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NH Department of
Environmental Services
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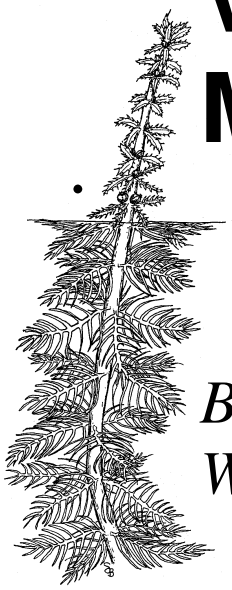
Long-Term Variable Milfoil Management Plan



Balch Lake
Wakefield, New Hampshire

Contents

Purpose

The purposes of this exotic aquatic plant management and control plan are:

1. To identify and describe the historic and current exotic aquatic infestation(s) in the waterbody;
2. To identify short-term and long-term exotic aquatic plant control goals;
3. To minimize any adverse effects of exotic aquatic plant management strategies on non-target species;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To evaluate control practices used in this waterbody over time to determine if they are meeting the goals outlined in this plan.

This plan also summarizes the current physical, biological, ecological, and chemical components of the subject waterbody as they may relate to both the exotic plant infestation and recommended control actions, and the potential social, recreational and ecological impacts of the exotic plant infestation.

The intent of this plan is to establish an adaptive management strategy for the long-term control of the target species (in this case variable milfoil) in the subject waterbody, using an integrated plant management approach.

Appendix A and Appendix B detail the general best management practices and strategies available for waterbodies with exotic species, and provide more information on each of the activities that are recommended within this plan.

Invasive Aquatic Plant Overview

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and ponds (Luken & Thieret, 1997, Halstead, 2000), primarily by forming dense growths or monocultures in critical areas of waterbodies that are important for aquatic habitat and/or recreational use. Under some circumstances, dense growths and near monotypic stands of invasive aquatic plants can result, having the potential to reduce overall species diversity in both plant and animal species, and can alter water chemistry and aquatic habitat structure that is native to the system.

Since January 1, 1998, the sale, distribution, importation, propagation, transportation, and introduction of key exotic aquatic plants have been prohibited (RSA 487:16-a) in New Hampshire. This law was designed as a tool for lake managers to help prevent the spread of nuisance aquatic plants.

New Hampshire lists 27 exotic aquatic plant species as prohibited in the state (per Env-Wq 1303.02) due to their documented and potential threat to surface waters of the state.

According to the federal Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM), "exotic macrophytes are non-native, fast growing aquatic plants, which can quickly dominate and choke out native aquatic plant growth in the surface water. Such infestations are in violation of New Hampshire regulation Env-Wq 1703.19, which states that surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region" (DES, 2006). In fact, waterbodies that contain even a single exotic aquatic plant do not attain water quality standards and are listed as impaired.

Variable Milfoil Infestation in Balch Lake

Balch Lake is a border lake with the State of Maine. Roughly one-half of the surface area of the lake falls on the New Hampshire side of the border. This plan only covers milfoil control efforts on the New Hampshire side of the border.

Variable milfoil (*Myriophyllum heterophyllum*) became established in Balch Lake in Wakefield, New Hampshire in the late 1990s. Historically, variable milfoil infested many acres of this shallow lake, including many bays, coves, and shoreline segments. Figure 1 illustrates the distribution of variable milfoil in Balch Lake over time. The table below provides annual summaries of variable milfoil growth in the waterbody, and it uses labels derived from the grid overlay on the map in Figure 1 to identify blocks of lake area for discussion.

Area	Location/Area Description	Year	Description of Growth	Percent Cover
C1	North inlets (from Belleau Lake). Silty/organic substrates	2009	Variable milfoil present in scattered patches in cove	30%
		2010	Variable milfoil present in patches along shoreline areas, scattered in middle of cove	40%
		2012	Variable milfoil increasing in density along shoreline of cove	45%

Area	Location/Area Description	Year	Description of Growth	Percent Cover
		2013	Spring survey showed patchy variable milfoil growth along nearshore areas, late summer survey showed expansive growth beyond that observed in spring (dilution may have been a factor in 2013 treatment)	Spring-25% Late Summer-30%
		2014	Spring survey showed patchy growth near shore, with expanded growth late season	Spring-25% Late Summer-35%
		2015	Scattered early season growth as patches or single stems. Late season growth showed increase over spring observations.	Spring-15% Late Summer-30%
		2016	Small to medium patches of growth throughout.	~25%
		2017	Scattered growth of single stems and small patches, mostly along shore but some out in the middle of the cove	<25%
B2, C2	Stump Pond area. Organic substrates with stumps and woody debris throughout.	2009	Variable milfoil dense along shoreline areas and scattered in patches across middle.	30%
		2010	Variable milfoil dense along shoreline in B2, dense flower stalks.	40%
		2012	Variable milfoil thick along shore, present in patches off shore.	40%
		2013	Spring survey showed small to moderate sized patches near shore in several locations, late summer survey showed expansive growth into main body of this basin, plus on shore	Spring-20% Late Summer-35%
		2014	Spring survey showed patchy growth near shore, with expanded growth late season	Spring-25% Late Summer-35%
		2015	Lower growth overall as compared to past years. Slightly more growth in loon nesting	Spring-20% Late

