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Coventry Lake – Hydrilla Management Program

2017 Final Report

February 2018

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ENERGY & ENVIRONMENTAL PROTECTION

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SŌLITUDE
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NORTHEAST AQUATIC RESEARCH

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Introduction

Hydrilla (*Hydrilla verticillata*) were first discovered at Coventry Lake in September 2015 when a number of fragments where found at the State of CT boat ramp. In response, the Connecticut Department of Energy and Environmental Protection (CT DEEP) contracted with SOlitude Lake Management (SLM) who teamed with Northeast Aquatic Research (NEAR) to provide rapid response. Initial action was to intensively survey Coventry Lake (Oct.31st & Nov. 2nd, 2015) to find sites where Hydrilla was growing. Once plant beds were identified a plan; *2015 Hydrilla Survey & Management Plan for Coventry Lake,* was developed to control and manage the infestation of Hydrilla. An herbicide permit was obtained for a 9-acre Aquathol-K (endothall) treatment targeting the two Hydrilla beds identified and mapped during 2015 survey and verified by similar intensive surveys on July 5th, & 6th, 2016. Herbicide treatment was performed in August 2016.

During the late summer intensive post-treatment survey (Sept. 2nd & 8th, 2016) Hydrilla in both treated areas appeared to be in a state of decay. However, that survey also revealed one new Hydrilla location found via rake toss about 250 feet off shore of State of CT boat ramp. This small (3'x3') new patch was confirmed through underwater investigation in October 2016. Detailed documentation of the 2016 herbicide treatment and all survey work can be found in; *2016 Coventry Lake Hydrilla Management Report*.

The management plan for controlling Hydrilla in Coventry Lake calls for annual investigations and ongoing adaptive control efforts. This report documents all 2017 Hydrilla management efforts at Coventry Lake.

Management Approach

The ultimate goal of management is to achieve full managed eradication of Hydrilla in Coventry Lake. Treatments and bottom barriers are meant to minimize the presence of Hydrilla biomass which will prevent further spread of the infestation. For 2016, the primary focus of management was to control the known areas of Hydrilla growth using partial lake treatments with Aquathol-K (endothall). Based on the most recent experience with managing Hydrilla growth in the region, this was chosen as the best option for effective treatment given the known characteristics of the infestation. Treatments in 2017 continued with the endothall herbicide, using a higher applied dose and utilizing both liquid and granular formulations. Additionally, based on findings in late 2016, bottom barriers were utilized in areas of small, isolated growth, which did not lend itself well to herbicide treatment.

Permitting

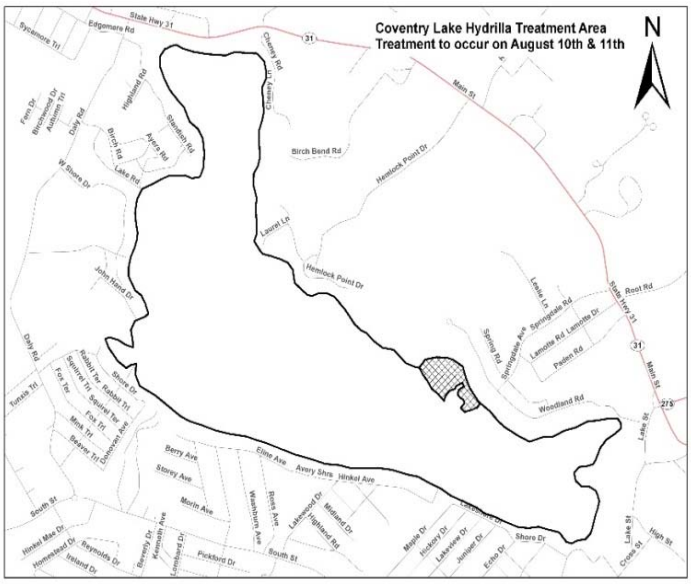
SOLitude submitted a permit application to CT DEEP in June 2017 to conduct treatment of the Hydrilla with Aquathol-K, which was approved in mid-July. The application was later amended to include the use of granular Aquathol-K. The amended permit was received in early September.

Herbicide Treatments

The following specific herbicide applications were conducted in 2016 & 2017.

