

January 5, 2009



Long Sought For Pond Protective Association
Mr. Douglas Bell, President
98 Dunstable Road
Westford, MA 01886

Re: 2008 Year-End Report for the Aquatic Management Program at Long Sought For Pond

Dear Association Members:

Please accept this as our Year-End Report for the 2008 Aquatic Management Program at Long Sought For Pond. Since the 2004 whole-lake treatment with Sonar herbicide to control Eurasian watermilfoil (*Myriophyllum spicatum*), the annual management program has focused on vegetation/water quality monitoring and control of curlyleaf pondweed (*Potamogeton crispus*).

Treatment Program

No treatments were required at Long Sought for Pond in 2008. During the pre-treatment survey (see below) there were no significant populations of curlyleaf pondweed and no observances whatsoever of Eurasian watermilfoil. We'd estimate that there were < 100 curlyleaf pondweed plants in the entire lake and no one area had more than 20-30 plants. Based on the number and distribution of the curlyleaf pondweed plants, treatment was deemed not to be cost-effective this year, but will likely be necessary in 2009.

Monitoring Program

Vegetation surveys and water quality sampling/measurements were conducted on May 8th and August 6th. During each visit, the pond's aquatic vegetation was sampled using a combination of visual observation, an Aqua-Vu underwater camera and sub-surface collection with a specially designed throw-rake. Water samples were collected from three stations and a temperature/dissolved oxygen profile and Secchi disk water clarity reading were measured over the deepest point in the pond.

Vegetation Distribution

The assemblage of aquatic vegetation in Long Sought For Pond was surveyed during both visits. Figure 1 & 2 depict the distribution of plants as observed during these surveys. The spring vegetation assemblage was dominated by Robbins pondweed with only scattered occurrences of curlyleaf pondweed as indicated on the map. Robbins pondweed was fairly well distributed on the pond bottom except in areas of deeper water (>~ 15-feet).

During the September survey, the vegetation assemblage was dominated by a healthy abundance of Robbins pondweed and tapegrass. While neither of these two plants was reaching the surface, the spiral reproductive structures of the tapegrass were emerging in some areas. Growth in shallow perimeter areas and within the beach areas was sparse, likely due to sandy substrates. A moderate amount of muskgrass (*Chara sp.*), a beneficial, rooted macro-algae, was observed to be co-habiting the areas of Robbins pondweed especially in deeper

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water. Widely scattered occurrences of bladderwort (*Utricularia sp.*), curlyleaf pondweed and ribbonleaf pondweed (*Potamogeton epihydrus*) were also observed. Small to moderate sized patches of white waterlilies (*Nyphaea odorata*) were observed in the coves.

No Eurasian milfoil was observed during the fall survey.

Water Quality Observations

Water quality samples were collected during each of the surveys. Two stations were collected in May and three in September (see Figure 1). In May, we were unable to gain permission from the property owner to sample the inlet stream. The following section presents the results of the laboratory testing with interpretation:

TABLE 1 - WATER QUALITY RESULTS (2008)

Station	Date	PH (S.U.)	Alkalinity (mg/L)	Turbidity (NTU)	Total Kjeldal Nitrogen (mg/l)	Nitrate Nitrogen (mg/l)	Phosphorus (mg/l)	E.Coli (org/100ml)
# 1 (North End)	May	7.28	16	0.36	<1	0.13	<0.02	<10
	Aug	7.08	15	0.6	<1	<0.1	<0.02	<10
# 2 (South End)	May	7.29	15	0.30	<1	0.15	<0.02	<10
	Aug	7.13	16	0.64	<1	<0.1	<0.02	10
# 3 (Inlet)	May	Not Sampled						
	Aug	5.92	8	1.2	1	<0.1	0.05	220

pH – The pH measurement scale is from 0 to 14, where zero is extremely acidic, 7 is neutral, and 14 is the most basic. pH is related to the concentration of H⁺ (hydrogen ions) in solution and can affect many different aspects of water chemistry. The values obtained at LSFP were very nearly neutral, except for the inlet sample station. This may indicate influence from the surficial geology of this stream’s watershed or possibly due to decomposition of humic material in the stream bed. A pH range of about 5.5 – 8.5 is desired for maintaining a healthy fishery.