Area	Location/Area Description	Year	Description of Growth	Percent Cover
			zone among islands, but less in stump marsh.	Summer-20%
		2016	Scattered patches of growth throughout this area	25-30% cover
		2017	Scattered variable milfoil, amidst extensive patches of native milfoil (Myriophyllum verticillatum)	<5%
D2	Northeastern shoreline of NH portion of lake with small coves off main basin. Silty/sandy with organic areas mixed in. Some of these coves do fall over the border into Maine.	2009	Variable milfoil sparse and scattered through area	20%
		2010	Variable milfoil sparse through area	15%
		2012	Variable milfoil becoming more dense in cove areas and along exposed shoreline areas	40%
		2013	Spring survey showed contiguous growth along sections of eastern shoreline, and patchy growth in inlet stream. Late summer survey showed expanded growth along shoreline areas and contiguous growth along inflowing stream channel.	Spring-20% Late Summer-30%
		2014	Only patchy/clumpy growth in this area, early and late season	25%
		2015	No growth observed in spring survey; patchy growth observed late season. Divers were actively working area as we surveyed.	Spring-0% Late Summer-15%
		2016	Scattered patchy growth , reduced compared to historic growth	<20
		2017	Scattered patches of milfol	<25%
B3, C3	Southwestern and south central areas of New Hampshire side of lake. Deeper area, sediments silty/sandy with organics mixed in.	2009	Variable milfoil scattered in small to medium patches along shore	25%
		2010	Variable milfoil scattered	15%
		2012	Variable milfoil scattered in patches along shore	20%
		2013	Spring and late summer surveys showed just patchy and isolated low density growth	Spring-1% Late Summer-1%
		2014	Spring survey showed patchy growth near shore, with expanded growth late season	Spring-25% Late Summer-35%

Area	Location/Area Description	Year	Description of Growth	Percent Cover
		2015	No growth observed in spring survey, patchy growth observed late season.	Spring-0% Late Summer-15%
		2016	Not surveyed	unknown
		2017	Low density milfoil	<10%
D3	Maine side of lake and location of marina/access area to lake. Some of these coves do fall over the border into Maine.	2009	Variable milfoil patchy in cove areas, none present at launch	25%
		2010	Variable milfoil spotty, none present at launch	15%
		2012	Variable milfoil increasing in density in cove areas, none present at launch	40%
		2013	Single scattered stems and patches	<5%
		2014	Scattered	<5%
		2015	None observed	0%
		2016	Scattered stems or small clumps	<5%
		2017	None observed	0%
B4, C4, D4	Southwestern cove of lake on New Hampshire side. Deeper water, firmer substrates (sandy with some silt mixed in) in B4 and C4, very shallow and sandy with rocks mixed in in D4.	2009	Variable milfoil present as patches along shoreline areas	30%
		2010	Variable milfoil sparse in this area	10%
		2012	Not surveyed	unknown
		2013	Not surveyed	unknown
		2014	Spring survey showed patchy growth near shore, with expanded growth late season	Spring-25% Late Summer-35%
		2015	Not surveyed	unknown
		2016	Not surveyed	unknown
		2017	Scattered small to medium patches of milfoil.	<10%

In terms of the variable milfoil impacts to shorefront property owners, there are approximately 485 houses surrounding the Balch Lake shoreline. Approximately half of these dwellings are on the New Hampshire side of the lake. Impediments to boating, swimming, and fishing have been noted my numerous lake residents over the last several years that variable milfoil has been a problem.

Milfoil Management Goals and Objectives

The goal for Balch Lake is the reduction of overall biomass and distribution of variable milfoil in the system through an integrated plant management

approach, and the maintenance of the infestations to levels that are not an impediment to the designated uses of the system. Eradication of the variable milfoil in this system is not feasible, as there is an upstream waterbody that is a regular source of fragments to Balch Lake.

Local Support

Town or Municipality Support

The Town of Wakefield regularly sets aside funds to assist the lakes in the town with exotic aquatic plant control activities. The Town of Acton, Maine is also willing to support the cost or activities related to milfoil control.

Balch Lake Improvement Association Support

There are many small lake associations on Balch Lake, mostly due to the large size of the waterbody, the division of the waterbody between two states, and the nature of the community development on the lake. All of these organizations have come together to support the control of variable milfoil, including donating financial resources, time in hand picking milfoil, time in patrolling the lake for new infestations, and time for fundraising activities, including an annual 'milfoil control bake sale.'

