7.98	22.1	27.5		
3	8.73	7.96	22.1	27.1		
4	8.66	7.85	22.1	27.11	**pH**	
5	8.72	7.35	21.8	27.05	7.4	7.0
6	8.90	6.32	21.4	26.9		
7	8.99		21.1			
8	9.22		19.9			
9	8.58		8.58			

The chart below outlines the secchi depth (feet) clarity between 2004 and 2020. At no point in this 15-year period has the secchi clarity dropped below 5.0 feet in both the south and the north end of the lake. This indicates that Lake Hayward has maintained desirable clarity for over a decade of time.

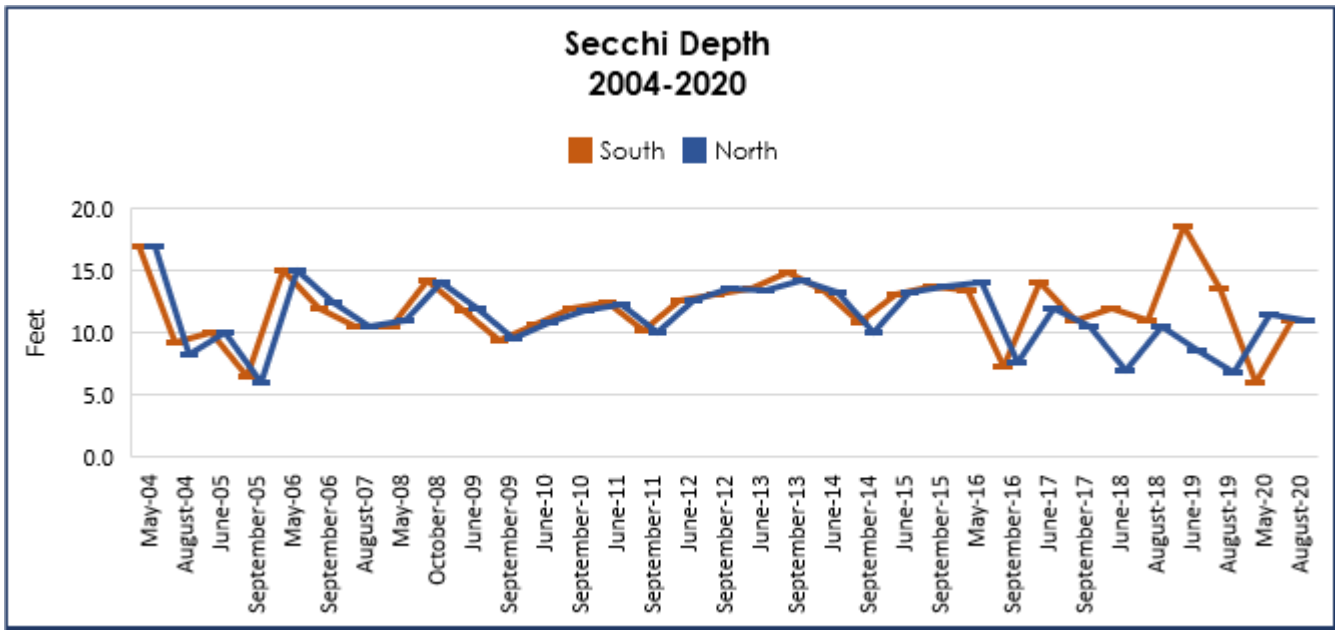

Table 4: Phytoplankton counts in Lake Hayward

Phytoplankton Counts (cells/mL)				
Family	**South**		**North**	
	5/28	8/10	5/28	8/10
Diatoms	39	0	210	80
Biraphid Pennate	0	1,200	0	270
Chlorophytes	306	0	150	300
Desmids	0	0	0	180
Cyanophyta	0	7,700	0	5,400
Filamentous Non-Nitrogen Fixers	0	40,000	0	15,400
Total Blue-green cell count	40	0	70	0

Cyanobacteria is naturally occurring in aquatic systems; thus, its presence in a lake system does not indicate poor water quality. The World Health Organization (WHO) determined that 70,000 cells/mL is the suggested threshold at which human health is at risk. A negligible amount of cyanobacteria was observed during the May and August sample collections. Algae sample results indicate that green algae (Chlorophyta) was present during the August collections (15,000 cells/mL). Depending on conditions observed in the lake by both Solitude Lake Management and Property Owners Association of Lake Hayward, algaecide applications will be decided when necessary.

4.0 MANAGEMENT RECOMMENDATIONS

A similar monitoring program is recommended for 2021. This will include detailed, point-intercept pre- & post-treatment vegetation surveys and three rounds of water clarity measurement and algae sampling (one to be collected by the Association).

We also recommend continuing with the approach of conducting partial lake treatment with the Clipper/Reward herbicides to control fanwort. This year's treatment resulted in a decrease of 8 points in fanwort and 14 points in inflated bladderwort abundances. Regarding the 2021 treatment areas, we recommend treating fanwort in the northern and southern basins as observed during the post-treatment survey. However, by combining fanwort distribution observed during the 2020 fall survey with the 2021 early-season fanwort survey results, the final treatment areas will be decided on in spring of 2021. The option should be left open to target the densest areas of fanwort growth and again use an increased dose of Clipper in some areas that may be subject to more dilution.

Our goal will be to keep the overall total treatment acreage at a similar level each year. Depending on the growth stage of the fanwort, to be determined during a pre-treatment survey in late May/early June, and the level of lake out-flow; treatment will likely occur sometime in mid-late June or July. Following treatment, all uses of the lake will be restricted for the remainder of the day. Additionally, the lake water should not be used for drinking, livestock watering and irrigation for 5-days following treatment. Should algaecide treatments for filamentous or microscopic algae be required or requested, we would recommend treatment with the Cutrine Plus algaecide. Algae have been intermittently problematic in some areas of the lake and we would defer to the Association to decide if and where treatment is needed.

We trust this report provides information to guide your future management decisions at Lake Hayward. If you have any questions, please feel free to give us a call. It has been a pleasure working with you this year and we look forward to continuing work with you and the Association in the future. With your permission, we'll forward a copy of this report to the appropriate parties at CT DEEP.