Town of Barnstable
2014 Hydrilla Control Program:
Long Pond, Mystic Lake & Middle Pond

Hydrilla (*Hydrilla verticillata*) Management Program Activities

Project Completion Report for 2014 Hydrilla Management Tasks Performed at Long Pond, Mystic Lake, and Middle Pond – Barnstable, MA

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Town of Barnstable

Prepared by:

AQUATIC CONTROL TECHNOLOGY

The following report summarizes the 2014 Hydrilla Management Programs at Long Pond, Mystic Lake, and Middle Pond in Barnstable, MA. The report will discuss results of the vegetation and tuber monitoring performed at all three waterbodies as well as the chemical and non-chemical controls performed at Mystic Lake and Middle Pond.

Long Pond

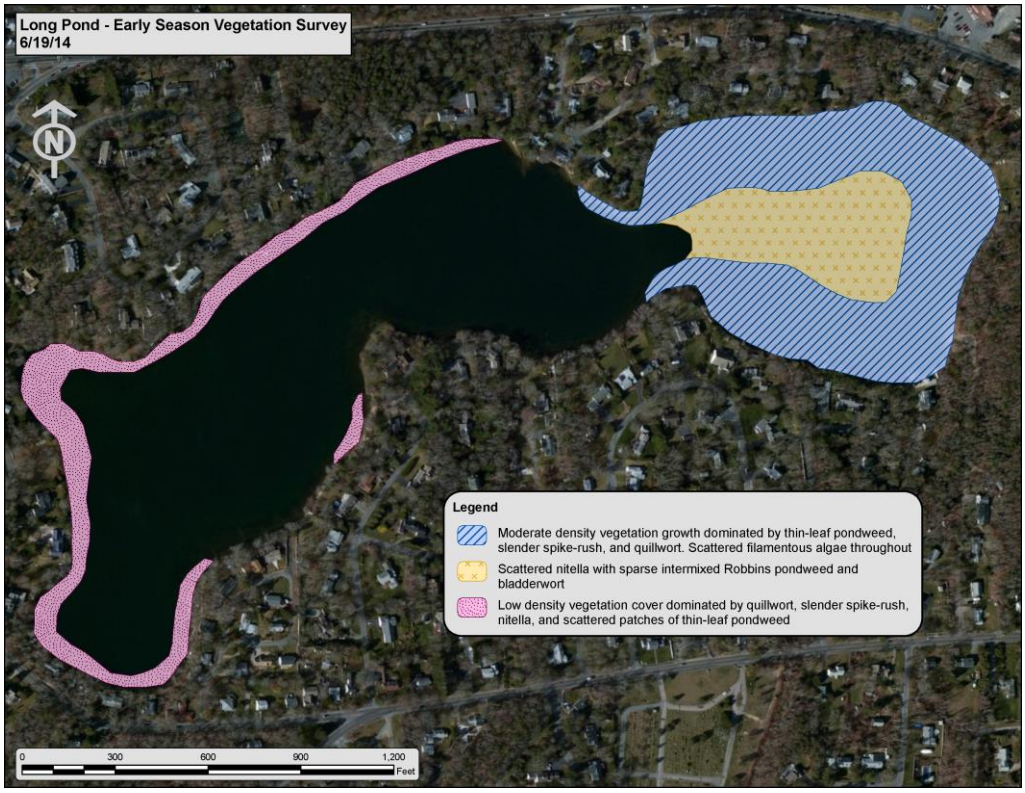
In-lake work performed at Long Pond consisted of early and late season vegetation surveys and several other inspections. No hydrilla was found during any of the surveys or inspections performed in 2014, so no active management tasks were recommended or performed.

Early-Season Survey

An early season survey was performed on June 19. During the survey the littoral zone of the pond was systematically toured by two snorkelers.

Vegetation composition and distribution was generally consistent with previous years and was dominated by: stonewort (*Nitella sp.*), bladderwort (*Utricularia sp.*), quillwort (*Isoetes sp.*), thin-leaf pondweed (*Potamogeton pusillus*), and slender spike rush (*Eleocharis tenuis*), with lesser amounts of golden hedge hyssop (*Gratiola sp.*), robbins pondweed (*Potamogeton robbinsii*), ribbon-leaf pondweed (*Potamogeton epihydrus*), and filamentous algae.

