



Proactive by Design



Mapping of Invasive Aquatic Species in the Connecticut River with a focus on *Hydrilla verticillata* & *Trapa natans*

Agawam to Turners Falls, MA

March 2019

File No. 15.0166695.00



PREPARED UNDER CONTRACT TO:

Naturesource Communications

PREPARED FOR:

MA Department of Conservation & Recreation
Lakes & Ponds Program

GZA GeoEnvironmental, Inc.

1350 Main Street, Suite 1400 | Springfield, MA 01103
413-726-2100

Table of Contents

Abstract	1
Introduction & Study Purpose	1
Project Approach	2
Procedures & Methodology.....	3
Data & Observations.....	5
Discussion & Conclusions.....	7
Management Options & Recommendations	8
References	11

Appendix: Sample Site Location Maps & Sample Data Spreadsheet

Abstract

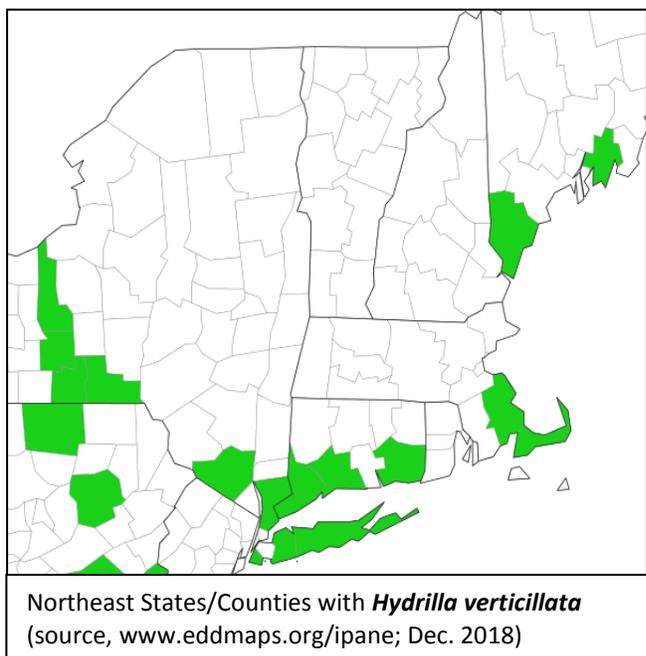
Hydrilla verticillata is an Aquatic Invasive Species (AIS) making rapid incursions into the New England freshwater environments. Introduced into North America as an aquarium plant in the 1950s, it has been reported in MA and CT for nearly a decade. Having been observed within the eastern portion of MA, it had yet to be identified within the western portion of the state. However, its observation within the Connecticut River near Hartford, CT suggests either an upgradient source or a threat for future transmissions northward within the Connecticut River valley. In collaboration with MA Dept. of Conservation and Recreation and under contract to Naturesource Communications, aquatic biologists from GZA conducted a study in late summer 2018 within the entire length of the MA segment of the Connecticut River. Forty (40) site locations with 465 distributed individual plots were examined along 55± miles of the river, focusing on areas of observed aquatic macrophyte beds, appropriate depth ranges, marinas, boat launches, as well as oxbows and selected tributary sections, collecting presence/absence data for AIS, identifying macrophytes by species, and recording prevalence data by species, with a specific focus on *H. verticillata* and *Trapa natans*. The reaches of the Connecticut River were divided into the following segments:

1. Lower section between CT border and the Holyoke Dam;
2. Lower middle section between the Holyoke Dam and the North Hatfield boat ramp including the Northampton oxbow;
3. Upper Middle section between the N. Hatfield boat ramp and the Turners Falls dam including the lower reaches of several tributaries; and,
4. Upper section above Turners Falls dam focusing on Barton's Cove.

Based upon the results of the study, *H. verticillata* was only observed at a single cluster of sampling points in the river, near the CT border in Agawam. At present, distribution appears limited and management is recommended to minimize northward expansion of the range. *T. natans* was more widely distributed but clustered in a known population in a cove near the Holyoke portion of the river.

Introduction and Study Purpose

Hydrilla verticillata is an Aquatic Invasive Species (AIS) making rapid incursions into the New York and New England freshwater environments. As a submersed, rooted aquatic plant, it can grow in water up to depths exceeding 20 ft (where water clarity allows). *Hydrilla* forms dense mats at the surface of the water and can readily invade most slow-moving or still water systems. *Hydrilla* can be a significant challenge to manage effectively. First introduced into North America as an aquarium plant in the 1950s, it has been reported in MA and CT for nearly a decade, and more recently within the Connecticut River. While currently having



Mapping of Hydrilla verticillata in the Connecticut River, Agawam to Turners Falls, MA

been observed within the eastern portion of MA, it has yet to be identified within the western portion of the state. Recent 2016 and later reports of CT Department of Energy and Environmental Protection (CT DEEP) alerted the public and region of the presence of this AIS in portions of the Connecticut River near Hartford, CT (Glastonbury). Its observation within the Connecticut River in Connecticut is troubling, suggesting either an upgradient source in MA and/or a threat for future transmissions northward within the Connecticut River valley.

Because the river flows north to south, MA DCR has correctly pointed out that a source population of *Hydrilla* within the MA portion of the river cannot be ruled out. Therefore, under a Request for Proposals, MA DCR Lakes & Ponds initiated a contract with GZA GeoEnvironmental Inc. via Naturesource Communications to conduct a survey of the MA portion of the Connecticut River for the presence of *Hydrilla* as well as note the presence of another AIS, *Trapa natans* (Water Chestnut).

Project Approach

MA DCR Lakes and Ponds Division gave GZA a Notice to Proceed in August 2018 with the project “Kick Off” meeting occurring on 8-21-18. As per the proposal, the work was performed under 5 Tasks as follows:

- **Task 1: Connecticut River Bathymetry Maps/Field Equipment/Background Information**
- **Task 2: Project Organization and Kick Off Meeting.**
- **Task 3: Assessment of Sites and Vegetative Mapping.**
- **Task 4: GIS Maps of Sites: GZA will produce a GIS maps for the selected species**
- **Task 5: Development of Management Options**

The designated area of study was the MA section of Connecticut River, from the CT border to the Barton’s Cove and Route 2 bridge, above the Turner’s Falls dam. The target was to complete all observation of AIS at multiple site by September 15, 2018 so that observations would be performed safely within growing season for aquatic plants. With 55± miles of the river to be assessed, it was determined at the kick off meeting with MA DCR that analysis sites would be prioritized based upon the following factors:

- Areas of known and observed macrophyte beds,
- Favorable habitat depths where plants may grow (typically <10 ft deep based upon CT river secchi depths of < 10 ft),
- At marinas and boat launches, oxbows, and major tributaries.

The proposal committed to the analysis of at least 30 sites. However, based upon access, time, and progress, and allocated effort, as many sites would be assessed as possible, prioritized according to location and potential of suitable habitat present for *Hydrilla*.

GZA acquired two sets of the foldable maps of the MA portions of the Connecticut River Bathymetry maps (source www.ctrivernmaps.com), providing one copy to MA DCR. GZA reviewed the maps to identify potential candidate sites.

The reaches of the Connecticut River were divided into the following segments:

1. Lower section between CT border and the Holyoke Dam;

2. Lower middle section between the Holyoke Dam and the North Hatfield boat ramp including the Northampton oxbow;
3. Upper Middle section between the N. Hatfield boat ramp and the Turners Falls dam including the lower reaches of several tributaries; and,
4. Upper section above Turners Falls dam, Barton’s Cove to Route 2 (French King) Bridge.

It was anticipated that the third segment, might require access by non-motorized craft. However, the water levels in the river were fairly high for this time of the year and all segments were accessible by small motorboat. GZA’s aquatic scientists implanted boat cleaning protocols between access at the various launch sites to limit any chance of the transfer of invasive species between different portions of the river.

GZA was to notify DCR Lakes & Ponds immediately if Hydrilla was found and provide site location, density and photo-documentation for each sighting. In addition to noting the presence and densities of these species, all macrophytes species were noted and documented by prevalence along, other AIS’s observed were recorded as well.

Procedures & Methodology

The project methodology for assessment of GZA field scientists sampled utilized the “Rake Toss Survey Methodology” for each area (<https://www.umass.edu/mwwp/pdf/weedmapping.pdf>), sufficient to adequately sample the sites to assess the potential presence of *Hydrilla verticillata* and *Trapa natans*. The rake was a double-sided steel tine rake fastened together with tines facing outwards, attached to 30 feet of rope for tossing. A minimum of 2 tosses (but typically more) in opposite directions were performed per location to assess and identify aquatic plant species present. Aquatic plants were identified mostly in the field at the time of retrieval. However, specimens were collected and kept in labelled plastic bags for later identification if necessary (rarely), with the



Aquatic Plant Collection Rake

Table 1. Rake Toss Survey Abundance Scale		
Abundance*	Field Measure	Biomass (dry weight; g/m²)
No Plants	No Plants Present	0.0
Trace Plants	Fingerful (1-2 stems)	0.0001 - 2.0
Sparse Plants	Handful (3-6 stems)	2 - 140
Medium Plants	Rakeful (no tines visible)	140 - 230
Dense Plants	Difficult to bring weed mass into boat	230 - 450

*USACE/Cornell abundance scale

exception that a voucher specimen of *Hydrilla verticillata* was always to be kept when encountered.



Tossing the Rake



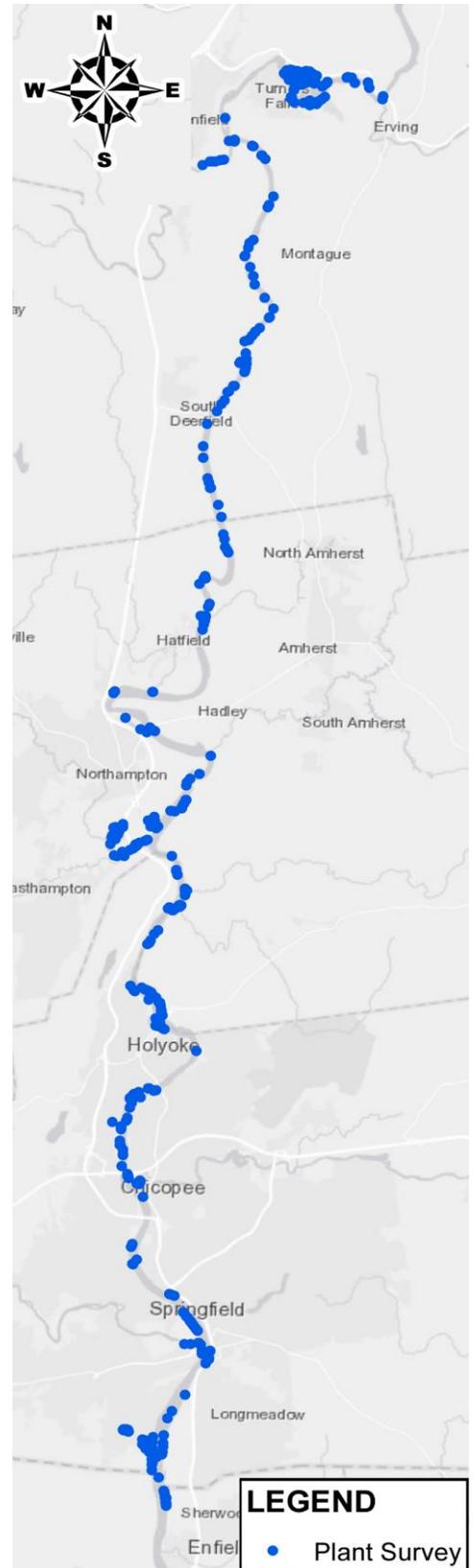
Macrophyte Sorting & Identification

GZA agreed to notify DCR Lakes & Ponds immediately if *Hydrilla* was found and provide site location, density and photo-documentation for each sighting. In addition to noting the presence and densities of *Hydrilla* and *Trapa*, all dominant macrophytes species were to be noted along with other invasive species observed to be present.

Using the “Rake Toss Survey Methodology”, a total of 40 Geographic Site Locations were assessed along the 55± mile length of the Connecticut River from the CT state boundary to Barton’s Cove at the Route 2 bridge. At the 40 geographic sites, 465 Individual Plots were investigated each having a (2 Rake Toss Minimum). At each site, the presence or absence of *Hydrilla verticillata* and *Trapa natans* was noted, as was as any other AIS. At all sites, all macrophytes were noted. The general site locations are depicted in the graphic to the right and more specifically in the figures in Appendix 1.

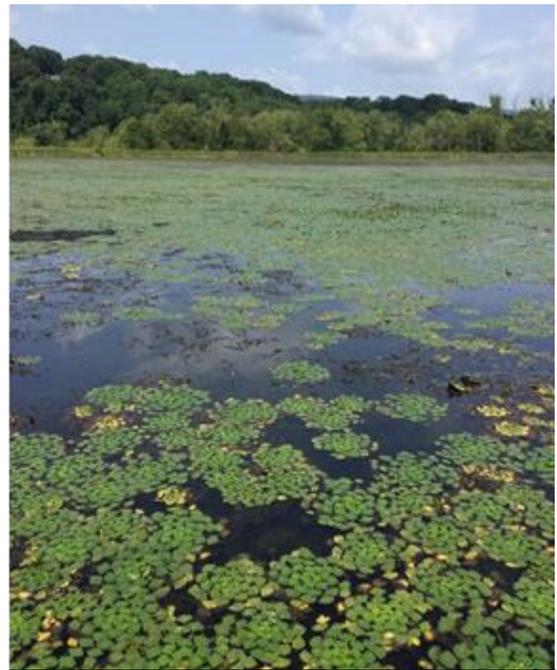


Dense Macrophytes



Data & Observations

The survey of aquatic macrophytes at the 40 Geographic Site Locations and 465 individual plots over the 55± mile length of the Connecticut River showed a large number of invasive species. Appendix 1 provides maps showing the location of all 465 sample sites on the Connecticut River and lower portions of some tributaries. The full data set and list of all AIS and native aquatic species observed is provided the accompanying excel datasheet. The location/coordinates were determined using a Trimble R1 Integrated GNSS System, called “the puck.” It provides sub-meter accurate to 50 cm with clear GNSS signal. It was coupled via Bluetooth to an iPad using ARCGIS’s Collector via ARCGIS online (the data was available immediately after each point was collected), for which with GZA holds an active account. The data was post-processed using GPS Pathfinder Office. The coordinate system it was collected in is NAD83 Massachusetts State Plane Mainland (feet).