Total Alkalinity – Alkalinity is a measure of the buffering capacity of a waterbody against acid additions such as acid rain and pollution, which can be detrimental to wildlife populations. Total alkalinity measures the presence of carbonates, bicarbonates and hydroxides. Values below 20 mg/l are a signal that the pond may be susceptible to fluctuations in pH. Alkalinity at LSFP is low, like many ponds in the region owing to the natural geology and soils in the area.

Turbidity - Turbidity is a relative measurement of the amount of suspended material in the water. It is measured through a process involving light diffraction of the pond sample as compared to a series of prepared samples. Turbidity values can range from less than one to thousands of units, however, values in most ponds and lakes rarely rises above 5 NTU. The turbidity values at the pond were desirable and show a low-level of suspended material. This value can vary significantly with stormwater influence.

Nitrogen - Nitrogen is a vital nutrient in the pond environment for plant and algae growth. Nitrogen exists in water as various compounds, with relative amounts governed by such things as atmospheric influence, precipitation, biological activity and water chemistry. Total Kjeldal nitrogen (TKN) is a measure of the nitrogen contained in organic compounds, such as proteins and amino acids, and as ammonia. It is created from biological growth and decomposition. A concentration of 1.0 mg/l or below is considered desirable. Both the spring and fall TKN levels in

the pond were desirable. Even the tributary station showed a TKN value of only 1.0 mg/l. Often inlet streams have higher TKN concentration due to the low water volume and abundance of decaying organic material.

Nitrate is another form of nitrogen in the water. Nitrate nitrogen is usually the most prevalent form of inorganic nitrogen in the water and results from such things as natural aerobic bacterial activity and fertilizer use. The 2008 values at LSFP were all desirably below this threshold.

Total Phosphorus – Phosphorus is generally considered to be the limiting nutrient for plant and algae growth, with concentrations of 0.03 mg/l or more being sufficient to stimulate algae blooms. The phosphorus level in LSFP was desirably below this level at all the in-lake stations although the fall sampling at the inlet showed slightly elevated levels. Water column phosphorus does not generally relate to rooted plant growth as they obtain most of their nutrients from the pond sediment.

E. Coli Bacteria – Coliform bacteria are naturally occurring in pond systems as well as resultant from human and animal inputs. E.Coli is an indicator of the presence of human or animal waste inputs. In general, acceptable values in “swimmable waters” for E. Coli is less than 230 organisms per 100 ml. Bacteria tests were well within these acceptable limits except for the fall sampling at the inlet station. This higher bacteria level was likely due to the near stagnant conditions in the streambed and not necessarily indicative of a pollution source.

Dissolved oxygen (DO) is very important in the pond system. Not only do fish and other aquatic fauna require adequate levels of oxygen, but it also controls many aspects of water chemistry. Values below 5.0 mg/l are undesirable for most aquatic life, however lower values are not uncommon near the sediment layer where oxygen demand is great and oxygen influx is at a minimum. Under extreme anoxic conditions (<1.0 mg/l), phosphorus can be released from the sediment and stimulate algae blooms. Under stratified conditions, which occur in many deeper lakes, oxygen depletion can occur in a significant portion of the water column, possibly endangering fish populations, especially coldwater species.

Temperature/dissolved oxygen profiling at LSFP was performed in the southern end of the pond over the “deep hole”. Measurements taken during the two surveys showed that stratification was already “setting up” between 3 & 4 meters in May and showed a distinct layering (thermocline) occurring between 6 and 7 meters in August. The May profile showed good oxygenation (at or near saturation levels) except for directly near the bottom. The September profile showed anoxic condition below ~ 7 meters.