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Balch Lake, including the variable milfoil infestation and the presence of any rare, threatened or endangered species, as listed by the Natural Heritage Bureau (NHB) database.

Parameter/Measure	Value/Description
Lake area (acres)	704
Watershed area (acres)	6,384.0
Shoreline Uses	Residential, forested
Max Depth (ft)	46.53
Mean Depth (ft)	9.57
Trophic Status	Mesotrophic
Color (CPU) in Epilimnion	20
Clarity (ft)	21.45
Flushing Rate (yr-1)	2.20
Natural waterbody/Raised by Damming/Other	Natural w/dam
Invasive Plants	Variable milfoil *(Myriophyllum heterophyllum)*
Infested Area (acres)	See Figures
Distribution	See Figures
Sediment type	Sandy/organic/silty
Rare, Threatened, or Endangered Species (according to NH Natural Heritage Bureau (NHB))	Common loon (*Gavia immer*)

An aquatic vegetation map and key by the DES Biology Section is shown in Figure 2. A bathymetric map is shown in Figure 3.

Beneficial (Designated) Uses of Waterbody

In New Hampshire, beneficial (designated) uses of our waterbodies are categorized into five general categories: Aquatic Life, Fish Consumption, Recreation, Drinking Water Supply, and Wildlife (CALM).

Of these, Aquatic Life, Wildlife and Recreation are the ones most often affected by the presence of invasive plants, though drinking water supplies can also be affected as well in a number of ways.

Following is a general discussion of the most potentially impacted designated uses, including water supplies and near shore wells, as they relate to this system and the actions proposed in this long-term plan.

The goal for aquatic life support is to provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region.

Aquatic Life

Fisheries Information (information obtained from an NHB review and information provided by the NH F&G Department)

Balch Lake in Wakefield is managed as a warmwater fishery, with the primary gamefish being largemouth bass, chain pickerel, horned pout and black crappie. Non-game species that are present and may be of interest to anglers include yellow perch, white perch, pumpkinseed, and brown bullhead, and common white sucker.

Wildlife Information (information obtained from an NHB review and information provided by the NH F&G Department). A map from NHB is included in Figure 5.

A review of rare, threatened and endangered species by the Natural Heritage Bureau (NHB) yielded the presence of the common loon (*Gavia immer*) on Balch Lake. The common loon is not listed federally but is listed as threatened in New Hampshire. Information from historic treatments on this waterbody and on other waterbodies suggests that the herbicide and the method of application have little impact on loons, including those that are nesting. Historical provisions (setbacks or no-treat zones) have been applied as permit conditions and complied with when loons are nesting or when chicks are present during treatment times.

The NH Fish and Game Department asks that herbicide treatments not be permitted within 100 meters of any nests. Their concern is that the method of application, by motorboat and/or airboat, may result in nest abandonment and loss of eggs and/or loon chicks, as well as herbicide damage to the floating aquatic plants. No chemical or non-chemical treatments, such as hand pulling should occur between May 15 and July 15th within 100 meters of any known or suspected loon nests to avoid “take” under RSA 212-Aof the Endangered Species Conservation Act.

Recreational Uses and Access Points

Balch Lake is used for numerous recreational activities, including boating, fishing and swimming by both lake residents and transient boaters.

There is only one boat access site on to Balch Lake on the New Hampshire side of the border, and that is a privately operated marina that charges a fee for access. Data from the marina show that there are roughly 8 visiting boaters on weekdays, and 15 on weekend days. An estimated 20 non-motorized crafts (canoes, kayaks) visit the lake each day.

There are no public beaches on the New Hampshire side of the lake, or near the proposed treatment areas on the Maine side of the lake. Many lake residents swim in front of their properties, and some have small private beaches established on their shorefront. There are scattered floating swim platforms in front of many homes on the lake; however no data were available on their location or exact number.

There are several private docks around Balch Lake, located on individual properties. There were no data as to the exact count or location of these structures; however lake association residents indicated that nearly every property on the lake has a dock structure of some type.

Figure 6 shows the locations of boat docks and likely swimming areas on Balch Lake, as well as the location of the access site at the marina.

Macrophyte Community Evaluation

The littoral zone is defined as the nearshore areas of a waterbody where sunlight penetrates to the bottom sediments. The littoral zone is typically the zone of rooted macrophyte growth in a waterbody.

The littoral zone of Balch Lake is characterized by a mix of native and non-native (variable milfoil) plant growth (Figure 2). Native species include a mix of floating plants (yellow and white lilies, watershield), emergent plants (bur-reed, cattail, pipewort, sedges), and submergent plants (pondweeds, bladderwort, muskgrass, waterweed). Native plant communities are mixed around the entire lake, and are characterized as ‘very abundant’ by the DES.