Dense Water Chestnut in Log Pond Cove,
West Side of River, Holyoke

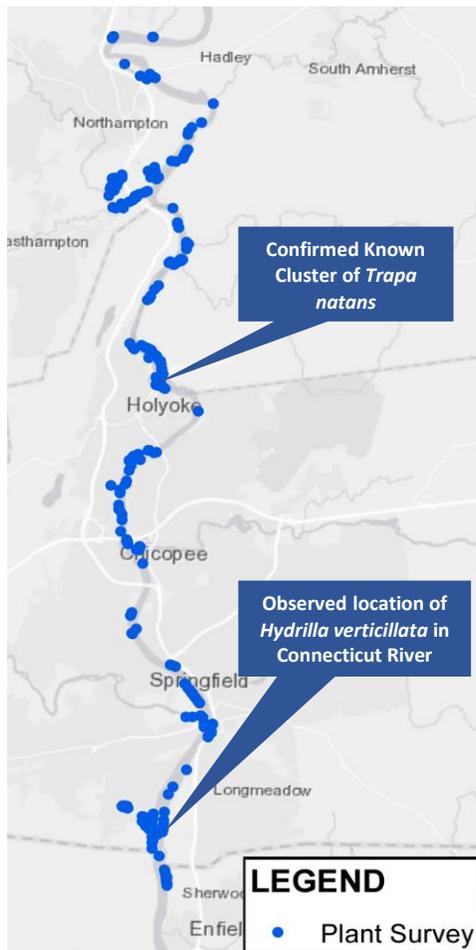
The diversity of species observed at all 465 sites was relatively low within only 20 native (5) and non-native (15) floating leaved and submerged aquatic macrophyte species observed (Table 2). Of the 20 aquatic species, 5 are considered invasive. *M. quadrifolia* is also considered non-native but is not known to be invasive.

Species name	Common name	Invasive Species?
<i>Charophyta, green algae</i>	Chara sp.	
<i>Cabomba caroliniana</i>	Fanwort	✓
<i>Ceratophyllum demersum</i>	Coontail	
<i>Elodea canadensis</i>	Elodea	
<i>Heteranthera dubia</i>	Waterstar Grass	
<i>Hydrilla verticillata</i>	Water Thyme	✓
<i>Lemna minor</i>	Duckweed	
<i>Marsilea quadrifolia</i>	European Waterclover	
<i>Myriophyllum spicatum</i>	Eurasian water milfoil	✓
<i>Nymphaea odorata</i>	White Water Lilly	
<i>Potamogeton amplifolius</i>	Big-leaf Pondweed	
<i>Potamogeton crispus</i>	Curly Pondweed	✓
<i>Potamogeton epihydrus</i>	Ribbonleaf Pondweed	
<i>Potamogeton pectinatus</i>	Sago Pondweed	
<i>Potamogeton g ramineus</i>	Variable Pondweed	
<i>Potamogeton richardsonii</i>	Redhead-grass	
<i>Potamogeton robbinsii</i>	Fern Pondweed	
<i>Trapa natans</i>	Water Chestnut	✓
<i>Vallisneria americana</i>	Tape Grass	
<i>Wolffia spp.</i>	Watermeal	

Relative to the invasive species observed, their distribution is summarized in Table 3. *Hydrilla verticillata*, a primary focus of this study, was observed at only a single geographic area in Agawam, MA, near the CT border. The location with *H. verticillata* was roughly ½ acre in size with a dense population. This area will require management if it not to spread to other areas. In fact, this patch could be the source of this AIS for the downgradient populations. A limited number of sites were examined downgradient of the *Hydrilla* patch and no new individuals or populations were observed. Additional more cursory survey was conducted downgradient to the Enfield boat ramp and similarly, no populations of *H. verticillata* were observed.



***Hydrilla verticillata* Specimen from Connecticut River, Agawam**



***Hydrilla verticillata* aquatic bed, Agawam**

Trapa natans, also a target invasive species for this study, was noted at only a few locations but was particularly dense in Log Pond Cove on the west side of the river, north of the Holyoke Dam and Route 202 bridge. At this location, surface coverage exceeded 75%. This area has been subject to removal by volunteers on multiple occasions. *T. natans* was also noted at a few locations in Barton’s Cove area, above the Turners Falls dam, and at the confluence at Bachelor Brook in South Hadley, suggesting it may just becoming established.

Table 3. Invasive species observed in Connecticut River Segments						
Species name	Common name	# of Sample Sites with Positive ID's per Total	Segments (Sample Sites Nos.)			
			Turners Falls Dan North	N. Hatfield Boat Ramp to Turners Falls Dam	Holyoke Dam to N. Hatfield Boat Ramp	Enfield CT to Holyoke Dam
			1-90	91-162	163-296	297-465
<i>Hydrilla verticillata</i>	Water Thyme	9/465	No	No	No	9/168
<i>Trapa natans</i>	Water Chestnut	8/465	3/90	No	5/133	No
<i>Myriophyllum spicatum</i>	Eurasian water milfoil	113/465	44/90	No	32/133	37/168
<i>Cabomba caroliniana</i>	Fanwort	42/465	23/90	1/71	18/133	No
<i>Potamogeton crispus</i>	Curly Pondweed	20/465	No	13/71	5/133	2/168
		<i>notes</i>	Fairly uniform distribution within aquatic macrophyte bed habitats	Few aquatic macrophyte beds in this segment. Single obs. <i>P. crispus</i> Deerfield R. sites	Fairly uniform distribution within aquatic macrophyte bed habitats. Milfoil and Fanwort common in Northampton oxbow; None to Few at marina sites.	Fairly uniform distribution within aquatic macrophyte bed habitats. Dense <i>Trapa</i> above Holyoke Dam in Log Pond Cove. None in Westfield R. and lower Three Mile Brk. Milfoil common in upper Three Mile Brk.
<i>xx/xx = number of sample sites where observed / total number of sample sites; no= not observed; note: sample sites not uniformly distributed within segments and often clustered (see text)</i>						

Eurasian Water Milfoil and Fanwort were noted as being widely distributed along most segments of the Connecticut River, except for the area between the Turners Falls Dam and the North Hatfield boat ramp. Within this area, fewer aquatic macrophyte beds were observed in general; however, the restriction to further expansion of the population may be the lack of favorable habitat type. Marinas and boat ramps in general were not observed to be areas of concentrated aggregations of AIS, but limitations may be more associated with lack of suitable habitat at these locations and damage from props. The Deerfield River, and Three Mile Brook did not have significant populations of AIS, due to lack of suitable habitat, with the exception of a ponded area of the Three Mile Brook where milfoil was dominant. The Northampton Oxbow and Log Pond Cove had significant populations of AIS. Both are quiescent embayments off of the main river channel with abundant shallow areas and suitable AIS habitat.

Discussion and Conclusions

The first known observation of *Hydrilla verticillata* in western Massachusetts has been documented as part of this study. A roughly ½-acre patch of a dense population was observed on the west side of the Connecticut River in Agawam, adjacent to the Six Flags amusement park, immediately south of the confluence with the Three Mile Brook. This brook immediately became suspect for AIS and an additional 50 sampling sites were surveyed roughly 1-mile northwest upstream of the confluence, no additional

Hydrilla was observed. While this population was dense at this location, and this species is known for being highly invasive and able to spread populations quickly, no other populations were observed at the other 465 locations along the Connecticut River corridor, including northern segments of Enfield, CT. However, given the size of this single populations, it is reasonable to presume that it is a potential source of other *Hydrilla* populations, and its role as a beachhead population for the Glastonbury CT site cannot be ruled out. The flow of the river is an immediate potential vector for population expansion. In addition, this section of the river is frequented by recreational boaters and waterfowl, both of which are known vectors for spreading this aquatic species. As we approach the new growing season, immediate aggressive management is recommended to minimize expansion of its range and to reduce propagule transfer southward (see management recommendations below).

Trapa natans was observed at multiple locations in the Connecticut River, but primarily at the already well-known location in the 20± acre Log Pond Cove, on the west side of the river, just north of the Route 202 bridge in Holyoke. The infestation at Log Pond Cove in Holyoke, the oldest and most entrenched infestation within the watershed. The Silvio O. Conte National Fish and Wildlife Refuge staff and partners have made attempts to control this species, but the infestation remains extensive. Since its discovery in the Connecticut River Watershed in 1998, the Conte Refuge has led an effort to stop the plant from spreading further within the watershed. Hundreds of citizen volunteer hours from many organizations removed plants during the growing season to prevent the plants from dropping additional seeds, gradually attempting to exhaust the existing (12-year) seedbank. As recently as July 28, 2018, the Connecticut River Conservancy hosted a “Water Chestnut Pull” in Log Pond Cove. There has also been the use of herbicide treatment by the U.S Fish and Wildlife Service, who has also, most recently, purchase a small aquatic weed harvester to augment hand pulling.

The other concerning population of *T. natans* has been observed in Barton’s Cove in Turners Falls, in the pool above the dam. Currently this population is small in size and immediate removal and annual survey/removal is recommended (see management recommendations below); the individuals were hand removed at the time of observance.

Eurasian Milfoil and Fanwort are two other aggressive aquatic invasive species that were observed within the Connecticut River and they were both more widely distributed. Surprisingly, Fanwort was not observed in the most downgradient section of the river, below the Holyoke Dam. Neither species appear to have significant populations in the segment of the river between the North Hatfield boat ramp and the Turner’s Fall Dam, but as previously mentioned, this area does not have extensive habitat for aquatic macrophytes and therefore fewer would be expected.

Management Options & Recommendations

Hydrilla: By this study, it is apparent that *Hydrilla verticillata* has established a population on the Connecticut River in Massachusetts, along the southern border with Connecticut. The population is dense and encompasses an aquatic macrophyte bed of about ½ acre. Rapid and aggressive management is needed and highly recommended early in the 2019 growing season if this population is to be kept from spreading. Herbicide application is the most effective means of *Hydrilla* management.

Based on successful eradication programs elsewhere, eradication is a multi-year effort and requires a long-term commitment, often needing five to eight years of treatment, with the first year or two being most critical. A sustained funding source is critical. Because the existing infestation is an isolated patch, the following approach is recommended, which has been documented to effective elsewhere:

- Apply contact herbicides at the maximum label rates, along with limited public access in those areas; and
- Enclose the treatment area within a “limnocorral” (impermeable enclosure) to isolate the *Hydrilla* bed for direct application of herbicide to sustain effective concentration of the herbicide and exposure time.

Contact and systemic herbicides should be considered for treatment of the *Hydrilla* patch, with chemical treatment using contact herbicides after tubers have sprouted (late June to July) but prior to the formation of new tubers (late August to November). Systemic chemical treatments, such as fluridone, which targets vegetative tissues (leaves, stems, or roots) should likely occur no earlier than mid-June, as systemic herbicides should be applied when tubers are sprouting.

Surveys for *Hydrilla* should occur after seasonal regrowth of the aquatic bed has begun, typically when water temperatures reach 17°C for at least two weeks. This will establish the precise area of treatment. The sediments should also be sampled for the presence of tubers. The herbicide applicators should be provided with GIS shapefiles of the area to be treated that can be downloaded into their GPS systems to help to keep herbicide applications in the target area of interest.

Because treatment is subject to permitting, this activity should be planned and initiated in April to May to allow adequate time for permit acquisition. Permitting will require a “License to Treat” as well as an Order of Conditions from the Agawam Conservation Commission. In addition, because the Connecticut River is within a NHESP polygon, coordination with NHESP for potential impacts to rare species may be an issue. Pre-permit coordination with NHESP is encouraged as soon as possible to minimize any delay of treatment.

Monitoring is critical to assess the success of treatment and provide for any necessary adaptive management. Nearby aquatic plant bed areas should also be monitored to check for spread of the original site of infestation. Initial pre-treatment and annual fall tuber sampling at established locations via taking sediment cores should be considered, which will provide an indication of tuber presence and density. The tuber monitoring would only be for the first few years of a treatment plan because, as treatment continues, the tuber numbers should become so low that the sampling effort outweighs the benefits of collecting the data.

We also recommend a survey of the Connecticut River in Connecticut. It seems likely that *Hydrilla* populations may exist downgradient of the Agawam site.

In addition, public education, through signage and brochures, especially at boat ramps and marinas, is highly encouraged to help aid early detection and inform boaters and marina owners and encourage boat and boat trailer cleaning activities, as well as identification and reporting on the presence of *Hydrilla* or a plant suspected to be *Hydrilla*. A sign or signs should be considered to be posted at marinas to dissuade boaters from entering the area of infestation to decrease the likelihood of plant matter being carried away in props and bilges until a time when treatment may occur.