Water clarity measurements were taken with a standard Secchi disk during each of the sampling rounds. The May water clarity was ~ 20-feet while the September clarity was still good, but reduced to ~ 11.5-feet. Overall, the water clarity continues to be excellent in LSFP.

Management Recommendations

After observing the continued milfoil control this year from the 2004 treatment, we fully expect to see little re-growth of milfoil in 2009. In the event that some localized milfoil growth is observed in 2009, we may recommend some alternative methods of control including diver handpulling and/or benthic barrier. These methods are much more suitable for small infestation (<1/2 acre) and may help to prolong the duration of control before another treatment is required. More sizable infestations (> 1-acre) or one located along with curlyleaf pondweed should be “spot” treated with the Reward (diquat) herbicide. If the Association decides to manage smaller areas of re-growth with hand-pulling, barriers or treatment, you may want to budget a contingency amount of ~\$5,000-\$7,500 to do so.

Curlyleaf pondweed was successfully treated in 2006 & 2007 but the population level and distribution in 2008 was sufficiently minimal and scattered that treatment was not recommended. Past experience suggests that the population should be kept in check with

periodic treatments and, while skipping a year in 2008 was justified, treatments should be resumed in 2009. Even the small number of plants that were allowed to mature this past summer is likely enough to eventually allow expansion of the infestation in the future. Continued periodic treatments of curlyleaf pondweed, performed before the plant produces its reproductive structures (called "turions") has shown at some waterbodies to result in a gradual, long term reduction of this highly invasive plant. A pre-treatment survey will be used to confirm the areas of curlyleaf growth and set the actual treatment areas. We estimate the cost of such a treatment to be in the range of \$5,000-\$6,000, similar to 2007.