2016 Treatment

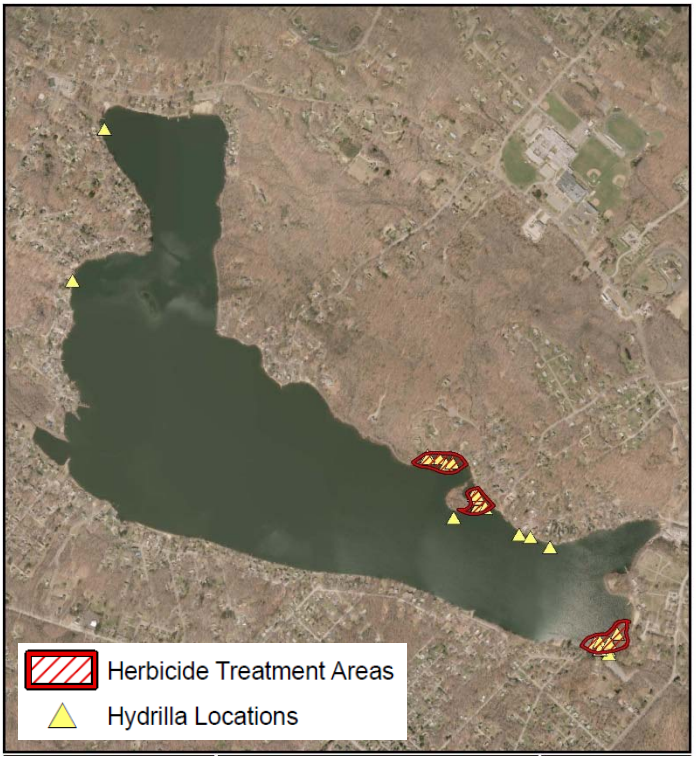
- Initial treatment on August 10th & 11th of 9-acre cove. (**Map 1**)
- Two 1.5 parts per million (ppm) Aquathol-K doses each day (3 ppm total).
- Treatments were conducted about 16 hours apart to increase the duration exposure of plants to herbicide.
- Initial post-treatment survey results showed prolonged Hydrilla growth after treatment, but eventual decay by October 16, 2016.



Map 1 - 2016 Initial Treatment Areas

2017 Treatment

- Treatment was performed on September 28th in areas of the island cove plus around the boat ramp. (**Map 2**)
- Treatment occurred later than planned due to funding and contractual delays.
- Treatment included a combination of liquid and granular formulations of the endothall (Aquathol-K & Aquathol Super K) herbicide to achieve a total dose of 5 ppm.
- Liquid herbicide was applied in the morning and the granular herbicide was applied in the afternoon, approximately 6 hours apart.
- Post treatment survey on October 18, 2017 showed plants were unaffected.
- November follow-up found plants still present in northeastern bed.



Map 2 – 2017 Management Areas

Aquatic Plant Survey Timeline & Data

The following is a discussion on results of the various surveys conducted this year at Coventry Lake.

August 9-10, 2017

- Whole lake pre-treatment survey consisted of a boat survey team for the entire lake, and a shallow water snorkel search in the two original island cove areas. Remove fragments from boat ramp.

- Total of 300 waypoints collected throughout littoral zone. All invasive and native species present at each waypoint were recorded. A total of 22 aquatic plant species were found.