Water Chestnut: Appropriate management activities appear to be well underway at the Log Pond Cove area of the Connecticut River, also the area of infestation remains quite severe. However, a new effort should be launched in Barton’s Cove in Turner’s Falls and at the confluence of Bachelor Brook to a more severe infestation occurs in that area. At this stage of infestation, a hand pulling effort, perhaps

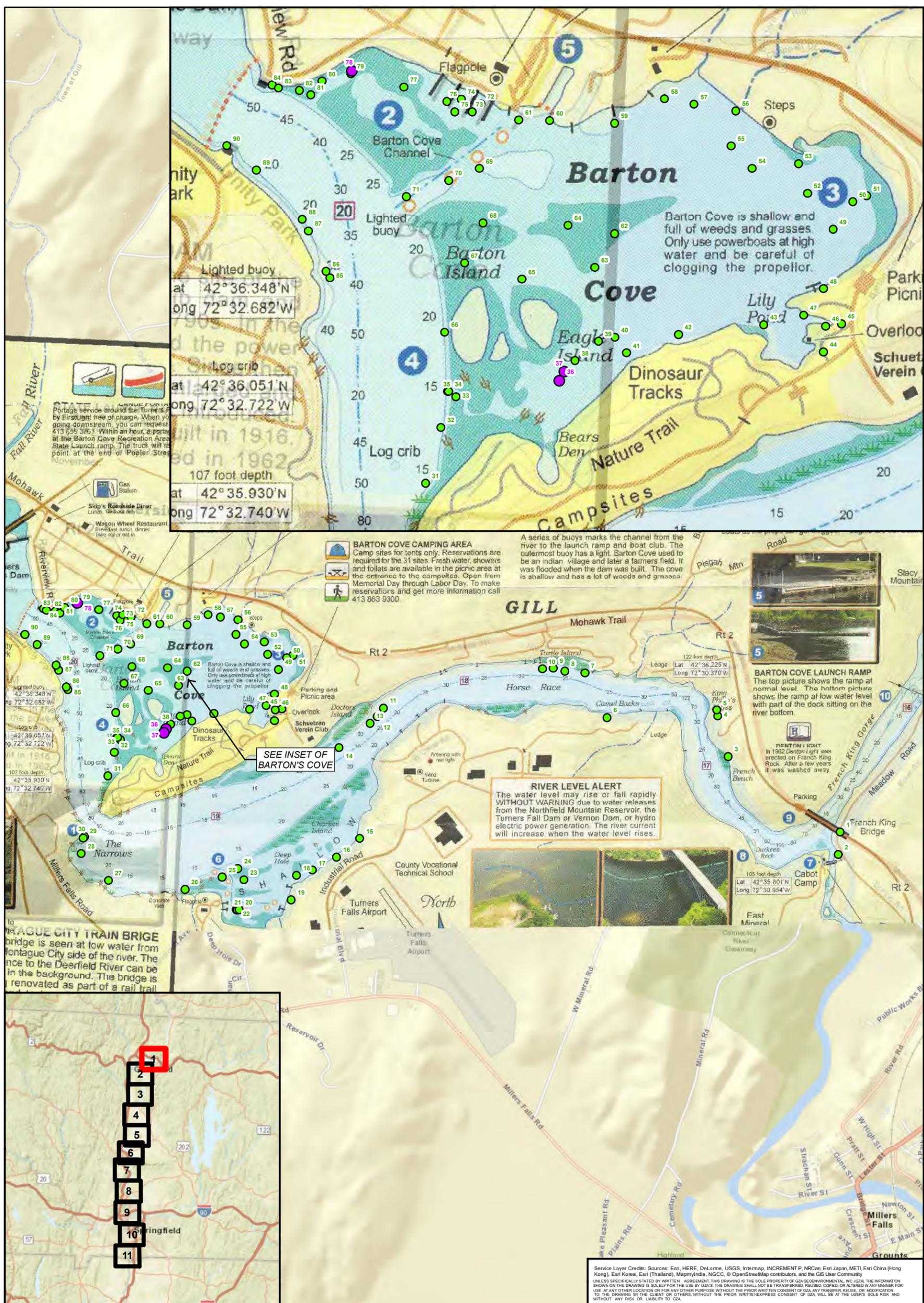
conducted by organizations and volunteers, should be sufficient to establish control. Individual plants observed in 2018 were removed during the survey, but re-emergence is likely in 2019. Coordination with U.S. Fish & Wildlife and the Connecticut River Conservancy would be useful first steps to initiate this activity.

References

- Connecticut River Conservancy July 28, 2018. Water Chestnut Pull – Log Pond Cove.
<https://www.facebook.com/events/220596522098870/>
- Cornell Cooperative Extension, Allegany County. Hydrilla Library. Website, March 2019.
<http://allegany.cce.cornell.edu/natural-resources-environment/invasive-species/invasive-plants/hydrilla/hydrilla-library>
- Crow, G.E. & C. Barre Hellquist. 2000. Aquatic and Wetland Plants of northeastern North America, Vol. 1 & 2. The University of Wisconsin Press.
- Great Lakes Hydrilla Collaborative. Website, March 2019.
<http://hydrillacollaborative.com/>
- Hagstrom, N. T., M. Humphreys, and W. A. Hyatt. 1990. A Survey of Connecticut Streams and Rivers – Connecticut River Tributaries, Scantic River, Mattabesset River, Salmon River, Coginchaug River, and Eightmile River drainages. State of Connecticut Department of Environmental Protection, Inland Fisheries Division. Federal Aid to Sport Fish Restoration Progress Report F-66-R-2 Progress Report for April 1, 1989 to September 30, 1990.
- Hebebrand, K., and J. Bossenbroek. 2017. Potential Spread of Hydrilla verticillata in the Great Lakes Basin, University of Toledo – Hydrilla Risk Assessment, Final Report. Prepared for Ecology and Environment, Inc.
- Hydrilla Management. Website, March 2019.
https://www1.nyc.gov/html/dep/html/watershed_protection/invasive_species_hydrilla.shtml
- New York Department of Environmental Conservation, “Rake Toss Sampling instructions Form”.
- New York Sea Grant. 2014. New York State Watercraft Inspection Steward Program Handbook: A Guide for Starting New Watercraft Inspection Programs. Prepared for the Cornell University Statewide Invasive Species Outreach Program Publication ID: NYSGI-H-14-001. Accessed online at:
http://www.dec.ny.gov/docs/lands_forests_pdf/aiswcimanual2.pdf.
- Rothlisberger, J.D., W.L. Chadderton, J. McNulty, and D.M. Lodge. 2010. Aquatic invasive species transport via trailered boats: what is being moved, who is moving it, and what can be done. Fisheries, 35(3), 121- 132.
- U.S. Fish & Wildlife Service Field Notes. “The fight against water chestnut: It takes a village. “ October 11, 2017. <https://www.fws.gov/fieldnotes/regmap.cfm?arskey=37685>
- Water Chestnut: An Exotic Invasive Aquatic Plant. DCR Massachusetts.
www.mass.gov/eea/docs/dcr/watersupply/lakepond/factsheet/water-chestnut.pdf

Appendix

Sample Site Location Maps & Sample Data Spreadsheet



Legend

- Trapa Natans (Present)
- Hydrilla Verticulata (Present)
- All Other Vegetation Plot Locations

0 0.125 0.25 0.5 0.75 1 Miles

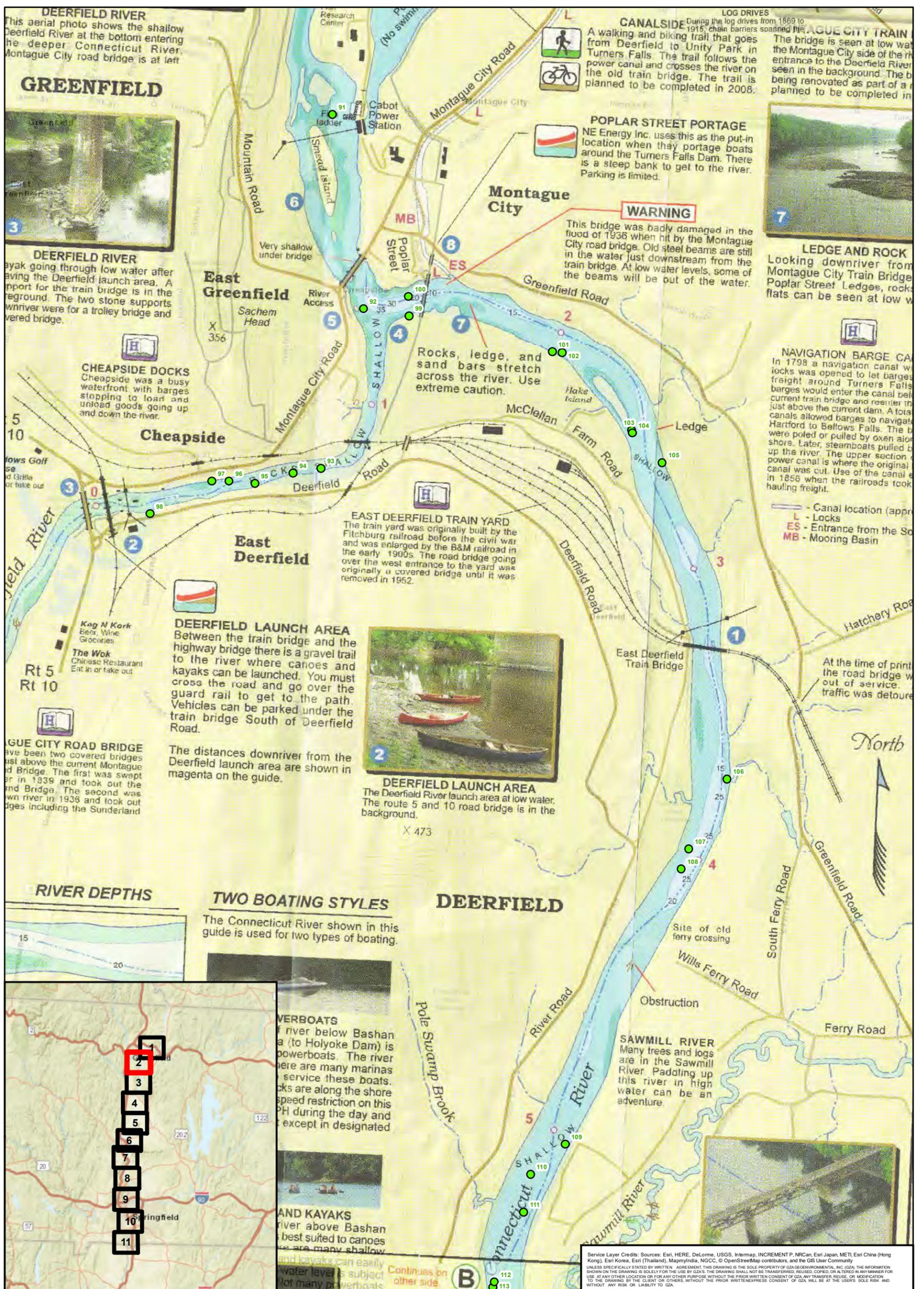
HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

PREPARED BY:
GZA GeoEnvironmental, Inc.
 Engineers and Scientists
 www.gza.com

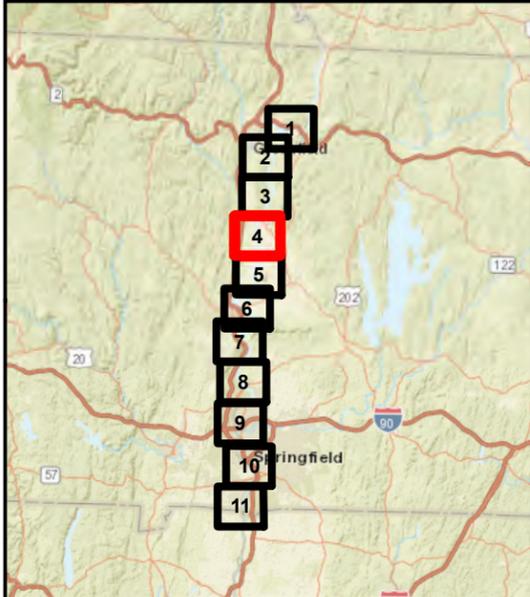
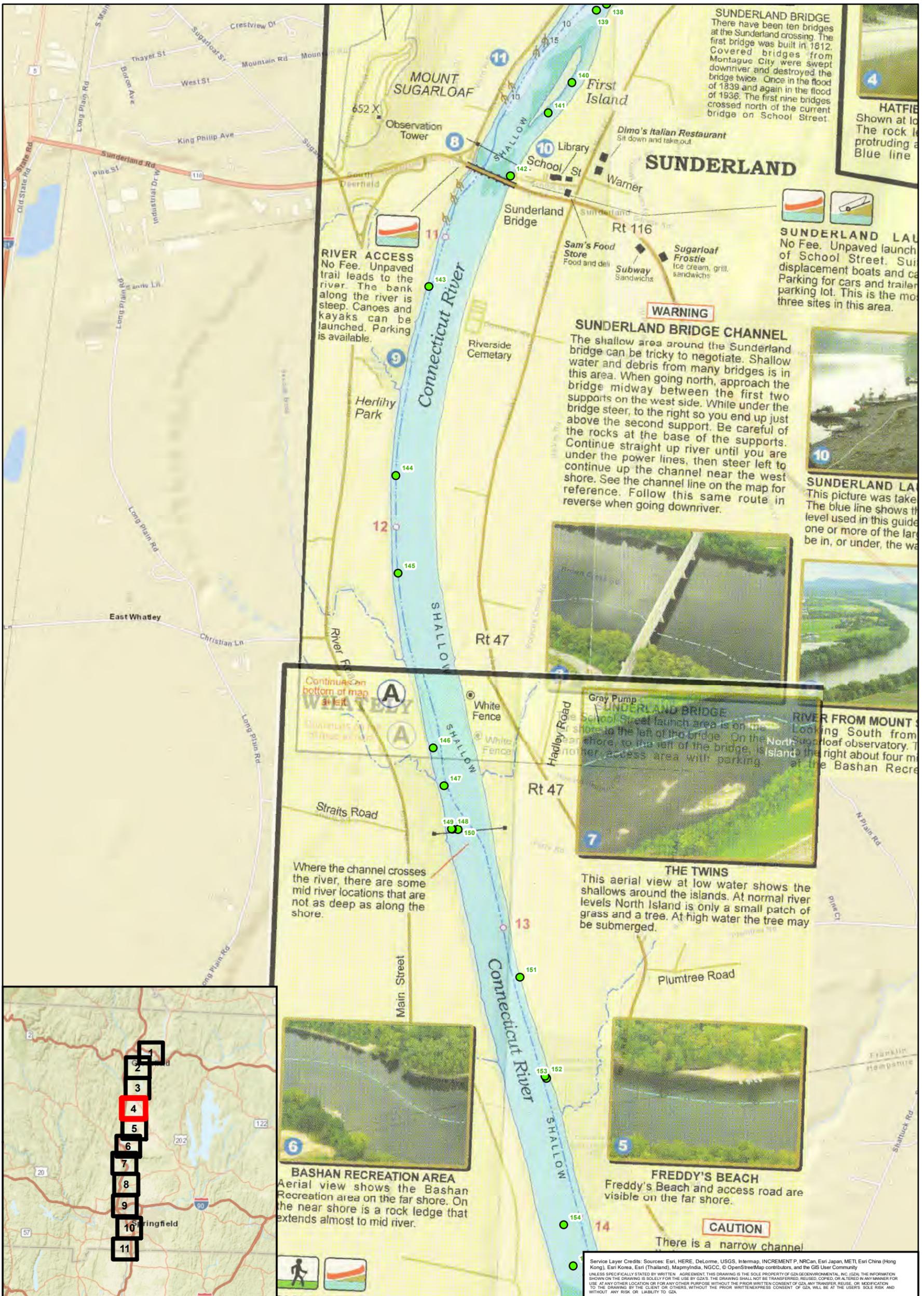
PREPARED FOR:
DEPARTMENT OF CONSERVATION AND RECREATION
 251 CAUSEWAY ST # 9
 BOSTON, MA 02114