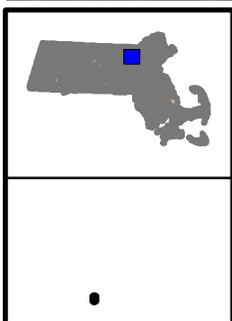
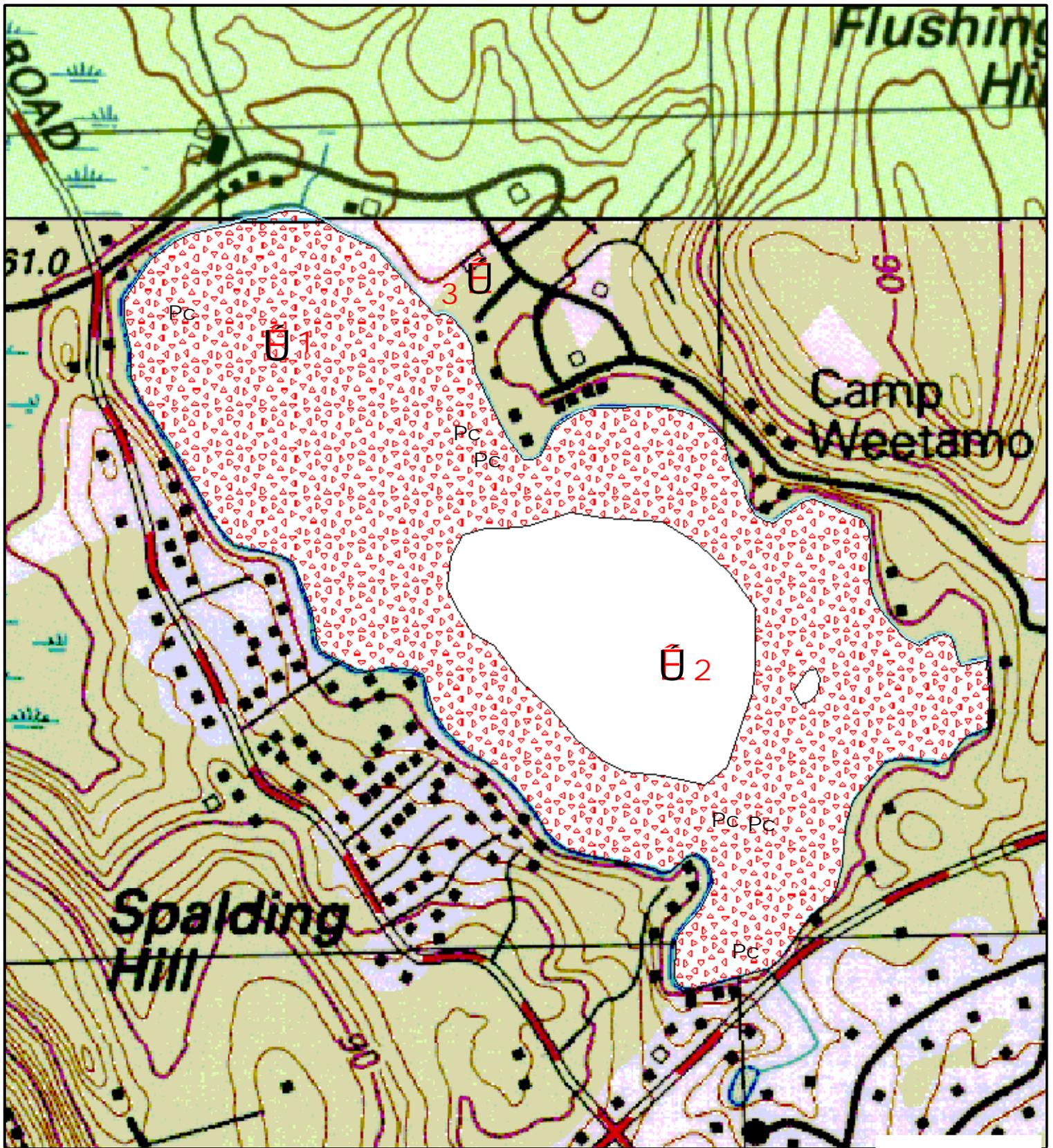
For 2009, we also strongly recommend continuing with an early & late summer vegetation/water quality survey. The vegetation surveys will be important to monitor for re-growth of milfoil and document the presence and extent of other species in the pond. We recommend that you budget \$2,950 for the two vegetation surveys and water quality monitoring sampling rounds. Continued monitoring of the pond is not only prudent but was also alluded to, if not required, by the Order of Conditions permit issued by the Town for this project. In the event that the Association moves forward with treatment of the curly-leaf pondweed, the cost of monitoring will be somewhat reduced as we can perform some of the monitoring tasks during our visits to the pond as part of the treatment program.

We appreciate your cooperation with this past year's program and look forward to working with you again next year. If you have any questions, please feel free to give me a call. Please be sure to forward a copy of this report to the Conservation Commission.

Sincerely,
AQUATIC CONTROL TECHNOLOGY, INC.