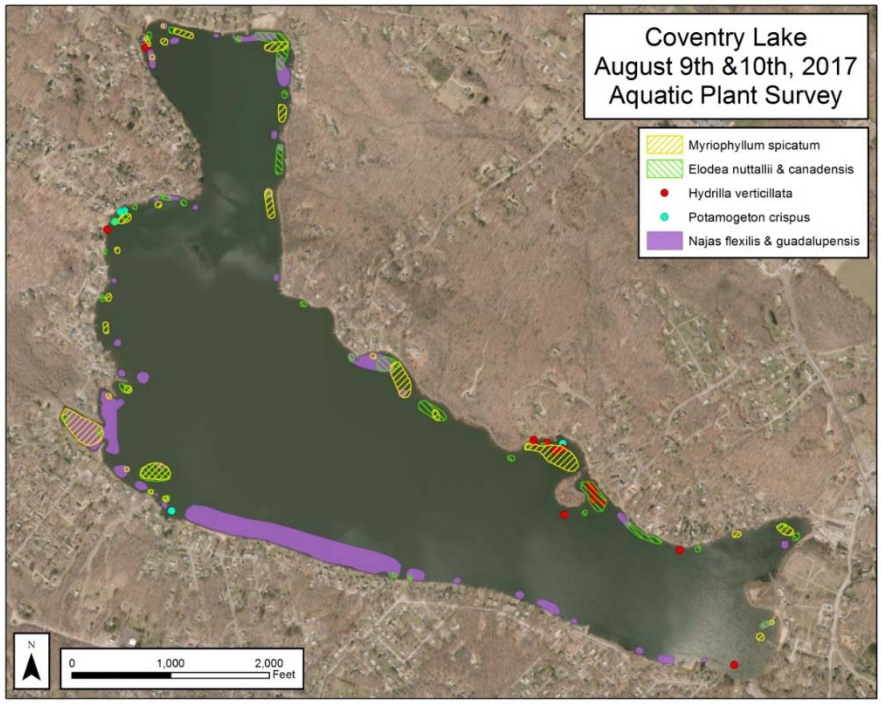
- The most dominant aquatic plant species lake-wide were: *Zosterella dubia, Ceratophyllum demersum, Nitella sp., Najas flexilis* & *guadalupensis, Myriophyllum spicatum* (invasive), and *Elodea nuttallii* & *canadensis*. Dominant species displayed in **Map 3**.

- 20 new waypoints with Hydrilla (waypoints were made at each bed so some points are grouped together where there are clusters of beds). Also remove many floating Hydrilla fragments.

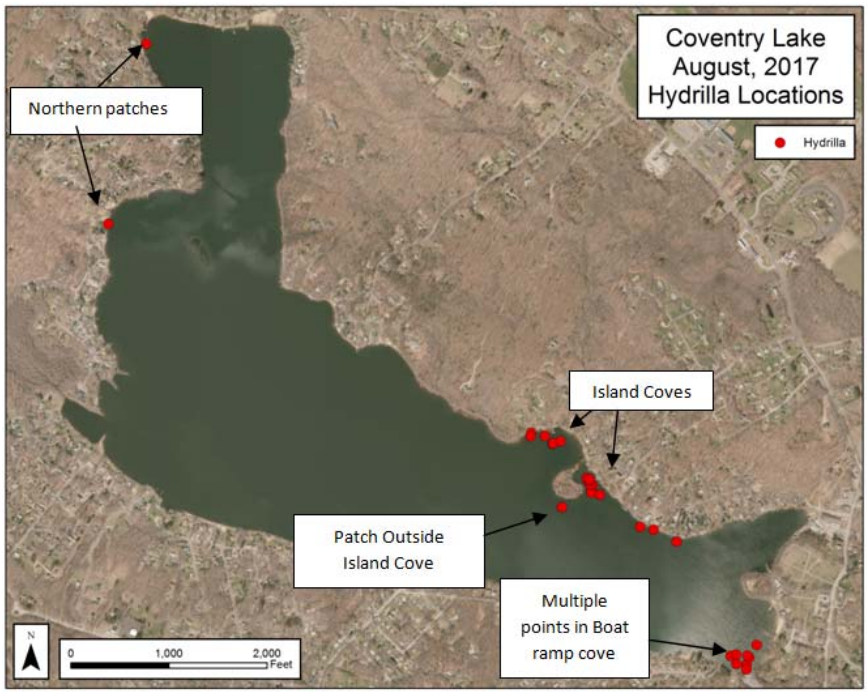
- Two new small (3'x3') Hydrilla patches found in northern part of lake (**Map 4**).

- Many scattered small Hydrilla plants on both sides of the island cove area in <2' of water. Snorkel surveyor removed multiple plants, but this finding provides further evidence that Hydrilla fragments are spreading and starting new patches lake-wide.

- One new larger patch was found by the snorkel surveyor in 8'-12' of water, just outside the island. Bed size was estimated to be about 10'x12'.