VEGETATION PLOT SURVEY POINT LOCATIONS MAP

PROJ MGR: KDC	REVIEWED BY: PGD	CHECKED BY: PGD	SHEET 1 of 11
DESIGNED BY: SRT	DRAWN BY: DRN	SCALE:	
DATE: November 2018	PROJECT NO: 15.0166695.00	REVISION NO: N/A	

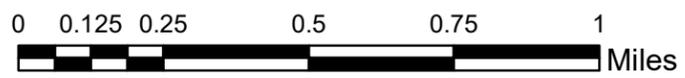


<p>Legend</p> <ul style="list-style-type: none"> ● Trapa Natans (Present) ● Hydrilla Verticulata (Present) ● All Other Vegetation Plot Locations 		<p>0 0.125 0.25 0.5 0.75 1 Miles</p>	
<p>HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER</p>		<p>PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com</p>	
<p>VEGETATION PLOT SURVEY POINT LOCATIONS MAP</p>		<p>PREPARED FOR: DEPARTMENT OF CONSERVATION AND RECREATION 251 CAUSEWAY ST # 9 BOSTON, MA 02114</p>	
<p>PROJ MGR: KDC</p>	<p>DESIGNED BY: SRT</p>	<p>REVIEWED BY: PGD</p>	<p>CHECKED BY: PGD</p>
<p>DATE: November 2018</p>	<p>PROJECT NO: 15.0166695.00</p>	<p>SCALE:</p>	<p>REVISION NO: N/A</p>
			<p>SHEET 2 of 11</p>



Legend

- Trapa Natans (Present)
- Hydrilla Verticulata (Present)
- All Other Vegetation Plot Locations



HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

PREPARED BY:
GZA GeoEnvironmental, Inc.
 Engineers and Scientists
 www.gza.com

PREPARED FOR:
DEPARTMENT OF CONSERVATION AND RECREATION
 251 CAUSEWAY ST # 9
 BOSTON, MA 02114

VEGETATION PLOT SURVEY POINT LOCATIONS MAP

PROJ MGR: KDC	REVIEWED BY: PGD	CHECKED BY: PGD	SHEET 4 of 11
DESIGNED BY: SRT	DRAWN BY: DRN	SCALE:	
DATE: November 2018	PROJECT NO: 15.0166695.00	REVISION NO: N/A	



<p>HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER</p>	<p>PREPARED BY:</p> <p>GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com</p>		<p>PREPARED FOR:</p> <p>DEPARTMENT OF CONSERVATION AND RECREATION 251 CAUSEWAY ST # 9 BOSTON, MA 02114</p>	
	<p>VEGETATION PLOT SURVEY POINT LOCATIONS MAP</p>	<p>PROJ MGR: KDC DESIGNED BY: SRT DATE: November 2018</p>	<p>REVIEWED BY: PGD DRAWN BY: DRN PROJECT NO: 15.0166695.00</p>	<p>CHECKED BY: PGD SCALE: REVISION NO: N/A</p>



<p>HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER</p>		<p>PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com</p>		<p>PREPARED FOR: DEPARTMENT OF CONSERVATION AND RECREATION 251 CAUSEWAY ST # 9 BOSTON, MA 02114</p>	
<p>VEGETATION PLOT SURVEY POINT LOCATIONS MAP</p>		<p>PROJ MGR: KDC</p>	<p>REVIEWED BY: PGD</p>	<p>CHECKED BY: PGD</p>	<p>SHEET 6 of 11</p>
		<p>DESIGNED BY: SRT</p>	<p>DRAWN BY: DRN</p>	<p>SCALE:</p>	
		<p>DATE: November 2018</p>	<p>PROJECT NO: 15.0166695.00</p>	<p>REVISION NO: N/A</p>	



ARK 9, LOG CRIB
Normal water level. Two in this area. The daymark 9 is furthest from shore. The flashing light is covered. During the log crib is covered.



MITCH'S ISLAND SOUTH END
Shown at low water. The sand bar extending off the tip of the island is right next to the channel which is 10 feet deep at normal levels. Three buoys mark the rock jetty.



OXBOW CHANNEL
channel between marker 12 is very shallow. Buoys and buoys are used to mark the channel. Go slow and heed the buoys.

STATE LAUNCH RAMP
No fee. Two lane paved launch ramp. Shown at normal water level. During the summer there is a dock. At high water this lot can be flooded.

JW MARINA
1 ramp is limited to seasonal docks and fine supply store, boat vice. 413 584 2775.

OXBOW WATER SPORTS
Northampton Youth and Community Rowing, www.bampcrew.com, and Oxbow Water Ski Show Team (413 623 5293) share this facility. Please go slow and use caution during events.

NATURE CENTER
ctuary features including trails. For more info call 413 584 3009. Boat and kayak only.

CAUTION
This channel is very shallow. Follow the markers and buoys. Raise stern drives and outboards if possible.

EASTHAMPTON ROD AND GUN CLUB
Private launch ramp for members only.

STATE LAUNCH RAMP
No fee. Paved two lane ramp. Parking for cars and trailers. Overflow parking on lot is provided at the ramp.

AIL TRAIL
ail Trail starts at the top of the hill and runs 6 miles through the town of Northampton.

VARIED BOATING STYLES
The river has enough depth and width for powerboats to travel the length of this section. This means that powerboats are sharing the river with canoes and kayakers. Be courteous and slow to a no wake speed when passing canoes, yaks, and other small craft.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

SMITH'S FERRY
1770 Elias Lyman started a ferry service between what is now Holyoke Canoe Club and the Holyoke Marina. A steamboat ferried passengers from here to a Summit House at Mount Holyoke in the mid-1800s.

SMITH'S FERRY
1770 Elias Lyman started a ferry service between what is now Holyoke Canoe Club and the Holyoke Marina. A steamboat ferried passengers from here to a Summit House at Mount Holyoke in the mid-1800s.

CAUTION
Fog can extend a few miles up the river. A thick fog can be so dense that you can't see the other side of the river. In heavy fog go slow and use your horn or whistle to let others know you are on the river.

CAUTION
Fog can extend a few miles up the river. A thick fog can be so dense that you can't see the other side of the river. In heavy fog go slow and use your horn or whistle to let others know you are on the river.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

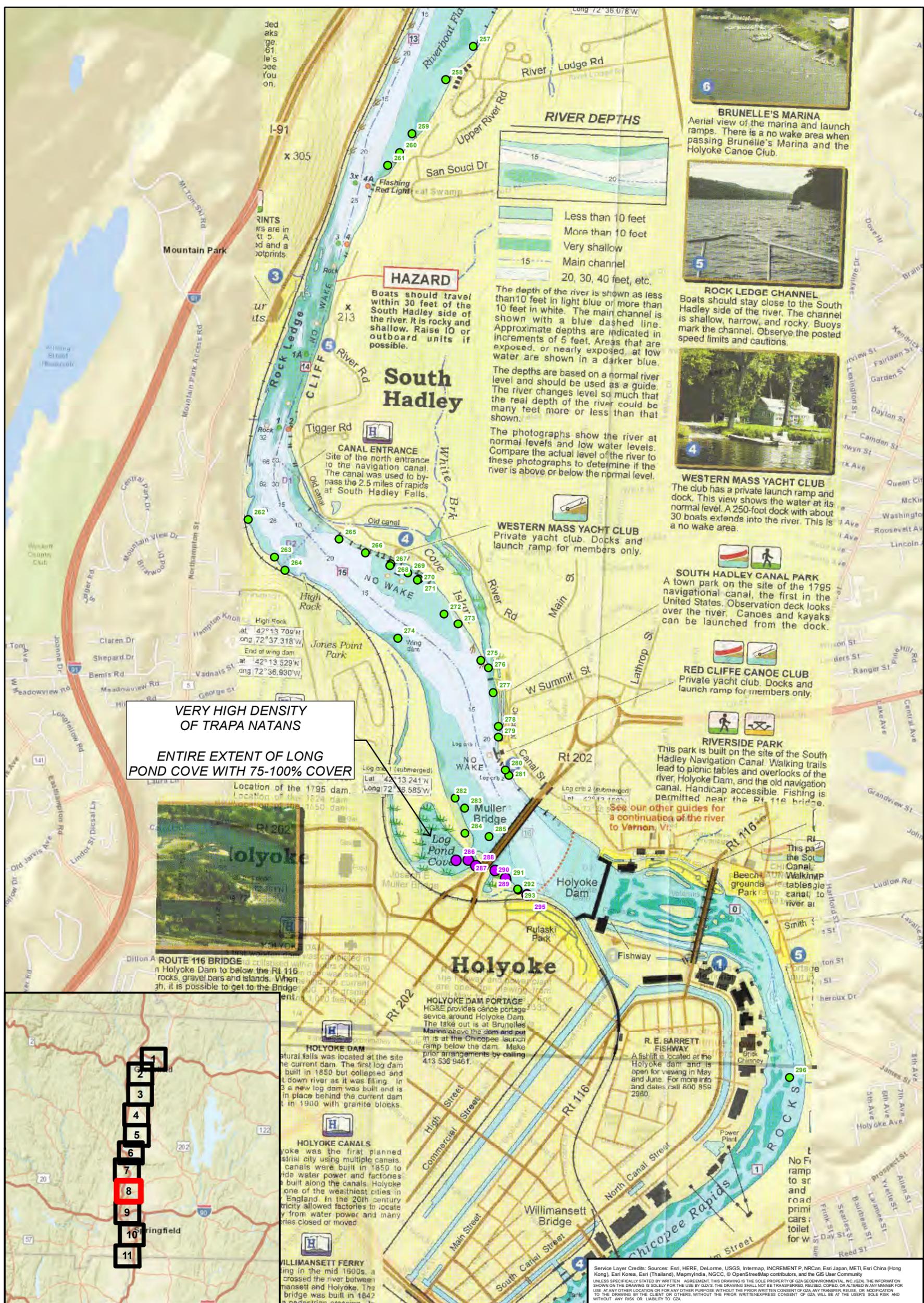
CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.

CAUTION
A large, irregular, rock mass known as Indian Dam goes from one side of the river to the other. It can be just a few feet below the surface. Boaters should use caution in this area, especially when the water level is low. The dam was built by hand in the 1500s using thousands of rocks.