Figure 1 – 2014 Early Season Vegetation Distribution Map



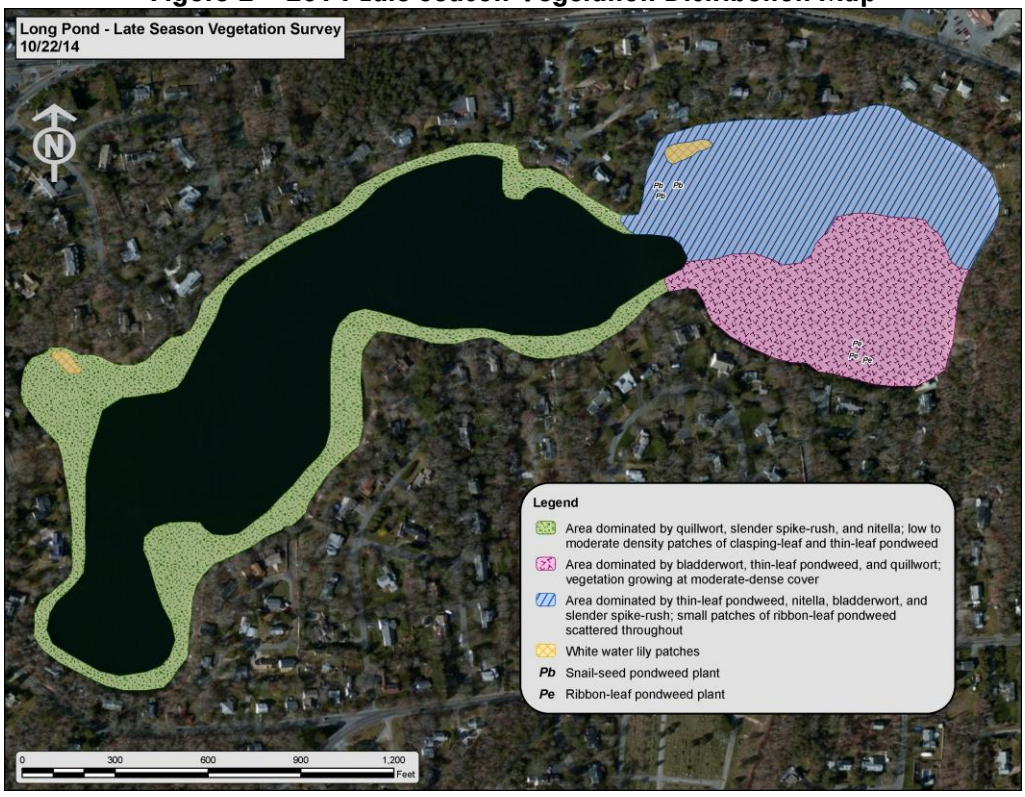
The greatest density and diversity of plants remains in the eastern basin, where despite repeated treatment native pondweeds and bladderwort have continued to increase over the past few years. Aquatic plant growth in the middle portion of the pond and in the western basin remains confined to the narrow littoral area. Plant growth in these areas was less diverse consisting primarily of low-density quillwort and thinleaf pondweed with scattered occurrences of slender spikerush, snailseed pondweed, and robbins pondweed. A map of the representative conditions observed on June 19 is depicted above.

Late-Season Survey

Two additional surveys were conducted on July 29 and October 22. During each of the surveys the entire shoreline of the pond was visually toured using a Jon boat and underwater camera. In addition to the visual ID and assessment of the vegetation growth random samples were collected using a throw rake. Dominant plant species were identified and various assemblages' distribution and density were characterized.

The vegetation composition observed on October 22 was similar to what was recorded in June and was dominated by: bladderwort, ribbon-leaf pondweed, thin-leaf pondweed, clasping-leaf, quillwort which were abundant throughout the littoral area of the pond, particularly the east basin. Plant richness and diversity remained greatest in the eastern basin where a total of different species were observed growing at moderate densities. Aquatic plant growth in the middle portion and western basin remained dominated by low-density growth of quillwort, nitella and slender spikerush, which accounted for greater than 95% of the vegetation observed in these portions of the lake. Some scattered growth of thin-leaf pondweed, robbins pondweed and clasping-leaf pondweed (*Potamogeton richarsonii*) were also observed. Low density patches of white waterlily were also noted in the cove along the northern shore in the western basin. A map of the representative conditions observed on October 22 is depicted below.

Figure 2 – 2014 Late Season Vegetation Distribution Map



Hydrilla Tuber Sampling

Again, no active hydrilla growth was found in Long Pond during the 2014 season. As a result no tuber sampling was performed in Long Pond.