Map 3: August 9-10th, 2017 Dominant Species and Hydrilla Points



Map 4: August 9-10th and 16th, 2017 Hydrilla Locations (pre-treatment survey results)

August 16, 2017

- Underwater survey of boat ramp area and partial shoreline survey from Island cove shore towards the outlet/dam cove.

- Transect survey was conducted in fan-like pattern from the State boat ramp dock. [Notes on page 10] Survey boat followed diver to pick up waypoints; waypoints and diving notes were used to create the August 2017 Hydrilla map (**Map 4**).

September 26, 2017

- Post-treatment Hydrilla bed investigation. Benthic barrier not yet installed on non-treated patches.

- Many large floating Hydrilla fragments in the boat ramp area, collected as feasible.

- Largest patch near the boat ramp estimated from surface to be ~80'x80', clearer water allowed Hydrilla to be visible from surface.

- Hydrilla bed outside island cove appears larger, estimated from surface ~25'x20' but possibly larger and not seen fully from surface.

October 10, 2017

- First day of benthic barrier installation.

- Observed fishermen casting from State boat ramp dock into/near the large Hydrilla bed in boat ramp cove. Fishing in this area suspected to aid fragmentation and spread of Hydrilla.

October 17-18, 2017

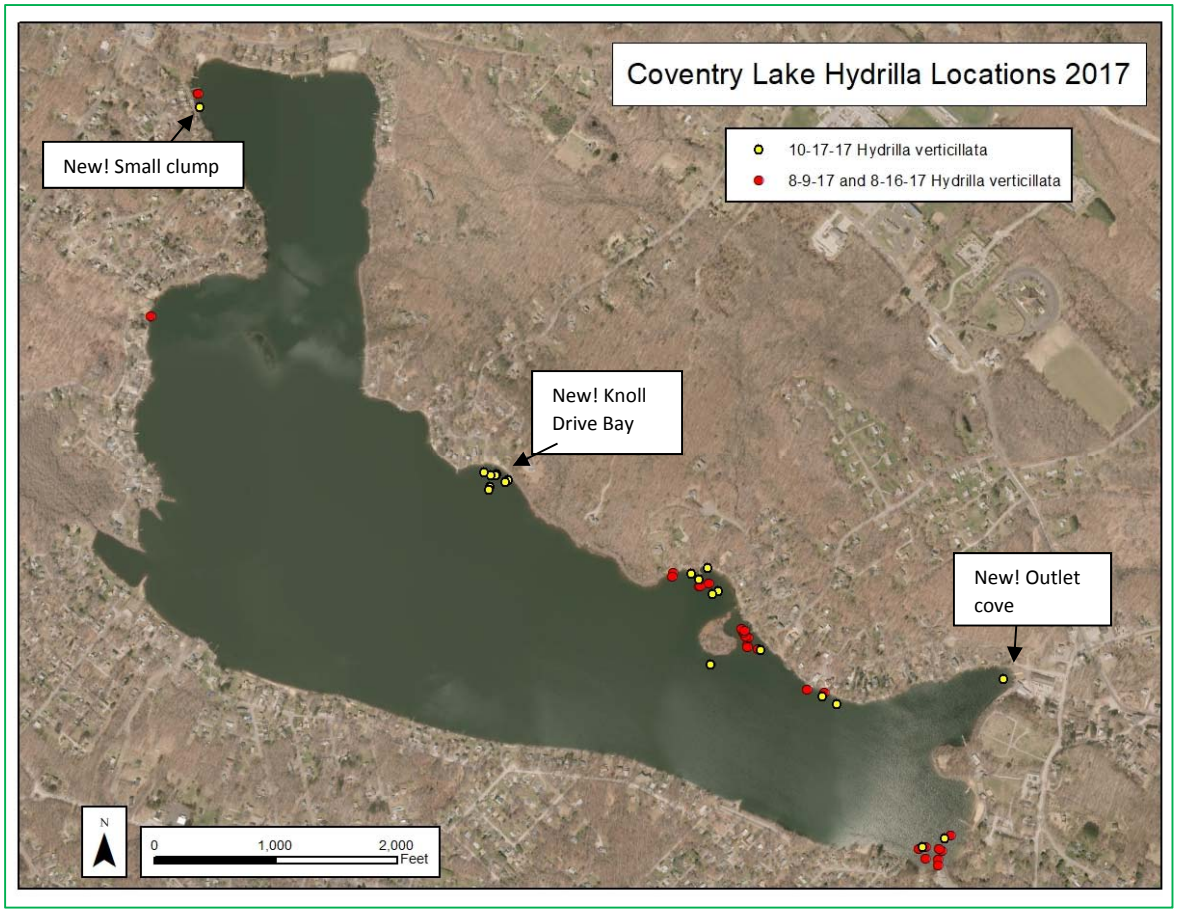
- Post-treatment whole littoral zone aquatic plant survey conducted.