Dominic Meringolo
Senior Environmental Engineer



Long Sought
For Pond
Vegetation
Distribution
May 2008

FIGURE	SURVEY DATE	MAP DATE
1	5/8/08	1/2009

LEGEND

 Low growing cover of
Robbins Pondweed

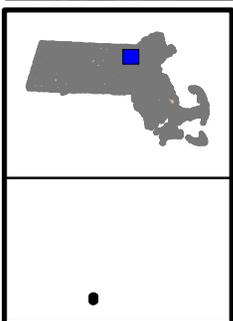
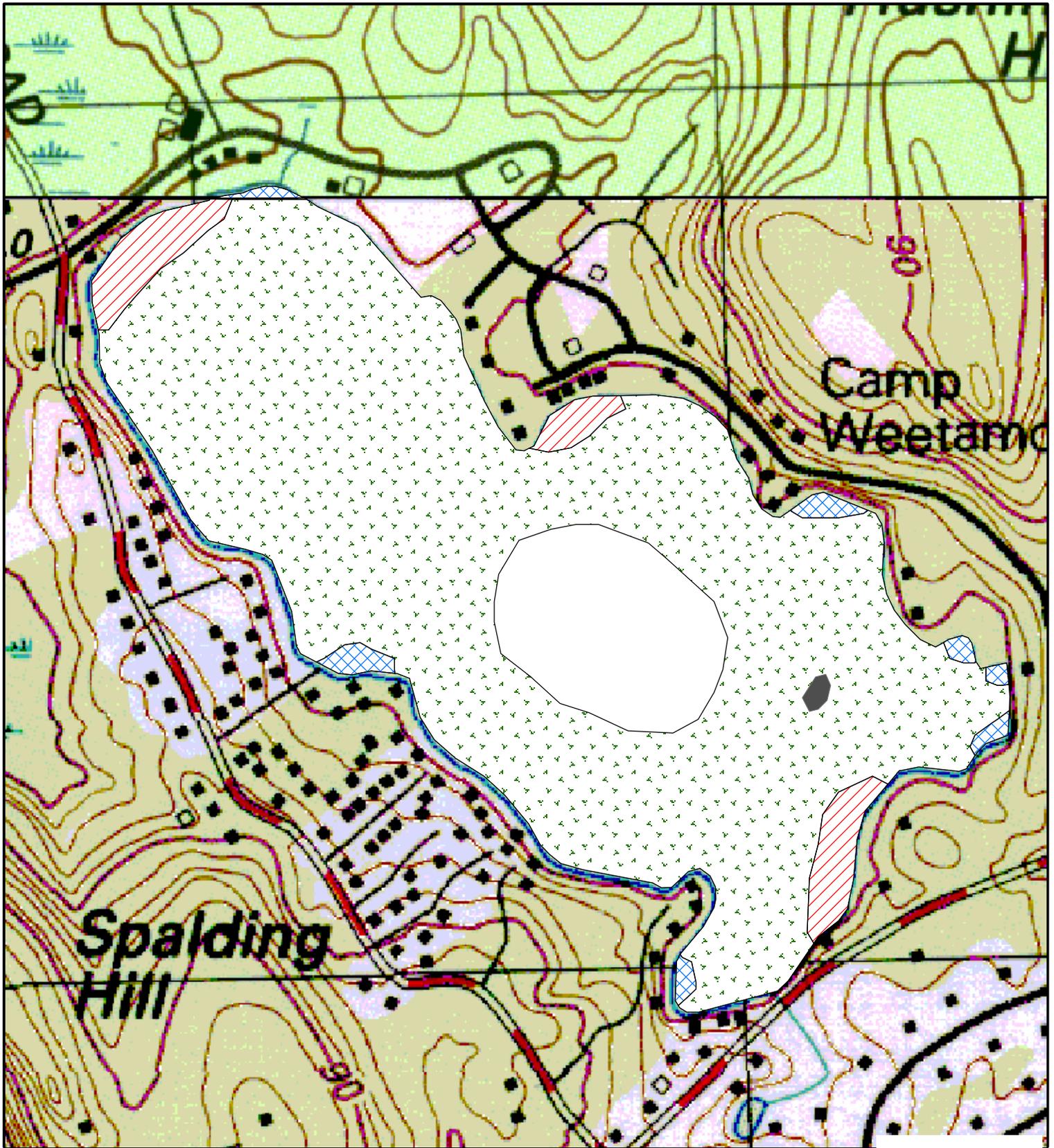
Pc - curlyleaf pondweed (*P. crispus*)

 Sampling Station

0 175 350 700 1,050 1,400
Feet

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Long Sought
For Pond
Vegetation
Distribution
August 2008

FIGURE	SURVEY DATE	MAP DATE
2	8/6/08	1/2009

Legend

-  Area dominated by tapegrass with Robbins pondweed along the bottom
-  Area of waterlily growth, mostly white lilies (*Nymphaeae odorata*)
-  Dominated by healthy cover of Robbins pondweed transitioning to stonewort (*Nitella*) in deeper water
-  Submerged Island



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