Mystic Lake

The following portion of the report will discuss the hydrilla management tasks performed at Mystic Lake and Middle Pond in 2014. In addition we have also included recommendations for the continued management of the hydrilla in these waterbodies in the future.

The 2014 management program consisted of assessment, monitoring, and active management hydrilla management tasks (Aquathol K treatment, DASH, and benthic barrier installation). A brief outline of the 2014 Management Program is provided in the following chronology. All work performed in 2014 was consistent with the Order of Conditions issued for this project and the DEP License to Apply chemicals (#14248)

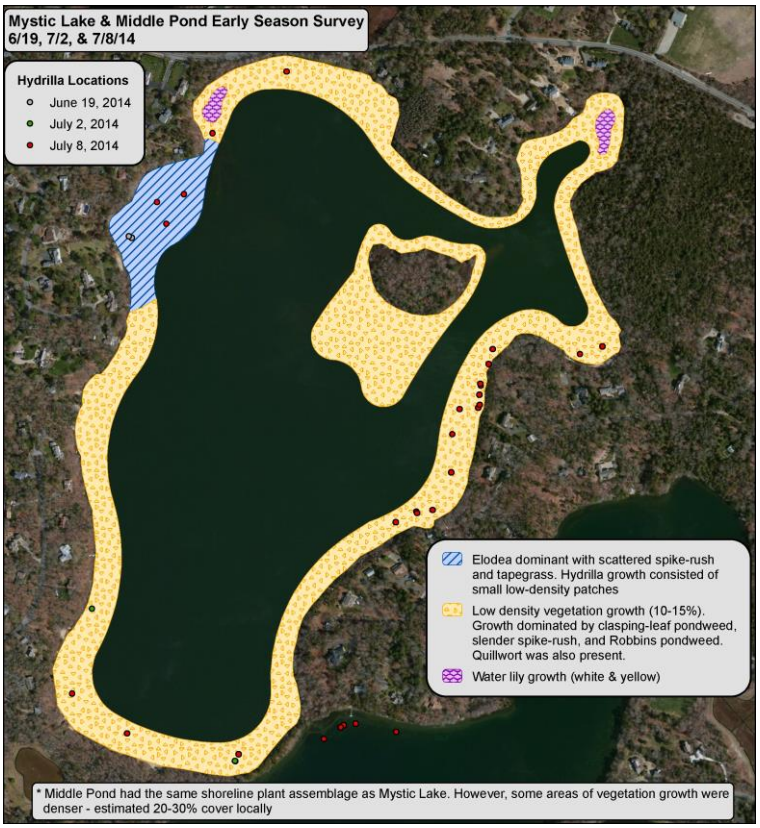
2014 Treatment Program Chronology

- Received approved MA DEP *License to Apply Chemicals* 6/12/14
- Pre-Treatment tuber sampling & Initial vegetation survey 6/19; 7/3; 7/8/14
- Split-treatment with Aquathol K 7/8; 7/9/14
- Interim vegetation inspections 7/29; 8/6; 8/28
- DASH and benthic barrier deployment 9/2-9/9/14
- Post-Treatment vegetation survey & tuber density sampling 10/20; 10/22/14

Pre-Treatment Survey

A pre-treatment survey was performed on June 19. During the survey the shoreline of Mystic Lake was snorkeled and systematically toured with a boat using an underwater camera. The vegetation was identified visually and by plant collection with a throw-rake.

Figure 3 – 2014 Pre-Treatment Vegetation Distribution



Vegetation growth at the time of the June 19 survey was very sparse and only a few hydrilla occurrences were identified at that time. The emergence of hydrilla in this area has historically been later than other species; however, on account of the cooler spring in 2014 we suspect that widespread active growth was delayed by a couple of weeks. For this reason the hydrilla infestation was surveyed several times (7/3 and 7/8) in order to compile an accurate depiction of the 2014 hydrilla infestation. The hydrilla growth observed later in the summer suggested a similar level of hydrilla growth outside of the Area A treatment area, but significantly less within the treatment area.

The vegetation growth as a whole was generally confined to the immediate shoreline, extending roughly 75-100' feet from shore to a depth of 10-12 feet creating a contiguous ring around the lake. The plant assemblage was generally characterized by low-density growth of clasping-leaf pondweed (*Potamogeton perfoliatus*) and tapegrass (*Vallisneria americana)* with scattered occurrences of hydrilla (mostly individual plants), common waterweed (*Elodea canadensis*) and slender spikerush. As in 2013, the only area that supported larger denser patches of hydrilla growth was the Area A cove along the western shore (the ~5.5 acre area designated herbicide treatment area). This area supported several moderate density patches of hydrilla. At the time of the surveys the hydrilla growth was still relatively immature and was only 4-5" inches in height. A map of the representative conditions observed on July 8 is above.