- Total of 24 aquatic plant species found - two additional species: *Glossostigma cleistanthum* (non-native) & *Elatine sp* (native).

- Two **new** Hydrilla locations in the lake (**Map 5**):
  1. Outlet/dam cove - One bed estimated from surface to be 12'x12'. Hydrilla fragments found in outlet grate, Hydrilla may be moving downstream of the lake.
  2. Central northern shore near Knoll Drive -
     - Large Hydrilla bed estimated ~15'x50' with 100% cover in central part of bed and less dense along edges.
     - Is doesn't seem possible that the September 2017 survey could have missed these beds. The GPS tracks from both surveys overlap, and waypoints where the large bed of Hydrilla was found is only 15' away from the September survey track.
       - Possible that this large patch grew entirely in the 2017 season.
     - Two additional 6' diameter patches and three 3' diameter patches were also found in the Knoll Drive location.

- Observed a handful of Hydrilla plants approximately 100' away from the patch in the northern cove that was covered by benthic barrier.

- While still less than 30-days post-treatment, the treated Hydrilla in both island coves and boat ramp cove was still growing high in the water column and did not yet appear affected by herbicide treatment. Much more Hydrilla in the northern island cove than was present in September. All Hydrilla locations were marked with GPS.



Map 5 – Latest Map of Hydrilla Locations in Coventry Lake

November 20, 2017

- No Hydrilla was visible from the surface near the outlet cove (untreated) nor boat ramp area (treated 2017).
  - Several ~10'-pole hand rakes revealed no Hydrilla, but throw-rake tosses were not conducted to avoid potential fragmentation.

- One of the original patches (northern eastern most) in the island cove area (treated in 2016 and 2017) still had Hydrilla present.
  - Hydrilla plants appeared to be partially decaying - Photo 1 – Page 11.
  - Due to choppy water and low temperatures, no other beds were inspected on this date.

Benthic Barrier Work

Consistent with the 2017 management plan, the small scattered beds of Hydrilla in the northwest section of the lake and along the shoreline from Island Cove south towards the outlet to be addressed with the installation of benthic barriers. Barriers were pre-constructed as 8' x 10' sections attached to weighted PVC frames.

- On October 10th, NEAR and SOLitude divers laid ten total 8'x10' benthic barriers.

- Some barriers were laid as full panels, others were cut into smaller shapes to match the irregularity of the individual Hydrilla patches. All benthic barriers were secured with steel rebar, and/or bricks and medium-sized rocks.

- All small patches covered successfully. The larger untreated bed off shore of the island cove was only half covered (using 8 full barriers) - area indicated in **Map 2**. Hydrilla plants in this bed documented as 3'-5' tall and 8'-12' deep.

- On November 2nd, NEAR and SOLitude divers go back to large partially covered patch from 10/3 and lay 8 more 8'x10' benthic barrier panels. Most of this Hydrilla bed was covered successfully, but it appears to be growing quickly and some areas were left completely uncovered.
  - This bed is now too large to manage with benthic barriers alone. Total estimated bed size is now ~40'x35' (initially estimated by swimmer to be only 10'x12' in August), though semi-irregular in shape.
    - Possible that initial size estimate was too low and underwater inspection estimate more accurate, but also appears to be growing rapidly throughout 2017 season.
  - Hydrilla in this area is spreading to deeper water (>12ft), where there are currently no other aquatic plants, leaving much open sediment for colonization.
  - Many large boulders present that make laying more benthic barrier very difficult.
  - Light penetrates to at least 24ft. Distance from 12-24ft is about 130ft perpendicular to shore.