Legend

- Trapa Natans (Present)
- Hydrilla Verticulata (Present)
- All Other Vegetation Plot Locations

0 0.125 0.25 0.5 0.75 1 Miles

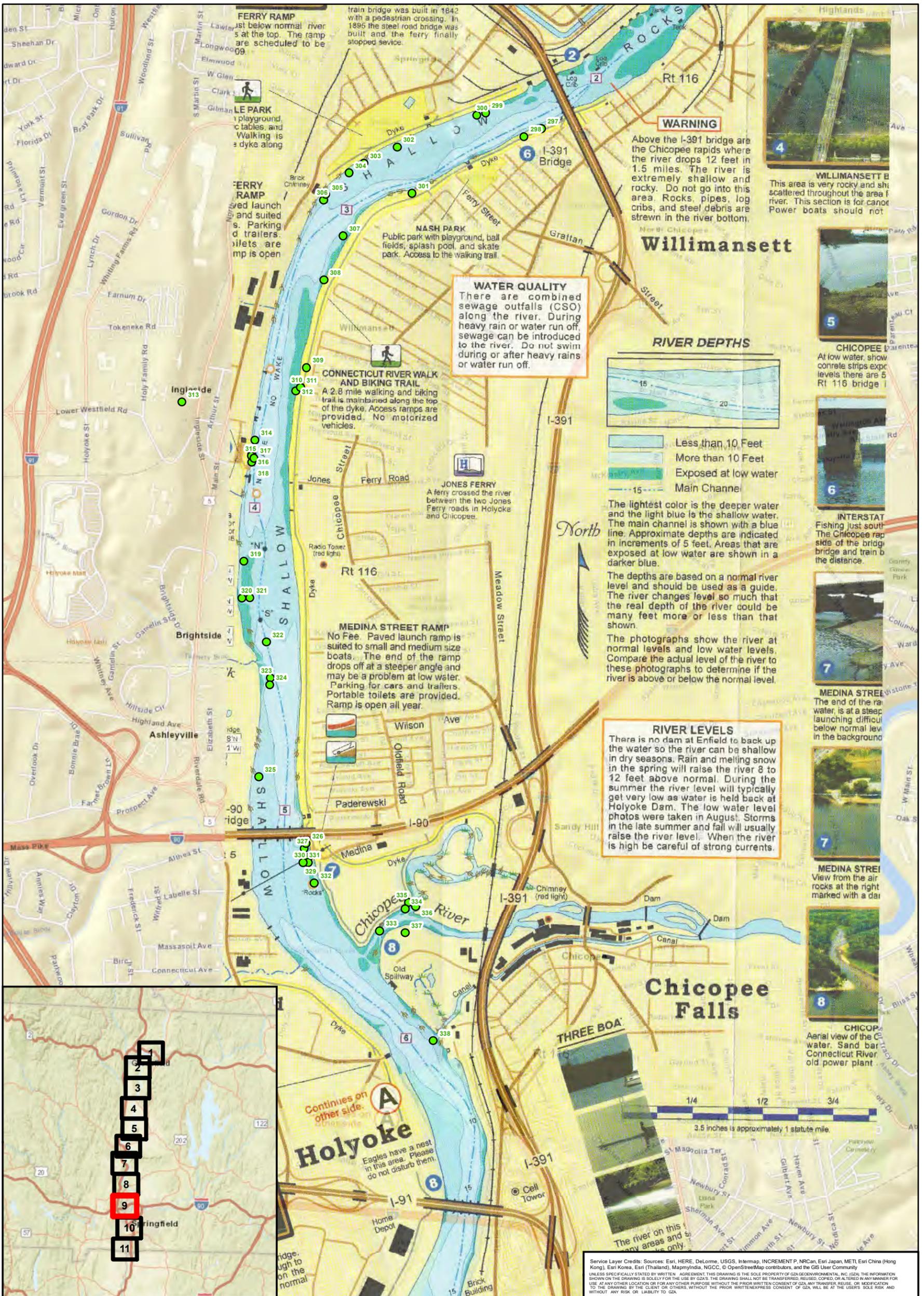
HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

PREPARED BY: **GZA GeoEnvironmental, Inc.**
Engineers and Scientists
www.gza.com

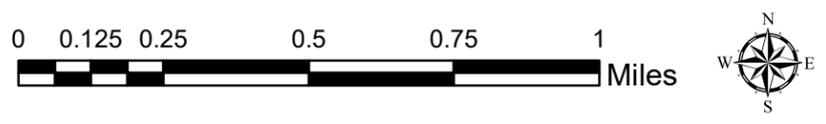
PREPARED FOR: **DEPARTMENT OF CONSERVATION AND RECREATION**
251 CAUSEWAY ST # 9
BOSTON, MA 02114

VEGETATION PLOT SURVEY POINT LOCATIONS MAP

PROJ MGR: KDC	REVIEWED BY: PGD	CHECKED BY: PGD	SHEET 8 of 11
DESIGNED BY: SRT	DRAWN BY: DRN	SCALE:	
DATE: November 2018	PROJECT NO: 15.0166695.00	REVISION NO: N/A	



- Legend**
- Trapa Natans (Present)
 - Hydrilla Verticulata (Present)
 - All Other Vegetation Plot Locations



HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

PREPARED BY:
GZA GeoEnvironmental, Inc.
 Engineers and Scientists
 www.gza.com

PREPARED FOR:
DEPARTMENT OF CONSERVATION AND RECREATION
 251 CAUSEWAY ST # 9
 BOSTON, MA 02114

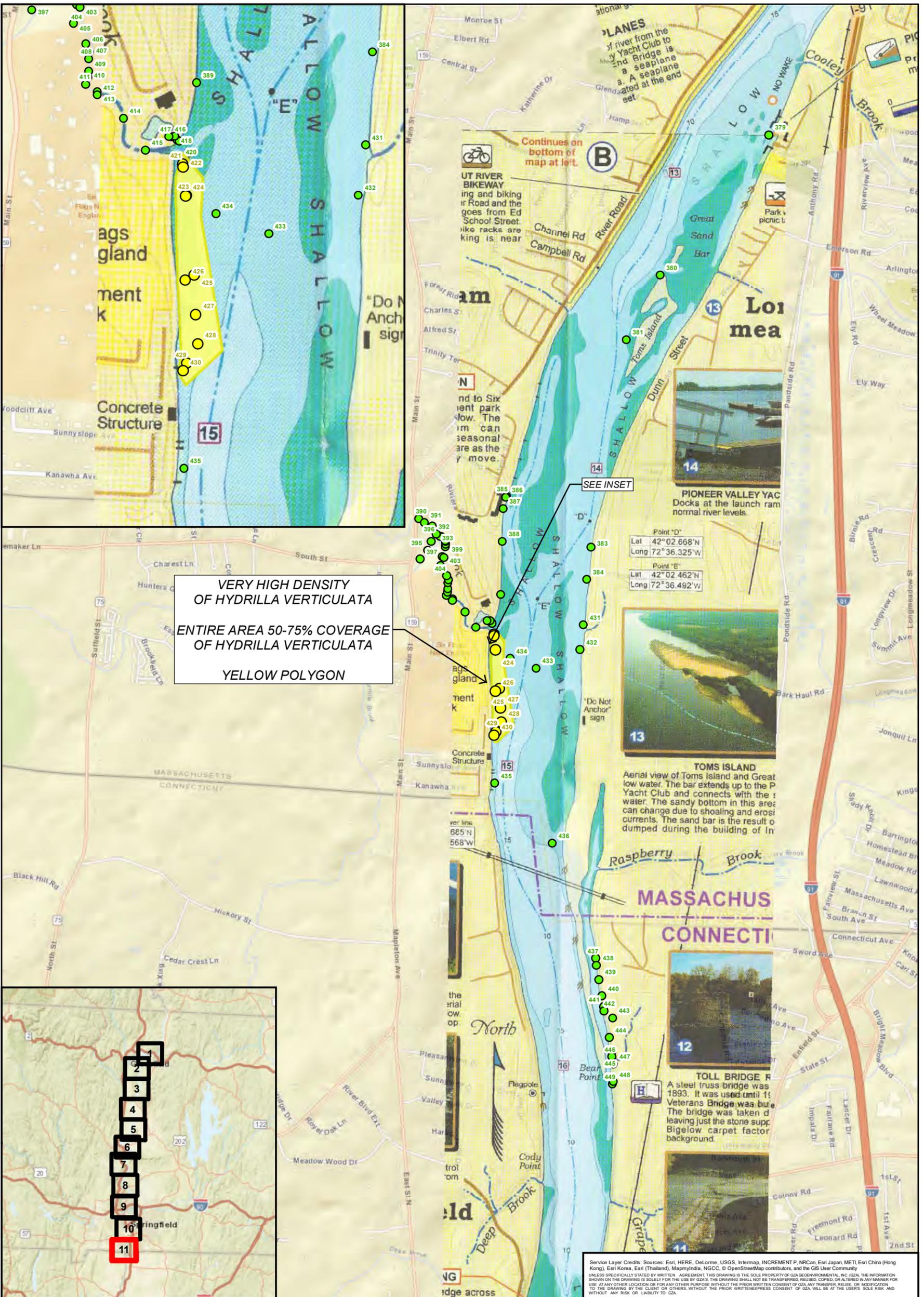
VEGETATION PLOT SURVEY POINT LOCATIONS MAP

PROJ MGR: KDC	REVIEWED BY: PGD	CHECKED BY: PGD	SHEET 9 of 11
DESIGNED BY: SRT	DRAWN BY: DRN	SCALE:	
DATE: November 2018	PROJECT NO: 15.0166695.00	REVISION NO: N/A	



Legend Trapa Natans (Present) Hydrilla Verticulata (Present) All Other Vegetation Plot Locations	0 0.125 0.25 0.5 0.75 1 Miles		
	PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		
HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER			
VEGETATION PLOT SURVEY POINT LOCATIONS MAP			
PROJ MGR: KDC DESIGNED BY: SRT DATE: November 2018	REVIEWED BY: PGD DRAWN BY: DRN PROJECT NO: 15.0166695.00	CHECKED BY: PGD SCALE: REVISION NO: N/A	SHEET 10 of 11

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, OpenStreetMap contributors, and the GIS User Community
 UNLESS SPECIFICALLY STATED BY WRITER, AGREEMENT THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THIS DRAWING IS SOLELY FOR THE USE BY GZAS. THE DRAWING SHALL NOT BE TRANSMITTED, REPRODUCED, COPIED OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

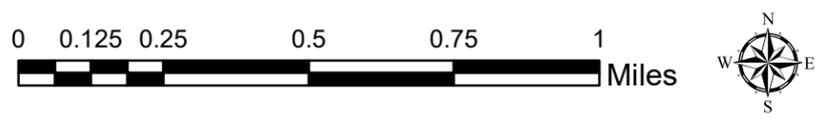


**VERY HIGH DENSITY
OF HYDRILLA VERTICULATA**
ENTIRE AREA 50-75% COVERAGE
OF HYDRILLA VERTICULATA
YELLOW POLYGON

Point "D"
Lat 42°02.668'N
Long 72°36.325'W
Point "E"
Lat 42°02.462'N
Long 72°36.492'W

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR THE USE BY GZAS. THE DRAWING SHALL NOT BE TRANSFERRED, REPRODUCED, COPIED OR ALTERED IN ANY MANNER FOR USE AT ANY OTHER LOCATION OR FOR ANY OTHER PURPOSE WITHOUT THE PRIOR WRITTEN CONSENT OF GZA. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING BY THE CLIENT OR OTHERS WITHOUT THE PRIOR WRITTEN EXPRESS CONSENT OF GZA WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

- Legend**
- Trapa Natans (Present)
 - Hydrilla Verticulata (Present)
 - All Other Vegetation Plot Locations



HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY ST # 9
BOSTON, MA 02114

VEGETATION PLOT SURVEY POINT LOCATIONS MAP

PROJ MGR: KDC	REVIEWED BY: PGD	CHECKED BY: PGD	SHEET 11 of 11
DESIGNED BY: SRT	DRAWN BY: DRN	SCALE:	
DATE: November 2018	PROJECT NO: 15.0166695.00	REVISION NO: N/A	

HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

VEGETATION PLOT SURVEY LOCATIONS DATA

KEY:

Algae – General Algae, Arrow – Green Arrow Arum (*Peltandra virginica*), BL – Big-leaf Pondweed (*Potamogeton amplifolius*), Char – Chara (Algae), Coon – Coontail (*Ceratophyllum demersum*), CT – Cattail (*Typha latifolia*), Curly – Curly Pondweed (*Pot. crispus*), DW – Duckweed (*Lemna minor*), Elo – Elodea (*Elodea canadensis*), EW – European watercress (*Marsilea quadrifolia*), Fan – Fanwort (*Cabomba caroliniana*), FL – False loosestrife (*Ludwigia polycarpa*), Hyd - Waterthyme (*Hydrilla verticillata*), Mil – Eurasian watermilfoil (*Myriophyllum spicatum*), Nym = White Water Lilly (*Nymphaea odorata*), Red – Redhead-grass (*Pot. richardsonii*), Ribbon – Ribbonleaf Pondweed (*Pot. epihydrus*), Rob - Robbins' Pondweed (*Potamogeton robbinsii*), Sago – Sago Pondweed (*Potamogeton pectinatus*), Spad - Spatterdock (*Nuphar advena*), Star - Waterstar Grass (*Heteranthera dubia*), Trapa - Water Chestnut (*Trapa natans*), Val – Tape Grass (*Vallisneria americana*), Var – Variable Pondweed (*Pot. gramineus*), WC - Watercress (*Nasturtium officinale*), WM – Watermeal (*Wolffia* spp.).