<u>Summary of 2014 Treatment</u>

Treatment of the 5.5 acre cove area was performed on Tuesday July 8 & Wednesday July 9 (see picture right).

The treatment was conducted with an 18 foot work skiff equipped with a specialized low pressure spray system. The liquid Aquathol K herbicide was applied subsurface using weighted hoses to avoid aerial drift of the herbicide. The treatment boat was equipped with a Differential/WAAS GPS navigation system to insure that the herbicide was evenly applied to the designated treatment area.

Treatment was performed as a split application whereby roughly 50% of the herbicide was applied to the designated treatment area on the first day of treatment and then the remaining 50% was applied 12 hours later. The 2014 treatment strategy was modified slightly to reduce the lag-time between applications in order to increase concentration-exposure-time (CET) and subsequently enhance the effects on the targeted hydrilla growth. Aquathol K herbicide was applied at a target

dose of 1.5 ppm during each application for a total dose of 3.0 ppm over the course of the two day treatment.

Diver Assisted Suction Harvesting (DASH) and Benthic Barrier Deployment

Following an additional hydrilla inspection in late August (8/28) the DASH work to control the scattered hydrilla growth outside of the Area A treatment area was scheduled. The work was initiated on September 2 and completed on September 9. The hydrilla growth during this period averaged only 1 ft.-2 ft. tall and no evidence of turion or tuber production was observed on any of the collected plants. Based on the size and density of the identified hydrilla growth the plants were either suction harvested or covered with bottom barriers from other locations in the lake. The entire littoral zone of Mystic Lake was inspected by the DASH diver crew twice. The bulk of the hydrilla growth areas that were addressed were located on the eastern shoreline of the lake (See DASH location map). A general summary of the extent of the non-chemical control effort is outlined below.

- More than 24 different locations were addressed during the eight day non-chemical control effort. Some growth locations that were identified were so close to existing barrier locations or previously recorded growth sites that additional GPS points were not recorded.
- A total of eight bottom barriers were redeployed over larger hydrilla patches - four in the south end of Section B and four in the "cut" area of Middle Pond.
- A total of 36 gallons of hydrilla biomass was suction harvested from Mystic Lake and Middle Pond.
- In addition to the DASH and bottom barrier work performed by Aquatic Control, Indian Ponds Association volunteers performed additional barrier redeployment and hand-pulling.

Post-Treatment Inspections and Survey

Inspections of the treatment area were performed on July 29, August 6, August 28, and October 20. During all inspections and surveys the treatment area was evaluated by an Aquatic Control biologist to assess treatment impact and hydrilla and non-target plant viability.