Review of 2016/2017 Management Approaches

The following presents a discussion of the overall effectiveness of the two techniques employed to this point in the management of Hydrilla at Coventry Lake.

Herbicide Treatment

Based on the distribution of Hydrilla in Coventry Lake, as observed in 2015 & 2016, partial lake treatment with endothall was determined to be the best approach. The treatments conducted in August of 2016, worked well to control Hydrilla biomass for the remainder of the season, but effects were slower to be observed than anticipated in some areas. Adjustments were made for the 2017 treatments to account for possible increased dilution, including applying at higher labeled doses and using both liquid and granular formulations, however many of the same issues were seen in terms of delayed effect, which was probably exacerbated by the late start of the program due to contractual and

funding issues. Treatment this year also was expanded to include the area around the boat ramp, while the island cove areas were more focused in and around the known beds instead of treating the entire cove as was the case in 2016. Overall, the partial treatment approach has seen some marginal success but in conjunction with various logistical circumstances has yielded less than desirable results.

The less that optimal results of the current program along with the continued discovery of additional areas of Hydrilla growth in new areas of the lake, including beds at greater depth than first expected, suggests that an alternative is necessary. The most logical alternative would be treatment with the systemic herbicide, Sonar (fluridone). Given the varied locations and depths where the Hydrilla is being found and the realization that there are likely more areas either yet to be found or are too small to be readily observed, a whole lake treatment is likely to be the most efficacious approach moving forward.

Benthic Barriers

When the August 9, 2017 survey revealed several small Hydrilla beds scattered in varying places around the lake, benthic barriers seemed like the most feasible option to tackle the small isolated patches. It was unrealistic to conduct spot treatments because there would be so much dilution of the herbicide in these areas.

In general, the benthic barriers, which were constructed from black felt with or without a steel rebar/PVC frame, worked very well to cover the small patches of Hydrilla. However, the Hydrilla bed outside island cove turned out to be very large. Despite two days of diving and many benthic barrier panels, this large untreated patch was not entirely covered. The majority of the bed was carefully covered with barrier, but there are large boulders (and a few large household items) that made the whole bed extremely difficult to cover. Again, given the higher cost and challenges of using this approach, along with the likelihood of finding more areas of Hydrilla growth, a whole-lake treatment option should be considered.

Recommendations for Future Management

In 2015, only two small patches of Hydrilla were found in the lake. In 2016, three small patches were found. In 2017, Hydrilla was found in two totally new areas of the lake while additional patches near old olds. Large deeper water beds – 6-10 feet were observed rapidly increasing in season as the 2017 season progressed. There are now three very large beds of Hydrilla (boat ramp cove and outer island area, outlet cove), and there are smaller patches spread out over nine general areas of the lake. Furthermore, Hydrilla plants in the three large beds grow rapidly with shoots that nearly made it to surface during the 2017 season.

Given this expansion and concerns with the current approach, whole lake treatment with fluridone should be considered. Although more costly than the current approach, whole lake treatment will provide excellent, lake-wide biomass reduction and thus eliminate the reliance on locating and treating specific areas of Hydrilla growth. In fact, if started at the optimal time (June), there should not be any appreciable Hydrilla biomass in the lake at any point in the season.

Whole-lake fluridone treatments have a proven track record of success and have been used to manage many Hydrilla infestations in the New England region. Fluridone works by inhibiting carotenes, pigments in plants that help protect chlorophyll, from being degraded by sunlight. Without carotenes, chlorophyll degrades and is not able to be used by the plants to make food. Fluridone works slowly and often takes 60-90 days at the target concentration to provide desirable control of Hydrilla. Coventry Lake has a relatively slow flushing rate, which helps to maintain an effective concentration, however several applications over the course of the season will still be required.

While the treatment will be designed to maintain a suitable, whole-lake concentration, the herbicide will be applied in pellet formulations only to the littoral area of the lake. As the herbicide releases from the pellets and prior to mixing with the lake volume, it will be present at a higher concentration directly in the areas of Hydrilla growth and at the base of the plants, which will help to intensify plant uptake and ultimately increase the effectiveness of the treatment. Treatments should also be started so fluridone is present in the water at the onset of active Hydrilla growth, when the plants are most susceptible to the herbicide. This is likely to occur in mid to late June at Coventry Lake.