Vegetation Plot Survy Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude	Vegetation Plot Survy Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude
1	Absent	N/A	Absent	Absent	42.597842	-72.496899	51	Absent	N/A	Absent	Absent	42.606024	-72.532531
2	Absent	N/A	Absent	Absent	42.596762	-72.496994	52	Char	Medium	Absent	Absent	42.606057	-72.534145
3	Val	Sparse	Absent	Absent	42.601418	-72.504203	53	Char, Mil, Fan	Medium	Absent	Absent	42.60665	-72.534398
4	Mil, Var	Sparse	Absent	Absent	42.603359	-72.504925	54	Fan, Val, Sago, Char	Medium	Absent	Absent	42.606546	-72.535657
5	Mil, Var	Sparse	Absent	Absent	42.603637	-72.504979	55	Val, Fan, Sago, Char	Medium	Absent	Absent	42.606991	-72.536234
6	Elo	Sparse	Absent	Absent	42.603217	-72.512097	56	Sago, Fan, Char, Val	Medium	Absent	Absent	42.607699	-72.536121
7	Mil, Val, Elo, Var	Medium	Absent	Absent	42.605343	-72.513574	57	Char, Val, Var, Fan	Medium	Absent	Absent	42.607823	-72.537255
8	Absent	N/A	Absent	Absent	42.605427	-72.51487	58	Fan, Nym, Char, Val, Sago	Medium	Absent	Absent	42.607921	-72.538059
9	Absent	N/A	Absent	Absent	42.605558	-72.515632	59	Val, Fan, Char	Sparse	Absent	Absent	42.607419	-72.539409
10	Mil, Var	Sparse	Absent	Absent	42.605512	-72.516325	60	Fan, Val, Sago, Nym, Char	Sparse	Absent	Absent	42.607454	-72.541168
11	Mil, Val, Var	Medium	Absent	Absent	42.603549	-72.526597	61	Val, BL, Fan, Val, Char, Sago	Sparse	Absent	Absent	42.60746	-72.542014
12	Mil	Medium	Absent	Absent	42.603123	-72.527012	62	Sago, Fan, Val, Mil, Char	Medium	Absent	Absent	42.605199	-72.539368
13	Var, Mil	Medium	Absent	Absent	42.602809	-72.527458	63	Val, Char, Sago	Medium	Absent	Absent	42.604515	-72.539897
14	Var	Sparse	Absent	Absent	42.601613	-72.529444	64	Char, Val, Nym, Mil, Fan	Medium	Absent	Absent	42.605354	-72.540637
15	Val, Nym, Mil	Sparse	Absent	Absent	42.597266	-72.528039	65	Val, Nym, Sago	Medium	Absent	Absent	42.604259	-72.541872
16	Val, Nym, Var, Char	Sparse	Absent	Absent	42.596362	-72.52952	66	Char, Val, Mil	Medium	Absent	Absent	42.603174	-72.543948
17	Val, Nym, Char, Mil	Sparse	Absent	Absent	42.595718	-72.531086	67	Val, Mil, Nym	Medium	Absent	Absent	42.604572	-72.543436
18	Mil, Val, Nym	Sparse	Absent	Absent	42.59545	-72.532101	68	Var, Val, Char, Sago, Mil	Medium	Absent	Absent	42.605384	-72.542944
19	Sago, Char, Val, Mil	Sparse	Absent	Absent	42.594287	-72.53243	69	Fan	Medium	Absent	Absent	42.606475	-72.543066
20	Val, Char	Medium	Absent	Absent	42.593788	-72.5358	70	Fan, Char	Medium	Absent	Absent	42.606228	-72.543894
21	Val, Char, Sago	Medium	Absent	Absent	42.593765	-72.535923	71	Val, Coon, Char, Mil, Elo	Medium	Absent	Absent	42.605893	-72.54504
22	Val, Char	Medium	Absent	Absent	42.593775	-72.53598	72	Val, Char, Fan	Medium	Absent	Absent	42.607777	-72.543039
23	Char, Val, Sago, Nym, Mil	Medium	Absent	Absent	42.595206	-72.535517	73	Val, Char, Var	Medium	Absent	Absent	42.607617	-72.543275
24	Val, Var, Mil	Medium	Absent	Absent	42.595758	-72.535932	74	Val, Nym, Fan, Char, Elo	Medium	Absent	Absent	42.607867	-72.543579
25	Var, Mil, Char, Ribbon	Medium	Absent	Absent	42.595332	-72.536931	75	Val, Fan, Sago, Mil, Var	Medium	Absent	Absent	42.607609	-72.543748
26	Val, Red, Mil	Medium	Absent	Absent	42.594725	-72.539337	76	Val, Char, Sago, Mil	Medium	Absent	Absent	42.607817	-72.543969
27	Val, Mil, Nym, Elo	Sparse	Absent	Absent	42.595106	-72.544304	77	Char, Val, Fan, Sago, Nym, Mil	Medium	Absent	Absent	42.608095	-72.545143
28	Mil, Var, Char	Sparse	Absent	Absent	42.596376	-72.546084	78	Trapa	Sparse	Absent	Present	42.608407	-72.546558
29	Absent	N/A	Absent	Absent	42.597119	-72.545967	79	Fan, Char	Medium	Absent	Absent	42.608351	-72.54659
30	CT, Val, Elo, Mil, Var	Sparse	Absent	Absent	42.597206	-72.545876	80	Nym, Val, Var, Sago, Fan	Medium	Absent	Absent	42.608193	-72.547365
31	Nym, Mil, Var	Medium	Absent	Absent	42.600134	-72.54442	81	Val, Nym, Sago	Medium	Absent	Absent	42.607916	-72.547669
32	Mil, Val, Var, Nym	Medium	Absent	Absent	42.601258	-72.544022	82	Val, Nym, Var, Mil, Chara, Sago	Medium	Absent	Absent	42.608001	-72.547974
33	Elo	Medium	Absent	Absent	42.601875	-72.543627	83	Val, Coon, Star	Medium	Absent	Absent	42.608043	-72.548545
34	Mil, Var	Medium	Absent	Absent	42.601981	-72.543831	84	Absent	N/A	Absent	Absent	42.608108	-72.548723
35	Mil, Val, Elo	Medium	Absent	Absent	42.601985	-72.54385	85	Val, Mil	Sparse	Absent	Absent	42.60424	-72.54709
36	Sago, Nym, Val, Trapa	Medium	Absent	Present	42.602226	-72.540824	86	Val, Coon, Mil, Elo, Red	Sparse	Absent	Absent	42.60437	-72.547192
37	Nym, Sago, Val, Mil, Trapa	Medium	Absent	Present	42.60241	-72.540695	87	Mil, Val, Nym	Sparse	Absent	Absent	42.605178	-72.547687
38	Val, Mil, Nym, Fan	Medium	Absent	Absent	42.602637	-72.540398	88	Var, Mil	Sparse	Absent	Absent	42.605411	-72.547855
39	Fan, Val, Nym	Medium	Absent	Absent	42.60303	-72.539773	89	Val, Char, Fan, Star, Nym, Red, Elo, Mil	Sparse	Absent	Absent	42.606392	-72.54912
40	Absent	N/A	Absent	Absent	42.603113	-72.539327	90	Char, Mil, Val, Nym, Elo	Sparse	Absent	Absent	42.60687	-72.549931
41	Mil, Fan	Sparse	Absent	Absent	42.602801	-72.539006	91	Absent	N/A	Absent	Absent	42.588214	-72.581176
42	Val, Fan, Nym, Mil, Char	Sparse	Absent	Absent	42.603187	-72.537605	92	Absent	N/A	Absent	Absent	42.578799	-72.578985
43	Fan, Char, Val, Sago, Mil, Nym	Sparse	Absent	Absent	42.603405	-72.535289	93	Absent	N/A	Absent	Absent	42.571029	-72.581636
44	Absent	N/A	Absent	Absent	42.602873	-72.533661	94	Absent	N/A	Absent	Absent	42.570783	-72.583464
45	Fan	Sparse	Absent	Absent	42.603443	-72.533181	95	Absent	N/A	Absent	Absent	42.57025	-72.585955
46	Fan	Sparse	Absent	Absent	42.603388	-72.533606	96	Absent	N/A	Absent	Absent	42.570349	-72.587651
47	Val, Mil	Sparse	Absent	Absent	42.603604	-72.534209	97	Curly	Sparse	Absent	Absent	42.570339	-72.588793
48	Fan, Mil, Char	Sparse	Absent	Absent	42.604142	-72.533679	98	Absent	N/A	Absent	Absent	42.56871	-72.592814
49	Mil, Char	Medium	Absent	Absent	42.605339	-72.533439	99	Absent	N/A	Absent	Absent	42.57848	-72.575996
50	Val, Sago, Nym, Mil	Medium	Absent	Absent	42.605897	-72.532912	100	Absent	N/A	Absent	Absent	42.579419	-72.576042

HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

VEGETATION PLOT SURVEY LOCATIONS DATA

Vegetation Plot Survay Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude		Vegetation Plot Survay Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude
101	Val	Sparse	Absent	Absent	42.57683	-72.56657		151	Val	Sparse	Absent	Absent	42.42903	-72.582223
102	Val	Sparse	Absent	Absent	42.576792	-72.565936		152	Val	Sparse	Absent	Absent	42.424264	-72.580509
103	Val, Elo	Sparse	Absent	Absent	42.57307	-72.561311		153	Absent	N/A	Absent	Absent	42.424171	-72.580426
104	Val	Sparse	Absent	Absent	42.572938	-72.561264		154	Val	Sparse	Absent	Absent	42.417124	-72.579178
105	Val	Sparse	Absent	Absent	42.57151	-72.559275		155	Curly	Sparse	Absent	Absent	42.41516	-72.578516
106	Val	Sparse	Absent	Absent	42.556184	-72.554768		156	Val	Medium	Absent	Absent	42.411731	-72.578177
107	Absent	N/A	Absent	Absent	42.552769	-72.557231		157	Val	Medium	Absent	Absent	42.410541	-72.577297
108	Absent	N/A	Absent	Absent	42.551793	-72.557693		158	Val, Curly	Medium	Absent	Absent	42.409652	-72.57633
109	Absent	N/A	Absent	Absent	42.538351	-72.565078		159	Absent	N/A	Absent	Absent	42.399693	-72.5887
110	Curly	Sparse	Absent	Absent	42.53688	-72.567315		160	Val	Sparse	Absent	Absent	42.39895	-72.588389
111	Val, Curly	Sparse	Absent	Absent	42.535042	-72.567743		161	Val	Sparse	Absent	Absent	42.398862	-72.589428
112	Val	Sparse	Absent	Absent	42.531626	-72.569606		162	Val	Sparse	Absent	Absent	42.396578	-72.591567
113	Val	Sparse	Absent	Absent	42.53137	-72.569702		163	Absent	N/A	Absent	Absent	42.3884	-72.585992
114	Curly, Val	Sparse	Absent	Absent	42.526969	-72.566811		164	Absent	N/A	Absent	Absent	42.387117	-72.586822
115	Var, Val	Medium	Absent	Absent	42.523226	-72.565138		165	Val	Sparse	Absent	Absent	42.383507	-72.590616
116	Red, Val	Medium	Absent	Absent	42.519936	-72.564275		166	Val	Sparse	Absent	Absent	42.383447	-72.590649
117	Val	Sparse	Absent	Absent	42.514505	-72.558931		167	Absent	N/A	Absent	Absent	42.383399	-72.587926
118	Absent	N/A	Absent	Absent	42.510121	-72.554025		168	Val	Medium	Absent	Absent	42.382992	-72.588094
119	Val	Sparse	Absent	Absent	42.506547	-72.555908		169	Val	Medium	Absent	Absent	42.382158	-72.588215
120	Red	Sparse	Absent	Absent	42.506355	-72.556303		170	Val	Medium	Absent	Absent	42.381713	-72.588389
121	Val, Elo, Curly	Sparse	Absent	Absent	42.501972	-72.561121		171	Val, Red, Var	Medium	Absent	Absent	42.381111	-72.588899
122	Curly, Var	Medium	Absent	Absent	42.500572	-72.563546		172	Val, Red, Var, Curly	Medium	Absent	Absent	42.380324	-72.589125
123	Red, Val	Medium	Absent	Absent	42.500246	-72.563543		173	Val, Curly	Medium	Absent	Absent	42.379858	-72.588946
124	Val, Red	Medium	Absent	Absent	42.498778	-72.565393		174	Val	Medium	Absent	Absent	42.37784	-72.589519
125	Val, Var	Medium	Absent	Absent	42.49718	-72.567026		175	Elo, Val	Medium	Absent	Absent	42.351845	-72.615638
126	Red, Val	Medium	Absent	Absent	42.497058	-72.567038		176	Elo, Val	Medium	Absent	Absent	42.351882	-72.616054
127	Val	Sparse	Absent	Absent	42.496415	-72.569297		177	Absent	N/A	Absent	Absent	42.352052	-72.636014
128	Val, Curly	Sparse	Absent	Absent	42.491641	-72.568314		178	Absent	N/A	Absent	Absent	42.351344	-72.636803
129	Val	Medium	Absent	Absent	42.489313	-72.56815		179	Elo, Val	Sparse	Absent	Absent	42.35131	-72.636773
130	Absent	N/a	Absent	Absent	42.488152	-72.571504		180	Val	Sparse	Absent	Absent	42.341213	-72.630176
131	Absent	N/A	Absent	Absent	42.487673	-72.57164		181	Val	Medium	Absent	Absent	42.336462	-72.621872
132	Val	Sparse	Absent	Absent	42.487328	-72.568034		182	Val	Medium	Absent	Absent	42.33532	-72.618581
133	Val, Curly	Sparse	Absent	Absent	42.485646	-72.568378		183	Val	Medium	Absent	Absent	42.33724	-72.616976
134	Curly	Sparse	Absent	Absent	42.484697	-72.568583		184	Val	Medium	Absent	Absent	42.336294	-72.615757
135	Val	Sparse	Absent	Absent	42.48395	-72.569147		185	Absent	N/A	Absent	Absent	42.335842	-72.614281
136	Val, Elo	Sparse	Absent	Absent	42.478121	-72.574221		186	Absent	N/A	Absent	Absent	42.325879	-72.584352
137	Absent	Sparse	Absent	Absent	42.47811	-72.574872		187	Val, Fan, Mil, Elo, Curly	Medium	Absent	Absent	42.318307	-72.590244
138	Car, Elo, Val	Sparse	Absent	Absent	42.475949	-72.577405		188	Absent	N/A	Absent	Absent	42.316419	-72.595173
139	Val Curly	Sparse	Absent	Absent	42.475656	-72.578064		189	Char, Fan, Val, Mil	Medium	Absent	Absent	42.314962	-72.596838
140	Val	Medium	Absent	Absent	42.472166	-72.579584		190	Val	Medium	Absent	Absent	42.313668	-72.597108
141	Absent	Sparse	Absent	Absent	42.470691	-72.581096		191	Val	Medium	Absent	Absent	42.31354	-72.597132
142	Val	Medium	Absent	Absent	42.467617	-72.583504		192	Elo, Mil, Red, Val	Medium	Absent	Absent	42.307728	-72.597224
143	Val	Sparse	Absent	Absent	42.462239	-72.588715		193	Elo, Val	Medium	Absent	Absent	42.307563	-72.597404
144	Val	Sparse	Absent	Absent	42.453127	-72.590693		194	Elo, Val	Medium	Absent	Absent	42.30736	-72.597449
145	Absent	N/A	Absent	Absent	42.448413	-72.59046		195	Val, Elo	Medium	Absent	Absent	42.306312	-72.598185
146	Curly, Val	Sparse	Absent	Absent	42.440022	-72.588028		196	Val	Medium	Absent	Absent	42.306099	-72.598328
147	Absent	N/A	Absent	Absent	42.4382	-72.58731		197	Absent	N/A	Absent	Absent	42.305789	-72.598873
148	Val, Red	Sparse	Absent	Absent	42.43614	-72.586779		198	Absent	N/A	Absent	Absent	42.304779	-72.599407
149	Absent	N/A	Absent	Absent	42.436118	-72.586745		199	Val	Medium	Absent	Absent	42.304296	-72.599431
150	Val, Red	Sparse	Absent	Absent	42.436107	-72.586371		200	Absent	N/A	Absent	Absent	42.302951	-72.603059

HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

VEGETATION PLOT SURVEY LOCATIONS DATA

Vegetation Plot Survay Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude		Vegetation Plot Survay Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude
KEY: Algae – General Algae, Arrow – Green Arrow Arum (<i>Peltandra virginica</i>), BL – Big-leaf Pondweed (<i>Potamogeton amplifolius</i>), Char – Chara (Algae), Coon – Coontail (<i>Ceratophyllum demersum</i>), CT – Cattail (<i>Typha latifolia</i>), Curly – Curly Pondweed (<i>Pot. crispus</i>), DW – Duckweed (<i>Lemna minor</i>), Elo – Elodea (<i>Elodea canadensis</i>), EW - European waterclover (<i>Marsilea quadrifolia</i>), Fan – Fanwort (<i>Cabomba caroliniana</i>), FL – False loosestrife (<i>Ludwigia polycarpa</i>), Hyd - Waterthyme (<i>Hydrilla verticillata</i>), Mil – Eurasian watermilfoil (<i>Myriophyllum spicatum</i>), Nym = White Water Lilly (<i>Nymphaea odorata</i>), Red – Redhead-grass (<i>Pot. richardsonii</i>), Ribbon – Ribbonleaf Pondweed (<i>Pot. epihydrus</i>), Rob - Robbins' Pondweed (<i>Potamogeton robbinsii</i>), Sago – Sago Pondweed (<i>Potamogeton pectinatus</i>), Spad - Spatterdock (<i>Nuphar advena</i>), Star - Waterstar Grass (<i>Heteranthera dubia</i>), Trapa - Water Chestnut (<i>Trapa natans</i>), Val – Tape Grass (<i>Vallisneria americana</i>), Var – Variable Pondweed (<i>Pot. gramineus</i>), WC - Watercress (<i>Nasturtium officinale</i>), WM – Watermeal (<i>Wolffia</i> spp.).														
201	Absent	Sparse	Absent	Absent	42.303134	-72.605318		251	Absent	N/A	Absent	Absent	42.262232	-72.603666
202	Val	Medium	Absent	Absent	42.296619	-72.612006		252	Val	Sparse	Absent	Absent	42.264143	-72.599047
203	Val, Curly	Medium	Absent	Absent	42.295806	-72.612882		253	Elo, Val	Medium	Absent	Absent	42.262131	-72.603577
204	Char, Fan, Mil	Medium	Absent	Absent	42.29878	-72.613629		254	Elo	Sparse	Absent	Absent	42.263516	-72.605288
205	Fan, Val, Char, Mil	Medium	Absent	Absent	42.296702	-72.616083		255	Absent	N/A	Absent	Absent	42.263466	-72.605267
206	Fan, Char, Val, Mil	Medium	Absent	Absent	42.298969	-72.617198		256	Val	Sparse	Absent	Absent	42.262972	-72.606201
207	Fan, Char	Medium	Absent	Absent	42.300575	-72.614073		257	Elo, Val	Sparse	Absent	Absent	42.253395	-72.611317
208	l, WM, DW, Fan, Mil, WC, Spad, N	Dense	Absent	Absent	42.29104	-72.617499		258	Val, Elo	Sparse	Absent	Absent	42.252347	-72.613059
209	Mil, Spad, Fan, Nym, Var, Val	Dense	Absent	Absent	42.290663	-72.618923		259	Absent	N/A	Absent	Absent	42.249717	-72.61519
210	Fan, Val, Char, WC	Dense	Absent	Absent	42.289943	-72.62195		260	Absent	N/A	Absent	Absent	42.248801	-72.615961
211	Mil, Var, Char, Val, Nym	Dense	Absent	Absent	42.289389	-72.62261		261	Val, Elo	Sparse	Absent	Absent	42.248193	-72.616725
212	Fan, Char	Dense	Absent	Absent	42.289078	-72.623971		262	Val, Rob, Mil, Char	Medium	Absent	Absent	42.231086	-72.625424
213	Char, Mil, Fan	Dense	Absent	Absent	42.289055	-72.623689		263	Mil	Sparse	Absent	Absent	42.229296	-72.623696
214	Nym, Fan, Char	Dense	Absent	Absent	42.288524	-72.623099		264	Val, Elo	Sparse	Absent	Absent	42.228677	-72.62301
215	Rob, Mil, Nym, Val, Char	Dense	Absent	Absent	42.287518	-72.624963		265	Absent	N/A	Absent	Absent	42.230198	-72.619549
216	Mil, Char	Dense	Absent	Absent	42.287272	-72.625546		266	Val, Elo	Sparse	Absent	Absent	42.229565	-72.617837
217	Mil, Char, Nym	Dense	Absent	Absent	42.286703	-72.626904		267	Val	Sparse	Absent	Absent	42.22895	-72.616245
218	Mil	Medium	Absent	Absent	42.284287	-72.629694		268	Val, Elo	Sparse	Absent	Absent	42.22905	-72.61616
219	Mil	Medium	Absent	Absent	42.285003	-72.630081		269	Elo, Val, Rob, Char, Mil	Medium	Absent	Absent	42.228616	-72.615078
220	Mil, Fan, Val, Algae, Elo	Medium	Absent	Absent	42.285501	-72.630194		270	Val	Sparse	Absent	Absent	42.22828	-72.614451
221	Char, Val	Medium	Absent	Absent	42.28598	-72.630736		271	Val, Elo, Red	Medium	Absent	Absent	42.228339	-72.614382
222	Star, Mil, Val, Char	Medium	Absent	Absent	42.284144	-72.633335		272	Absent	N/A	Absent	Absent	42.226666	-72.612718
223	Char, Val	Medium	Absent	Absent	42.284302	-72.633741		273	Absent	N/A	Absent	Absent	42.226199	-72.611808
224	Mil, Val	Medium	Absent	Absent	42.284481	-72.634985		274	Curly, Val	Sparse	Absent	Absent	42.225483	-72.615675
225	Char, Mil, Val, Spad	Medium	Absent	Absent	42.289237	-72.637374		275	Absent	N/A	Absent	Absent	42.224469	-72.610312
226	Char, Star, Val, Mil	Medium	Absent	Absent	42.292647	-72.636462		276	Elo, Red, Val, Var	Medium	Absent	Absent	42.224111	-72.609812
227	Char, Star, Fan, Arrow	Medium	Absent	Absent	42.291956	-72.636779		277	Val, Elo	Sparse	Absent	Absent	42.222924	-72.609473
228	Mil, Star, Var	Medium	Absent	Absent	42.291159	-72.634546		278	Absent	N/A	Absent	Absent	42.221297	-72.609116
229	Fan	Sparse	Absent	Absent	42.293162	-72.633409		279	Elo, Mil, Val, Rob, Red	Medium	Absent	Absent	42.220782	-72.609112
230	Fan, Mil	Sparse	Absent	Absent	42.294479	-72.632772		280	Val, Star	Sparse	Absent	Absent	42.219208	-72.608634
231	Fan	Sparse	Absent	Absent	42.295825	-72.635852		281	Absent	N/A	Absent	Absent	42.218949	-72.608397
232	Absent	N/A	Absent	Absent	42.296053	-72.6347		282	Rob, Char, Mil, WM, Val, Elo	Medium	Absent	Absent	42.217835	-72.611833
233	Fan	Medium	Absent	Absent	42.296112	-72.630705		283	Val, Mil, Var	Medium	Absent	Absent	42.217365	-72.611225
234	Fan	Sparse	Absent	Absent	42.297493	-72.630611		284	Absent	N/A	Absent	Absent	42.216151	-72.611175
235	Red, Val, Elo	Medium	Absent	Absent	42.284619	-72.604276		285	Rob, Mil, Val	Medium	Absent	Absent	42.216012	-72.609618
236	Val, Elo	Sparse	Absent	Absent	42.278775	-72.601951		286	Trapa	Dense	Absent	Present	42.214843	-72.61172
237	Absent	N/A	Absent	Absent	42.278337	-72.601861		287	Mil, Val, Chara, Fan, Red, Trapa	Dense	Absent	Present	42.214875	-72.61095
238	Absent	N/A	Absent	Absent	42.276759	-72.601285		288	WM, Mil, Trapa	Dense	Absent	Present	42.214598	-72.610455
239	Val	Medium	Absent	Absent	42.271122	-72.597223		289	Val, Char, Trapa	Dense	Absent	Present	42.214386	-72.609208
240	Red, Val, Mil, Char, Trapa	Medium	Absent	Present	42.270135	-72.596993		290	Elo, Mil	Medium	Absent	Present	42.21401	-72.608534
241	Val, Char, Mil, Trapa	Medium	Absent	Present	42.270383	-72.596073		291	Mil, Elo, Char	Medium	Absent	Absent	42.213926	-72.608424
242	Val	Sparse	Absent	Absent	42.268457	-72.597139		292	Absent	N/A	Absent	Absent	42.2135	-72.607736
243	Rob	Medium	Absent	Absent	42.26437	-72.599592		293	Val, Chara	Medium	Absent	Absent	42.213463	-72.607698
244	Absent	N/A	Absent	Absent	42.263823	-72.59968		294	Absent	N/A	Absent	Absent	42.213295	-72.607134
245	Elo, Val	Medium	Absent	Absent	42.264168	-72.600233		295	Chara, Val	Sparse	Absent	Absent	42.213218	-72.607127
246	Val	Sparse	Absent	Absent	42.263167	-72.601682		296	Val	Sparse	Absent	Absent	42.204624	-72.590072
247	Val	Sparse	Absent	Absent	42.263034	-72.602048		297	Absent	N/A	Absent	Absent	42.188279	-72.611137
248	Elo, Star, Val	Medium	Absent	Absent	42.262645	-72.602627		298	Absent	N/A	Absent	Absent	42.187878	-72.612238
249	Absent	N/A	Absent	Absent	42.262248	-72.603277		299	Absent	N/A	Absent	Absent	42.189014	-72.614746
250	Absent	N/A	Absent	Absent	42.262172	-72.603552		300	Val	Sparse	Absent	Absent	42.188886	-72.615299

HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

VEGETATION PLOT SURVEY LOCATIONS DATA

KEY:

Algae – General Algae, Arrow – Green Arrow Arum (*Peltandra virginica*), BL – Big-leaf Pondweed (*Potamogeton amplifolius*), Char – Chara (Algae), Coon – Coontail (*Ceratophyllum demersum*), CT – Cattail (*Typha latifolia*), Curly – Curly Pondweed (*Pot. crispus*), DW – Duckweed (*Lemna minor*), Elo – Elodea (*Elodea canadensis*), EW - European waterclover (*Marsilea quadrifolia*), Fan – Fanwort (*Cabomba caroliniana*), FL – False loosestrife (*Ludwigia polycarpa*), Hyd - Waterthyme (*Hydrilla verticillata*), Mil – Eurasian watermilfoil (*Myriophyllum spicatum*), Nym = White Water Lilly (*Nymphaea odorata*), Red – Redhead-grass (*Pot. richardsonii*), Ribbon – Ribbonleaf Pondweed (*Pot. epihydrus*), Rob - Robbins' Pondweed (*Potamogeton robbinsii*), Sago – Sago Pondweed (*Potamogeton pectinatus*), Spad - Spatterdock (*Nuphar advena*), Star - Waterstar Grass (*Heteranthera dubia*), Trapa - Water Chestnut (*Trapa natans*), Val – Tape Grass (*Vallisneria americana*), Var – Variable Pondweed (*Pot. gramineus*), WC - Watercress (*Nasturtium officinale*), WM – Watermeal (*Wolffia* spp.).