The most recently available NHB review of the system revealed no state-listed endangered aquatic plants in Balch Lake.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the subject waterbody, based on information in the DES geographic information system records.

Note that it is likely that Figure 7 does not show the location of all private wells.

Note that the map in Figure 7 cannot be provided on a finer scale than 1:48,000. Due to public water system security concerns, a large-scale map may be made available upon agreement with DES' data security policy. Visit DES' OneStop Web GIS, http://www2.des.state.nh.us/gis/onestop/ and register to Access Public Water Supply Data Layers. Registration includes agreement with general security provisions associated with public water supply data. Paper maps that include public water supply data may be provided at a larger-scale by DES' Exotic Species Program after completing the registration process.

In the event that an herbicide treatment is needed for this waterbody, the applicator/contractor will provide more detailed information on the wells and water supplies within proximity to the treatment areas as required in the permit application process with the Division of Pesticide Control at the Department of Agriculture. It is beyond the scope of this plan to maintain updated well and water supply information other than that provided in Figure 7.

Historical Control Activities

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
03-Jun-03	DIQUAT	53	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
15-Jun-04	DIQUAT	53	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
15-Jun-05	DIQUAT	53	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
15-Jun-06	DIQUAT	16.5	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
13-Jun-07	DIQUAT	66	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
12-Jun-08	DIQUAT	34.75	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
16-Sep-09	2,4-D	46.4	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
21-Jun-11	2,4-D	16	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL/DASH	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
30-Jun-12	2,4-D (G)	27	AQUATIC CONTROL TECHNOLOGY
SUMMER MONTHS	HAND REMOVAL/DASH	NOT MEASURED	LOCAL RESIDENTS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
13-Jun-13	2,4-D (G)	20.8 ACRES	ACT
SUMMER MONTHS	HAND REMOVAL	NOT MEASURED	LOCAL RESIDENTS AND DIVERS
GROWING SEASON	FRAGMENT BARRIER	N/A	LOCAL RESIDENTS
12-Jun-14	DIQUAT TREATMENT	40 GALLONS FOR 20 ACRES	ACT
11-Sep-14	2,4-D (G)	2220 LBS FOR 20 ACRES	ACT
2014 GROWING SEASON	FRAGMENT BARRIER AND DIVING	NOT MEASURED/ REPORTED	LOCAL RESIDENTS AND DIVERS
5/19/2014	HAND REMOVAL/DASH	I BARREL/]75 LBS	CONTRACT DIVERS

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
5/20/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
5/21/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
6/2/2014	HAND REMOVAL/DASH	1 BARREL/75 LBS	CONTRACT DIVERS
6/3/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
6/4/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
6/5/2014	HAND REMOVAL/DASH	1.75 BARRELS/140 LBS	CONTRACT DIVERS
6/6/2014	HAND REMOVAL/DASH	1 BARREL	CONTRACT DIVERS
6/8/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
6/9/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
6/10/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
6/11/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
6/12/2014	HAND REMOVAL/DASH	2.5 BARRELS/225 LBS	CONTRACT DIVERS
6/13/2014	HAND REMOVAL/DASH	2 BARRELS/210 LBS	CONTRACT DIVERS
6/17/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
6/18/2014	HAND REMOVAL/DASH	2 BARRELS/225 LBS	CONTRACT DIVERS
6/19/2014	HAND REMOVAL/DASH	1 BARREL/75 LBS	CONTRACT DIVERS
6/24/2014	HAND REMOVAL/DASH	2 BARRELS/160 LBS	CONTRACT DIVERS
6/25/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
7/1/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
7/2/2014	HAND REMOVAL/DASH	2.5 BARRELS/190 LBS	CONTRACT DIVERS
7/7/2014	HAND REMOVAL/DASH	6 BARRELS/450 LBS	CONTRACT DIVERS
7/8/2014	HAND REMOVAL/DASH	1.5 BARRELS/120 LBS	CONTRACT DIVERS

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
7/14/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
7/22/2014	HAND REMOVAL/DASH	9 BARRELS/675 LBS	CONTRACT DIVERS
7/23/2014	HAND REMOVAL/DASH	8 BARRELS/600 LBS	CONTRACT DIVERS
7/20/2014	HAND REMOVAL/DASH	8 BARRELS/600 LBS	CONTRACT DIVERS
7/31/2014	HAND REMOVAL/DASH	4 BARRELS/280 LBS	CONTRACT DIVERS
8/9/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
8/19/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
8/27/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/15/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/16/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/17/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/18/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
9/19/2014	HAND REMOVAL/DASH	3.5 BARRELS	CONTRACT DIVERS
9/20/2014	HAND REMOVAL/DASH	4 BARRELS/280 LBS	CONTRACT DIVERS
9/21/2014	HAND REMOVAL/DASH	4 BARRELS/280 LBS	CONTRACT DIVERS
9/22/2014	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	CONTRACT DIVERS
9/23/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/24/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/25/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
9/26/2014	HAND REMOVAL/DASH	3 BARRELS/225 LBS	CONTRACT DIVERS
9/30/2014	HAND REMOVAL/DASH	3 BARRELS/225 LBS	CONTRACT DIVERS
10/1/2014	HAND REMOVAL/DASH	3.5 BARRELS/265 LBS	CONTRACT DIVERS