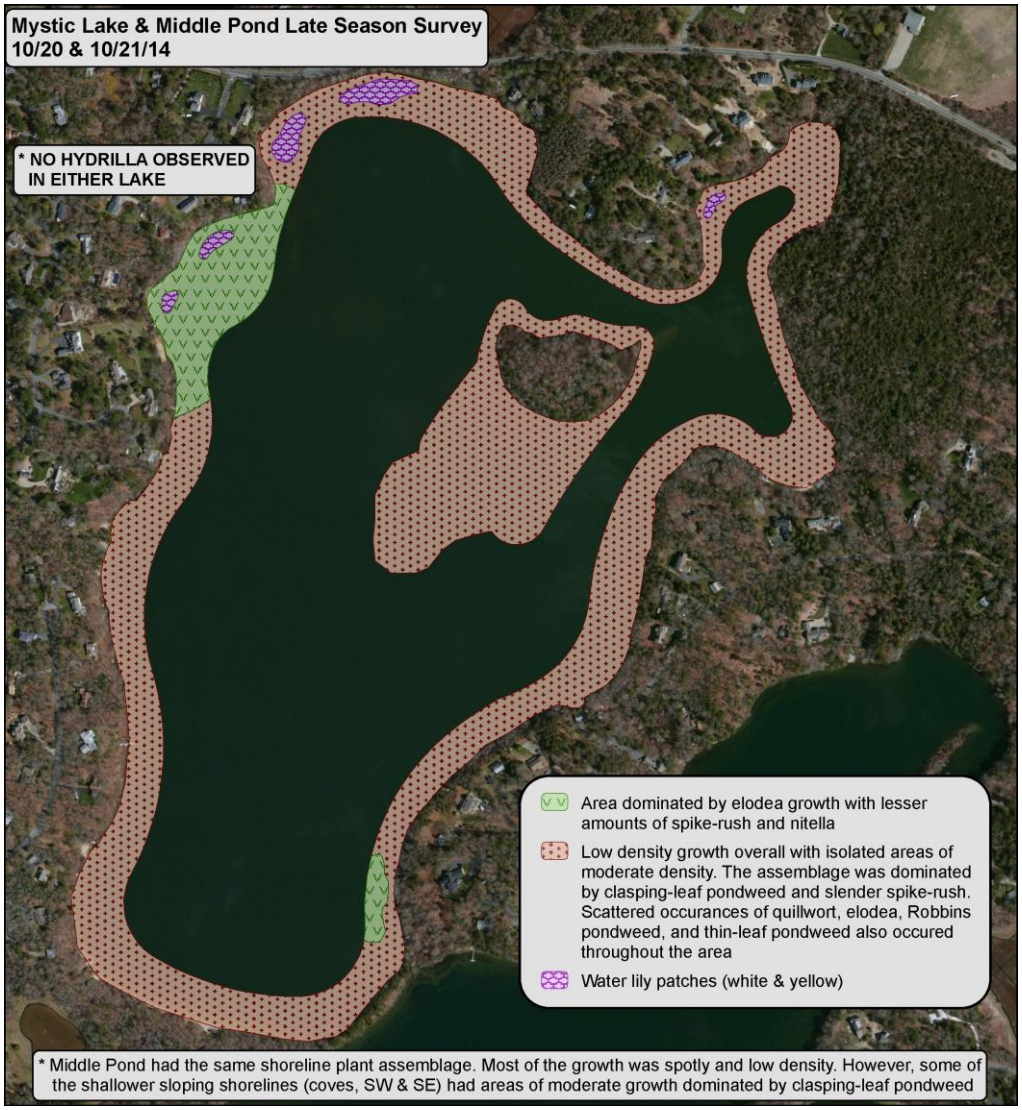
Unlike the 2013 treatment, impacts to the hydrilla were quick to develop. In fact, at the time of the first post-treatment inspection the hydrilla plants showed advanced symptoms of the herbicide treatment. At the time of the inspection the plants were missing most of their foliage, had darkened stems, and displayed a moderate level of decomposition. It was determined at this time that none of the hydrilla plants within the treatment area were viable. At the time of the August 6 inspection, no hydrilla plant material was observed within the treatment area. Successful hydrilla control was achieved within 3-4 weeks after the Aquathol K treatment, which is significantly faster and more complete than what was observed following the 2013 treatment.

The hydrilla outside of the treatment area was assessed during each of the interim inspections (7/29, 8/6, 8/28) in order to optimize the scheduling of the non-chemical control effort. Although we had originally intended to perform two hand-pulling efforts, the late and staggered emergence of the hydrilla at Mystic Lake and Middle Pond allowed one late season effort to be sufficient to provide optimal control. At the time of the August 28 inspection the hydrilla plant growth was more abundant throughout the remainder of the lake and the plants remained relatively small, with an average height of only 1-2 ft.

The final post-management survey was performed on October 20 and 22. The survey was conducted from an aluminum skiff using and underwater camera and a throw rake. The entire littoral zone was visually inspected and randomly sampled. No hydrilla plants, plant fragments, or reproductive propagules were found during the final survey. The native vegetation assemblage remained relatively unchanged from that which was observed prior to management activities. The only notable

changes were that the maturity and distribution of the native plant growth had increased from conditions observed on June 19 and that there was a reduced level in clasping-leaf pondweed within the herbicide treatment area. Although the clasping-leaf pondweed growth was diminished following the herbicide treatment, seed producing individual plants were observed during the final inspection. We therefore feel that the impacts to the clasping-leaf pondweed population within the treatment area will only be temporary in nature. The native plant growth as a whole, however, remained healthy throughout Mystic Lake and Middle Pond with no observed impacts on non-target species outside of the treatment area. Elodea, which dominated the treatment area pre-treatment, remained healthy, actually increasing in density. Outside of the treatment area, vegetation distribution and composition was similar to what was recorded in late August and was characterized by low-moderate density cover of clasping-leaf pondweed, nitella and tapegrass. Healthy growth of thin-leaf pondweed, robbins pondweed, slender spikerush and quillwort were also common and wide-spread but typically secondary in abundance to the more dominant species.