Given the presence of Hydrilla tubers and their known resistance to fluridone, despite its systemic properties, multiple years of fluridone treatment are likely to be required in order to deplete the tuber bank in the lake. As our knowledge of the true size if the Hydrilla infestation in Coventry Lake increases, partial lake treatments using endothall will continue to increase in cost and become less likely to achieve the long term goals of the program.

In terms of survey work, a minimum of two full littoral zone surveys (early season & late season) should be performed to monitor for any new areas of growth. Other more focused surveys should be provided for and implemented as needed, including more frequent, specific pre & post management inspections of the existing Hydrilla beds.

It is imperative that the CT DEEP establish a semi-permanent boat ramp monitor at the Coventry Lake state boat launch. With no exceptions, Hydrilla fragments were found along the shore of the boat launch on every visit in 2017. If there is no one inspecting boats and fishing gear leaving the lake it is almost certain that Hydrilla will be carried to other places in the state. It is possible for the State to cooperate with the Town of Coventry, the local Coventry Lake Associations, and the CT Federation of Lakes to organize volunteers and/or fund an Invasive Investigator for the foreseeable boating seasons.

Coventry Lake
Hydrilla Diving Survey Notes
8/16/2017

- Transect 1: directly off the end of the boat ramp dock, following 10 degrees West of North - adjusted heading due to Hydrilla fragments - from dock. Found one very small rooted plant and 3 fragments lying on the bottom. Removed all Hydrilla fragments that were found, but each fragment on the lake bottom is a potential new bed. Fragments had visible adventitious roots.

- Transect 2: 30 degrees West of North, started at boat ramp dock. Found one rooted plant when first swimming the transect, Hydrilla plant growing in the middle of an elodea bed. Then diverted when found huge Hydrilla bed. Hydrilla patch is estimated to be 30' x 30', 100% cover for main bed, growth form 3. Arms coming out of bed all around it (the 30'x30' size estimate includes branching arms of main bed and was made based on estimating body lengths underwater), plus scattered plants growing outside the main bed. Majority of the bed in 10' of water, but deepest part in 12'. Most of the area surrounding the bed is open sediment with no other plants growing nearby. Very dendritic surrounding the main bed.
    - Main bed starts at waypoint 7 and extends ~ southwest for approximately 30' then becomes more sparse, with single plants growing several feet apart from each other.

- Transect 3: 60 degrees West of North starting at boat ramp dock. Found 2 fragments lying on the bottom, which were removed. Then found ~6' x 6' patch slightly to the left of small yellow house when facing the house, ~50ft from shore.

- Transect 4: 30 degrees East of North off the end of the dock. Found 2 beds near waypoint 9, each ~3' x 3' to 4' x 4'.
    - Two patches to north and northeast of waypoint, one 8' x 4' and one 6' x 6'. In 7'-8' of water. Possible that it's the same 2 patches as seen before, but not sure.

- Transect 5: straight line from visible tip of rock jetty next to Patriots Park beach to waypoint 11. Found 8' x 12' patch ~ ½ way between tip of jetty and waypoint 11 in ~7' of water. Also saw an ~20' patch of scattered invasive *Potamogeton crispus* while swimming this transect.

- Most plants in this area off the boat ramp are ~3' tall, although some are smaller, closer to 1' tall. In the largest bed, some central Hydrilla plants were about 5' tall.

- Waypoint 13: starting shoreline survey here. Diver swimming in ~9' of water, ~50' from shore (mapping note: waypoint farther off shore than diver).

- Waypoint 14: searching in area where patch was found during full lake survey (Aug 2017). Can't find it now, but it was a 1 square foot patch. Lots of elodea and filamentous algae around here, worsened clarity.

- Waypoint 15: 4' x 4' patch of Hydrilla in 7' of water directly in front of dock of the large grey house. Plants are 2.5' tall.

- There is still much light in ~14 feet of water. Sparse Elodea growing in up to 13' of water, but not much other plant growth.

- Much open sediment in lake ~12-20ft deep in littoral zone, ready for potential Hydrilla colonization.

Photo 1: November 20, 2017 - Treated Hydrilla Partially Decaying