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
10/2/2014	HAND REMOVAL/DASH	4 BARRELS/280 LBS	CONTRACT DIVERS
10/3/2014	HAND REMOVAL/DASH	2 BARRELS/150 LBS	CONTRACT DIVERS
10/6/2014	HAND REMOVAL/DASH	3 BARRELS/225 LBS	CONTRACT DIVERS
10/7/2014	HAND REMOVAL/DASH	2.5 BARRELE/190 LBS	CONTRACT DIVERS
10/8/2014	HAND REMOVAL/DASH	2.5 BARRELE/190 LBS	CONTRACT DIVERS
10/9/2014	HAND REMOVAL/DASH	3 BARRELS/225 LBS	CONTRACT DIVERS
10/10/2014	HAND REMOVAL/DASH	5 BARRELS/350 LBS	CONTRACT DIVERS
10/11/2014	HAND REMOVAL/DASH	6 BARRELS/420 LBS	CONTRACT DIVERS
10/12/2014	HAND REMOVAL/DASH	4 BARRELS/280 LBS	CONTRACT DIVERS
5/17/2015	HAND REMOVAL/DASH	3 BARRELS/225 LBS	BLIMP TEAM
5/18/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
5/19/2015	HAND REMOVAL/DASH	0.5 BARREL/40 LBS	BLIMP TEAM
5/20/2015	HAND REMOVAL/DASH	3 BARRELS/225 LBS	BLIMP TEAM
5/21/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
5/22/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
5/23/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
5/24/2015	HAND REMOVAL/DASH	2.5 BARRELE/190 LBS	BLIMP TEAM
5/25/2015	HAND REMOVAL/DASH	0.5 BARREL/40 LBS	BLIMP TEAM
5/26/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
5/27/2015	HAND REMOVAL/DASH	0.5 BARREL/40 LBS	BLIMP TEAM
5/28/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
5/29/2015	HAND REMOVAL/DASH	3 BARRELS/225 LBS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
5/30/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
5/31/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
6/2/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/3/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/4/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
6/5/2015	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	BLIMP TEAM
6/6/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/9/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/10/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/11/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
6/12/2015	HAND REMOVAL/DASH	1.5 BARRELS/115 LBS	BLIMP TEAM
6/14/2015	HAND REMOVAL/DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/15/2015	HAND REMOVAL/DASH	3 BARRELS/225 LBS	BLIMP TEAM
6/16/2015	HAND REMOVAL/DASH	2 BARRELS/225 LBS	BLIMP TEAM
6/17/2015	2,4-D BEE (GRAN)	13.64 ACRES	ACT
6/19/2015	HAND REMOVAL/DASH	1 BARREL/75 LBS	BLIMP TEAM
9/8/2015	HAND REMOVAL/DASH	4.66 BARRELS/350 LBS	BLIMP TEAM
9/9/2015	HAND REMOVAL/DASH	4 BARRELS/280 LBS	BLIMP TEAM
9/10/2015	HAND REMOVAL/DASH	10 BARRELS/700 LBS	BLIMP TEAM
9/11/2015	HAND REMOVAL/DASH	6 BARRELS/420 LBS	BLIMP TEAM
9/14/2015	HAND REMOVAL/DASH	3 BARRELS/210 LBS	BLIMP TEAM
9/15/2015	HAND REMOVAL/DASH	3.75 BARRELS/260 LBS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
9/16/2015	HAND REMOVAL/DASH	6 BARRELS/420 LBS	BLIMP TEAM
9/17/2015	HAND REMOVAL/DASH	4 BARRELS/280 LBS	BLIMP TEAM
9/18/2015	HAND REMOVAL/DASH	7 BARRELS/490 LBS	BLIMP TEAM
9/21/2015	HAND REMOVAL/DASH	7 BARRELS/490 LBS	BLIMP TEAM
9/22/2015	HAND REMOVAL/DASH	3 BARRELS/210 LBS	BLIMP TEAM
9/23/2015	HAND REMOVAL/DASH	1 BARREL/70 LBS	BLIMP TEAM
9/24/2015	HAND REMOVAL/DASH	3 BARRELS/210 LBS	BLIMP TEAM
9/25/2015	HAND REMOVAL/DASH	4 BARRELS/280 LBS	BLIMP TEAM
9/28/2015	HAND REMOVAL/DASH	3 BARRELS/210 LBS	BLIMP TEAM
9/29/2015	HAND REMOVAL/DASH	2 BARRELS/140 LBS	BLIMP TEAM
5/16/2016	DASH	0.5 BARRELS/60 LBS	BLIMP TEAM
5/17/2016	DASH	0.75 BARRELS/120 LBS	BLIMP TEAM
5/18/2016	DASH	0.75 BARRELS/120 LBS	BLIMP TEAM
5/19/2016	DASH	0.5 BARRELS/70 LBS	BLIMP TEAM
5/20/2016	DASH	1 BARREL/100 LBS	BLIMP TEAM
5/22/2016	DASH	0.75 BARRELS/100 LBS	BLIMP TEAM
5/23/2016	DASH	1 BARREL/100 LBS	BLIMP TEAM
5/25/2016	DASH	1 BARREL/90 LBS	BLIMP TEAM
5/26/2016	DASH	1 BARREL/100 LBS	BLIMP TEAM
5/27/2016	DASH	1 BARREL/110 LBS	BLIMP TEAM
5/30/2016	DASH	2 BARRELS/150 LBS	BLIMP TEAM
5/31/2016	DASH	2 BARRELS/120 LBS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
6/1/2016	DASH	2 BARRELS/150 LBS	BLIMP TEAM
6/2/2016	DASH	3 BARRELS/250 LBS	BLIMP TEAM
6/3/2016	DASH	3 BARRELS/230 LBS	BLIMP TEAM
6/4/2016	DASH	1 BARREL/100 LBS	BLIMP TEAM