Figure 4 – 2014 Post-Treatment Vegetation Distribution



HYDRILLA TUBER SAMPLING

Sampling of tubers and turions pre and post-treatment was performed to quantify changes in their densities. The sampling was conducted by replicating the sample collection methods and sites established in 2013. Ten replicate samples were collected from each of the four one square meter sample sites using a modified post-hole type digger. Each of the sediment samples were screened on site to extract all tubers and/or turions present.

A summary of the tuber sampling performed at Mystic Lake in 2014 follows:

Table 3 - 2013 Pre & Post-Treatment Tuber Sampling Data – Mystic Lake

Sampling Locations	Qualitative Sediment Type	Pre-Treatment – July 8, 2014	Post-Treatment – Oct. 20, 2014
Site # 1	Sand and gravel	11	7
Site # 2	Sand and gravel	9	2
Site # 3	Sand and gravel	8	1
Site # 4	Sand and gravel	1	1
Total # of Tubers		**29**	**11**

- Sample sites 1-3 were located in the 5.5 acre treatment area where hydrilla densities were greatest and site 4 was located along the southern shoreline where an abundance of small hydrilla patches had been observed over the years.
- Based on the pre-treatment tuber sampling the tuber density within the designated treatment area was 9.7 tubers/m^2, which is roughly a 39% reduction from the 2013 pre-treatment tuber density.
- Following the Aquathol K herbicide treatment the tuber density was reduced to 3.7 tubers/m^2. This represents an approximate 62% reduction from pre-treatment and a 77% reduction since the start of the treatment program in 2013.

MANAGEMENT RECOMMENDATIONS

We are again happy to report that no hydrilla growth or viable tubers were observed at any time during the 2014 season at Long Pond. This marks the second consecutive year that Long Pond has been hydrilla-free since it was first discovered in 2001. Given the potentially lengthy dormancy of hydrilla subterranean tubers, we cannot be fully certain that this lack of growth represents eradication; however, we are hopeful that the lack of growth is a sign of extended long-term control, at a minimum. Based on the current vegetation growth conditions this past season we again do not anticipate that active hydrilla management will be required at Long Pond in 2015. We strongly recommend, however, that the Town continue to monitor the vegetation community in Long Pond for at least the presence/absence of hydrilla. Early detection of any hydrilla regrowth will be critical to a rapid management response and ultimately sustaining long-term control of hydrilla in Long Pond.

<u>Mystic Lake</u>

The Aquathol K treatment continues to provide good control of the target hydrilla, in fact, the 2014 modified treatment approach provided faster and more complete control than in 2013. We are, therefore, confident that the Aquathol K treatments have successfully prevented hydrilla propagation within the treatment area and as a result achieved a reduction in the overall hydrilla infestation in this area.

The smaller scale non-chemical control strategies employed elsewhere in the lake and in Middle Pond have also provided good short-term hydrilla control. However, based on the historic hydrilla distribution it appears that the frequency of occurrence outside of the herbicide treatment area continues to increase along with the level of annual non-chemical control. As a result, we feel the current management strategy for low density hydrilla (DASH and bottom barrier) is unlikely to achieve eradication in this case. Attempting to achieve eradication requires the control of all hydrilla plants in order to prevent successful tuber and/or turion production. The sizeable littoral zone coupled with the widely scattered low density growth of the hydrilla in Mystic Lake and Middle Pond makes identifying and removing every individual plant difficult if not impossible. These inherent limitations undoubtedly results in the successful propagation of some plants within the population. It is therefore our opinion that the management program be modified in order to further limit the potential for successful hydrilla propagation and increase the potential for sustained long-term control and/or eradication.

Based on our hydrilla management experience at Long Pond and elsewhere, we feel that Sonar (fluridone) herbicide treatment offers the best potential for eradication at Mystic Lake and Middle Pond. Moneicous hydrilla is extremely susceptible to fluridone allowing for effective control at extremely low concentrations (4 ppb) and with the advances in Sonar pellet formulations, effective partial lake treatment can be achieved. By maintaining a Sonar dose lethal to hydrilla throughout the infested areas we can effectively eliminate the long-term management limitations of DASH and bottom barriers. The widely varied emergence of active hydrilla will no longer be a significant concern and finding each and every plant to insure full control will not be necessary. The cost of a Sonar treatment program will also be less volatile and potentially more sustainable than the ever increasing DASH requirements.