Vegetation Plot Survy Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude	Vegetation Plot Survy Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude
301	Absent	N/A	Absent	Absent	42.18508	-72.619432	351	Star, Ribbon	Medium	Absent	Absent	42.095415	-72.593461
302	Absent	N/A	Absent	Absent	42.187296	-72.620436	352	Curly	Sparse	Absent	Absent	42.094554	-72.592567
303	Absent	N/A	Absent	Absent	42.186504	-72.622557	353	Absent	N/A	Absent	Absent	42.093374	-72.591169
304	Absent	N/A	Absent	Absent	42.186033	-72.623516	354	Star, Elo	Medium	Absent	Absent	42.093344	-72.591471
305	Absent	N/A	Absent	Absent	42.184968	-72.625013	355	Absent	N/A	Absent	Absent	42.092453	-72.590414
306	Absent	N/A	Absent	Absent	42.184702	-72.625143	356	Absent	N/A	Absent	Absent	42.092166	-72.590169
307	Absent	N/A	Absent	Absent	42.182991	-72.623856	357	Absent	N/A	Absent	Absent	42.09143	-72.589294
308	Val	Sparse	Absent	Absent	42.180847	-72.625052	358	Absent	N/A	Absent	Absent	42.090304	-72.58825
309	Val	Sparse	Absent	Absent	42.17662	-72.626104	359	Absent	N/A	Absent	Absent	42.089724	-72.587663
310	Absent	N/A	Absent	Absent	42.175674	-72.626467	360	Absent	N/A	Absent	Absent	42.089472	-72.587398
311	Absent	N/A	Absent	Absent	42.175654	-72.626483	361	Absent	N/A	Absent	Absent	42.083623	-72.585709
312	Curly	Sparse	Absent	Absent	42.17548	-72.626776	362	Absent	N/A	Absent	Absent	42.084386	-72.586614
313	Absent	N/A	Absent	Absent	42.174886	-72.634127	363	Absent	N/A	Absent	Absent	42.084352	-72.586846
314	Absent	N/A	Absent	Absent	42.173097	-72.629368	364	Absent	N/A	Absent	Absent	42.084354	-72.586925
315	Absent	N/A	Absent	Absent	42.172334	-72.629586	365	Absent	N/A	Absent	Absent	42.084024	-72.591016
316	Absent	N/A	Absent	Absent	42.172415	-72.629558	366	Absent	N/A	Absent	Absent	42.083867	-72.594105
317	Absent	N/A	Absent	Absent	42.172228	-72.62942	367	Absent	N/A	Absent	Absent	42.083898	-72.594317
318	Absent	N/A	Absent	Absent	42.172019	-72.62956	368	Absent	N/A	Absent	Absent	42.081405	-72.584828
319	Val	Medium	Absent	Absent	42.167251	-72.629975	369	Absent	N/A	Absent	Absent	42.080977	-72.584907
320	Val	Medium	Absent	Absent	42.165474	-72.630079	370	Absent	N/A	Absent	Absent	42.080405	-72.584859
321	Elo	Sparse	Absent	Absent	42.165495	-72.629552	371	Absent	N/A	Absent	Absent	42.080009	-72.584955
322	Absent	N/A	Absent	Absent	42.163371	-72.628464	372	Absent	N/A	Absent	Absent	42.081204	-72.580506
323	Absent	N/A	Absent	Absent	42.161648	-72.628156	373	Absent	N/A	Absent	Absent	42.081014	-72.580522
324	Absent	N/A	Absent	Absent	42.161315	-72.628203	374	Absent	N/A	Absent	Absent	42.078336	-72.581045
325	Absent	N/A	Absent	Absent	42.156882	-72.628835	375	Absent	N/A	Absent	Absent	42.07789	-72.581272
326	Absent	N/A	Absent	Absent	42.153686	-72.625729	376	Absent	N/A	Absent	Absent	42.077064	-72.582027
327	Val	Sparse	Absent	Absent	42.153448	-72.625841	377	Absent	N/A	Absent	Absent	42.076436	-72.582791
328	Absent	N/A	Absent	Absent	42.153003	-72.625589	378	Absent	N/A	Absent	Absent	42.076151	-72.582936
329	Absent	N/A	Absent	Absent	42.152936	-72.625765	379	Absent	N/A	Absent	Absent	42.063183	-72.593612
330	Elo, Mil	Sparse	Absent	Absent	42.152786	-72.625574	380	Absent	N/A	Absent	Absent	42.05637	-72.600497
331	Absent	N/A	Absent	Absent	42.152777	-72.625905	381	Absent	N/A	Absent	Absent	42.053238	-72.60262
332	Absent	N/A	Absent	Absent	42.151793	-72.625164	382	Absent	N/A	Absent	Absent	42.046305	-72.604441
333	Absent	N/A	Absent	Absent	42.149535	-72.620899	383	Val	Sparse	Absent	Absent	42.043225	-72.604736
334	Absent	N/A	Absent	Absent	42.150608	-72.619274	384	Absent	N/A	Absent	Absent	42.041675	-72.60497
335	FL	Sparse	Absent	Absent	42.150919	-72.61906	385	Absent	N/A	Absent	Absent	42.04562	-72.610223
336	Absent	N/A	Absent	Absent	42.150727	-72.618594	386	Absent	N/A	Absent	Absent	42.045577	-72.610263
337	Absent	N/A	Absent	Absent	42.149449	-72.619247	387	Absent	N/A	Absent	Absent	42.045029	-72.610412
338	Val	Medium	Absent	Absent	42.144267	-72.617333	388	Absent	N/A	Absent	Absent	42.043448	-72.610434
339	Val	Sparse	Absent	Absent	42.124755	-72.622717	389	Absent	N/A	Absent	Absent	42.040899	-72.610498
340	Val, Elo	Medium	Absent	Absent	42.124018	-72.623003	390	Absent	N/A	Absent	Absent	42.044497	-72.61585
341	Absent	N/A	Absent	Absent	42.12369	-72.62319	391	Absent	N/A	Absent	Absent	42.044305	-72.615469
342	Absent	N/A	Absent	Absent	42.118355	-72.620162	392	Absent	N/A	Absent	Absent	42.044151	-72.614962
343	Absent	N/A	Absent	Absent	42.116705	-72.622552	393	Absent	N/A	Absent	Absent	42.043774	-72.614707
344	Absent	N/A	Absent	Absent	42.116307	-72.622312	394	Absent	N/A	Absent	Absent	42.043411	-72.615029
345	Absent	N/A	Absent	Absent	42.104479	-72.602648	395	Absent	N/A	Absent	Absent	42.042979	-72.615254
346	Absent	N/A	Absent	Absent	42.104138	-72.601709	396	Absent	N/A	Absent	Absent	42.04365	-72.61446
347	Absent	N/A	Absent	Absent	42.103604	-72.600025	397	Absent	N/A	Absent	Absent	42.04256	-72.61572
348	Mil, Elo, Val	Dense	Absent	Absent	42.097074	-72.595145	398	Absent	N/A	Absent	Absent	42.04365	-72.614401
349	Elo, Mil	Medium	Absent	Absent	42.097148	-72.595185	399	Absent	N/A	Absent	Absent	42.043443	-72.614105
350	Elo, Mil	Medium	Absent	Absent	42.096627	-72.594594	400	Absent	N/A	Absent	Absent	42.043411	-72.614091

HYDRILLA VERTICULATA AND TRAPA NATANS SURVEY ON THE CONNECTICUT RIVER

VEGETATION PLOT SURVEY LOCATIONS DATA

KEY: Algae – General Algae, Arrow – Green Arrow Arum (*Peltandra virginica*), BL – Big-leaf Pondweed (*Potamogeton amplifolius*), Char – Chara (Algae), Coon – Coontail (*Ceratophyllum demersum*), CT – Cattail (*Typha latifolia*), Curly – Curly Pondweed (*Pot. crispus*), DW – Duckweed (*Lemna minor*), Elo – Elodea (*Elodea canadensis*), EW - European watercress (*Marsilea quadrifolia*), Fan – Fanwort (*Cabomba caroliniana*), FL – False loosestrife (*Ludwigia polycarpa*), Hyd - Waterhyme (*Hydrilla verticillata*), Mil – Eurasian watermilfoil (*Myriophyllum spicatum*), Nym = White Water Lilly (*Nymphaea odorata*), Red – Redhead-grass (*Pot. richardsonii*), Ribbon – Ribbonleaf Pondweed (*Pot. epihydrus*), Rob - Robbins' Pondweed (*Potamogeton robbinsii*), Sago – Sago Pondweed (*Potamogeton pectinatus*), Spad - Spatterdock (*Nuphar advena*), Star - Waterstar Grass (*Heteranthera dubia*), Trapa - Water Chestnut (*Trapa natans*), Val – Tape Grass (*Vallisneria americana*), Var – Variable Pondweed (*Pot. gramineus*), WC - Watercress (*Nasturtium officinale*), WM – Watermeal (*Wolffia* spp.).

Vegetation Plot Survy Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude	Vegetation Plot Survy Point ID	Dominant Vegetation by Prevelence (Decending Order)	Density	Hydrilla verticilata (Present / Absent)	Trapa natans (Present / Absent)	Latitude	Longitude
401	Absent	N/A	Absent	Absent	42.043287	-72.614079	451	Elo, Mil, Star	Medium	Absent	Absent	42.048439	-72.625411
402	Absent	N/A	Absent	Absent	42.043161	-72.614111	452	Elo	Sparse	Absent	Absent	42.048335	-72.625004
403	Absent	N/A	Absent	Absent	42.042639	-72.614207	453	Mil, Elo, Star	Medium	Absent	Absent	42.048453	-72.624892
404	Absent	N/A	Absent	Absent	42.042688	-72.614304	454	Mil, Star	Medium	Absent	Absent	42.048556	-72.624501
405	Absent	N/A	Absent	Absent	42.042259	-72.614399	455	Mil	Sparse	Absent	Absent	42.048341	-72.624087
406	Absent	N/A	Absent	Absent	42.041777	-72.613995	456	Mil, Elo, Star	Medium	Absent	Absent	42.048329	-72.623773
407	Absent	N/A	Absent	Absent	42.041584	-72.613873	457	Mil, Elo, Star	Medium	Absent	Absent	42.048121	-72.623485
408	Absent	N/A	Absent	Absent	42.041421	-72.613904	458	Elo, Mil	Medium	Absent	Absent	42.047746	-72.62342
409	Absent	N/A	Absent	Absent	42.041136	-72.613902	459	Mil, Elo	Medium	Absent	Absent	42.047726	-72.623624
411	Absent	N/A	Absent	Absent	42.040823	-72.613994	460	Mil	Sparse	Absent	Absent	42.047876	-72.623818
412	Absent	N/A	Absent	Absent	42.040576	-72.613619	461	Mil, Elo, Star	Medium	Absent	Absent	42.047889	-72.624041
413	Absent	N/A	Absent	Absent	42.040654	-72.613618	462	Var, Elo, Mil, Star	Medium	Absent	Absent	42.048003	-72.625234
414	Absent	N/A	Absent	Absent	42.040036	-72.612787	463	Elo, Star, Mil	Medium	Absent	Absent	42.048095	-72.625631
415	Absent	N/A	Absent	Absent	42.039296	-72.612079	464	Elo, Mil	Medium	Absent	Absent	42.048184	-72.625775
416	Absent	N/A	Absent	Absent	42.03962	-72.611352	465	Mil, Star, Elo	Medium	Absent	Absent	42.048189	-72.625892
417	Val	Sparse	Absent	Absent	42.039615	-72.611252							
418	Absent	N/A	Absent	Absent	42.039627	-72.611159							
419	Absent	N/A	Absent	Absent	42.039551	-72.611089							
420	Absent	N/A	Absent	Absent	42.039514	-72.611017							
421	Hyd	Medium	Present	Absent	42.038974	-72.610896							
422	Absent	N/A	Present	Absent	42.038902	-72.610888							
423	Hyd, Elo, Val	Medium	Present	Absent	42.038236	-72.610781							
424	Hyd, Elo, Mil	Medium	Present	Absent	42.038232	-72.610799							
425	Hyd	Dense	Present	Absent	42.036364	-72.610494							
426	Hyd, Val	Dense	Present	Absent	42.036247	-72.610769							
427	Hyd	Dense	Present	Absent	42.035436	-72.610425							
428	Hyd	Dense	Present	Absent	42.03475	-72.610353							
429	Hyd	Dense	Present	Absent	42.034287	-72.610691							
430	Hyd, Elo, Val	Dense	Present	Absent	42.034108	-72.610805							
431	Elo	Sparse	Absent	Absent	42.039486	-72.605144							
436	Absent	N/A	Absent	Absent	42.028953	-72.606976							
437	Char, Mil	Medium	Absent	Absent	42.023443	-72.604084							
438	Mil, Char	Medium	Absent	Absent	42.023102	-72.604027							
439	Var, Mil, Char	Medium	Absent	Absent	42.022419	-72.603858							
440	Char, Mil	Medium	Absent	Absent	42.021645	-72.603642							
441	Mil, Star, Char	Medium	Absent	Absent	42.021109	-72.603534							
442	Mil, Star, Char	Medium	Absent	Absent	42.020916	-72.603502							
443	DW, Nym	Medium	Absent	Absent	42.02058	-72.60293							
444	Mil, Char, Star	Medium	Absent	Absent	42.019641	-72.603135							
445	Star	Sparse	Absent	Absent	42.018954	-72.602965							
446	Val, Star, FL	Medium	Absent	Absent	42.018715	-72.602968							
447	Star	Sparse	Absent	Absent	42.018366	-72.602851							
448	Mil	Sparse	Absent	Absent	42.017519	-72.60284							
449	Absent	N/A	Absent	Absent	42.017399	-72.602888							
450	Mil, Star, Elo	Medium	Absent	Absent	42.048554	-72.625784							