6/5/2016	DASH & DEPLOY NET	3 BARRELS/250 LBS	BLIMP TEAM
6/6/2016	DASH	1 BARREL/90 LBS	BLIMP TEAM
6/7/2016	DASH	2 BARRELS/160 LBS	BLIMP TEAM
6/8/2016	DASH	2 BARRELS/180 LBS	BLIMP TEAM
6/9/2016	DASH	1/8 BARREL/20 LBS	BLIMP TEAM
6/10/2016	DASH	2 BARRELS/180 LBS	BLIMP TEAM
6/11/2016	DASH	2 BARRELS/170 LBS	BLIMP TEAM
6/12/2016	DASH	1 BARREL/90 LBS	BLIMP TEAM
6/13/2016	DASH	1 BARREL/90 LBS	BLIMP TEAM
6/14/2016	DASH	1 BARREL/70 LBS	BLIMP TEAM
6/15/2016	DASH	1 BARREL/90 LBS	BLIMP TEAM
6/16/2016	DASH	1 BARREL/80 LBS	BLIMP TEAM
6/17/2016	DASH	2.5 BARRELS/200 LBS	BLIMP TEAM
6/18/2016	DASH	2 BARRELS/180 LBS	BLIMP TEAM
6/19/2016	DASH	2 BARRELS/180 LBS	BLIMP TEAM
6/29/2016	2,4-D BEE (GRAN)	4316.8 LBS FOR 30.4 ACRES	SOLitude Lake Management
8/28/2016	DASH	2 BARRELS/180 LBS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
9/9/2016	DASH	1.5 BARRELS/180 LBS	BLIMP TEAM
9/6/2016	DASH	1 BARREL/80 LBS	BLIMP TEAM
9/10/2016	DASH	2 BARRELS/170 LBS	BLIMP TEAM
9/11/2016	DASH	2 BARRELS/170 LBS	BLIMP TEAM
9/12/2016	DASH	2 BARRELS/175 LBS	BLIMP TEAM
9/13/2016	DASH	2 BARRELS/150 LBS	BLIMP TEAM
9/16/2016	DASH	1 BARREL/70 LBS	BLIMP TEAM
9/17/2016	DASH	3 BARRELS/210 LBS	BLIMP TEAM
9/18/2016	DASH	6 BARRELS/420 LBS	BLIMP TEAM
9/19/2016	DASH	6 BARRELS/420 LBS	BLIMP TEAM
9/20/2016	DASH	4 BARRELS/260 LBS	BLIMP TEAM
9/21/2016	DASH	2 BARRELS/150 LBS	BLIMP TEAM
9/22/2016	DASH	1 BARREL/70 LBS	BLIMP TEAM
9/23/2016	DASH	2 BARRELS/130 LBS	BLIMP TEAM
9/24/2016	DASH	3 BARRELS/200 LBS	BLIMP TEAM
9/25/2016	DASH	3 BARRELS/210 LBS	BLIMP TEAM
9/26/2016	DASH	2 BARRELS/ 140 LBS	BLIMP TEAM
9/28/2016	DASH	1 BARREL/70 LBS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
9/29/2016	20 BARRIERS MOVED FROM HEAD OF LAKE TO LOON COVE		BLIMP TEAM
9/30/2016	DASH	3 BARRELS/200 LBS	BLIMP TEAM
10/2/2016	DASH	1 BARREL/75 LBS	BLIMP TEAM
10/3/2016	DASH	2 BARRELS/140 LBS	BLIMP TEAM
10/4/2016	DASH	1.5 BARRELS/110 LBS	BLIMP TEAM
10/5/2016	DASH	1 BARREL/70 LBS	BLIMP TEAM
10/6/2016	DASH & 10 BARRIERS MOVED FROM HEAD OF LAKE TO LOON COVE	0.5 BARRELS/40 LBS	BLIMP TEAM
10/8/2016	DASH	1 BARREL/70 LBS	BLIMP TEAM
10/9/2016	DASH	0.5 BARREL/50 LBS	BLIMP TEAM
10/12/2016	DASH	1.5 BARRELS/140 LBS	BLIMP TEAM
10/13/2016	DASH	1 BUCKET/70 LBS	BLIMP TEAM
10/14/2016	DASH	0.5 BUCKET/35 LBS	BLIMP TEAM
5/17/2017	DASH	1 BARREL	BLIMP TEAM
5/18/2017	DASH	1 BARREL	BLIMP TEAM
5/19/2017	DASH	1 BARREL	BLIMP TEAM
5/20/2017	DASH	2 BARRELS	BLIMP TEAM
5/21/2017	DASH	1 BARREL	BLIMP TEAM
5/22/2017	DASH	1/2 BARREL	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
5/23/2017	DASH	2 1/3 BARRELS	BLIMP TEAM
5/24/2017	DASH	1/2 BARREL	BLIMP TEAM
5/25/2017	DASH	2 BARRELS	BLIMP TEAM
5/26/2017	DASH	2 BARRELS	BLIMP TEAM
5/27/2017	DASH	1 BARREL	BLIMP TEAM
5/30/2017	DASH	1 BARREL	BLIMP TEAM
5/31/2017	DASH	1 BARREL	BLIMP TEAM
6/1/2017	DASH	3 BARRELS	BLIMP TEAM
6/2/2017	DASH	2 BARRELS	BLIMP TEAM
6/5/2017	DASH	1/2 BARREL	BLIMP TEAM
6/6/2017	DASH	2 BARRELS	BLIMP TEAM
6/7/2017	DASH	3 BARRELS	BLIMP TEAM
6/8/2017	DASH	2 1/2 BARRELS	BLIMP TEAM
6/9/2017	DASH	1 3/4 BARRELS	BLIMP TEAM
6/12/2017	DASH	1/2 BARREL	BLIMP TEAM
6/13/2017	DASH	1 BARREL	BLIMP TEAM
6/14/2017	2,4-D BEE (GRAN)	4 ACRES	SOLitude Lake Management
6/14/2017	DASH	1 1/2 BARREL	BLIMP TEAM
6/15/2017	DASH	6 BARRELS	BLIMP TEAM
6/16/2017	DASH	2 BARRELS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
6/17/2017	DASH	2 1/2 BARRELS	BLIMP TEAM
7/29/2017	DASH	2 BARRELS	BLIMP TEAM
8/12/2017	DASH	7 BARRELS	BLIMP TEAM
8/13/2017	DASH	5 BARRELS	BLIMP TEAM
8/19/2017	DASH	1 BARREL	BLIMP TEAM
8/20/2017	DASH	5 BARRELS	BLIMP TEAM
9/11/2017	DASH	1 BARREL	BLIMP TEAM
9/12/2017	DASH	2 BARRELS	BLIMP TEAM
9/13/2017	DASH	2 BARRELS	BLIMP TEAM
9/14/2017	DASH	3 BARRELS	BLIMP TEAM
9/15/2017	DASH	1 BARREL	BLIMP TEAM
9/16/2017	DASH	1 BARREL	BLIMP TEAM
9/17/2017	DASH	2 BARRELS	BLIMP TEAM
9/18/2017	DASH	3 BARRELS	BLIMP TEAM
9/19/2017	DASH	1 1/2 BARRELS	BLIMP TEAM
9/20/2017	DASH	8 BARRELS	BLIMP TEAM
9/21/2017	DASH	8 BARRELS	BLIMP TEAM
9/22/2017	DASH	8 BARRELS	BLIMP TEAM
9/24/2017	DASH	7 BARRELS	BLIMP TEAM
9/25/2017	DASH	8 BARRELS	BLIMP TEAM
9/27/2017	DASH	8 BARRELS	BLIMP TEAM

DATE	ACTION	AREA (ac) OR VOLUME (GAL)*	CONTRACTOR
9/28/2017	DASH	8 BARRELS	BLIMP TEAM
9/29/2017	DASH	8 BARRELS	BLIMP TEAM
9/30/2017	DASH	8 BARRELS	BLIMP TEAM
10/1/2017	DASH	8 BARRELS	BLIMP TEAM
10/2/2017	DASH	8 BARRELS	BLIMP TEAM
10/3/2017	DASH	4.5 BARRELS	BLIMP TEAM
10/4/2017	DASH	8 BARRELS	BLIMP TEAM
10/5/2017	DASH	8 BARRELS	BLIMP TEAM
10/8/2017	DASH	1 BARREL	BLIMP TEAM
10/9/2017	DASH	8 BARRELS	BLIMP TEAM
10/10/2017	DASH	2 BARRELS	BLIMP TEAM
10/11/2017	DASH	1 1/2 BARRELS	BLIMP TEAM
10/12/2017	DASH	2 BARRELS	BLIMP TEAM
10/13/2017	DASH	2 BARRELS	BLIMP TEAM

Local lake residents install and maintain fragment barriers each summer, and a team of volunteers performs hand removal activities throughout the New Hampshire side of the waterbody each summer, managing mainly the small pioneering populations of milfoil, so as to prevent further expansion of new growth.

Aquatic Invasive Plant Management Options

The control practices used should be as specific to the target species as feasible. No control of native aquatic plants is intended.

Exotic aquatic plant management relies on a combination of proven methods that control exotic plant infestations, including physical control, chemical control, biological controls (where they exist), and habitat manipulation.

Integrated Pest Management Strategies (IPM) are typically implemented using Best Management Practices (BMPs) based on site-specific conditions so as to maximize the long-term effectiveness of control strategies. Descriptions for the control activities are closely modeled after those prescribed by the Aquatic Ecosystem Restoration Foundation (AERF) (2004). This publication can be found online at http://www.aquatics.org/bmp.htm. Additional information can be obtained from a document prepared for the State of Massachusetts called the Generic Environmental Impact Report for Lakes and Ponds, available at http://www.mass.gov/dcr/watersupply/lakepond/geir.htm.

Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices currently used by the State of New Hampshire.

Feasibility Evaluation of Control Options in this Waterbody

DES has evaluated the feasibility of potential control practices on the subject waterbody. The following table summarizes DES' control strategy recommendations for the subject waterbody:

Control Method	Use on Balch Lake
Restricted Use Areas (RUAs) and/or Fragment Barriers	An RUA and fragment barrier has been maintained annually in the inlet channel from Belleau Lake/Woodman's Pond to prevent additional milfoil fragments from coming downstream and into the main body of Balch Lake. The lake association installs the barrier each year and maintains it throughout the summer under the approval of DES.
Hand-pulling	Lake association divers perform hand-removal every summer and fall on small patches or areas with singles stems to prevent milfoil expansion following larger-scale control efforts. Work like this is recommended annually to keep on top of the milfoil.
Mechanical Harvesting/Removal	For Balch Lake, mechanical harvesting is not recommended due to the threat of spreading variable milfoil to uninfested areas of the lake through the generation of fragments.
Benthic Barriers	For Balch Lake, DES recommends installing small benthic barriers in areas of re-growth if small patches of variable milfoil re-grow and can adequately be contained by benthic barriers. Benthic barriers are also recommended at individual points where pioneering colonies may not be successfully removed with hand-pulling alone.

Control Method	Use on Balch Lake
Herbicides	Herbicide treatment is recommended for areas where variable milfoil growth is dense and expansive. Navigate (2,4-D) is the preferred herbicide where it can feasible be used as it is a systemic and will target both roots and shoots.
Extended Drawdown	For Balch Lake, this is not a recommended or feasible strategy due to the size of the impoundment, and the ineffectiveness of drawdown along to control variable milfoil.
Dredge	Not recommended due to nature of exotic plant distribution, and the fact the variable milfoil quickly colonizes dredged areas.
Biological Control	There are no approved biological controls for variable milfoil at this time in New Hampshire.
No Control	In order to maintain a healthy and well distributed mix of native vegetation in Balch Lake, DES recommends managing variable milfoil. Balch Lake is shallow, it has sediments that are conducive to variable milfoil growth, and thus can easily be dominated by variable milfoil. We have seen exponential growth of variable milfoil in Balch Lake since it was introduced, and a 'no control' option would only result in complete colonization of all suitable habitats in the lake.

Recommended Actions, Timeframes and Responsible Parties

An evaluation of the size, location, and type of variable milfoil infestation, as well as the waterbody uses was conducted at the end of the last growing season (see attached figures for findings). Based on this survey the following recommendations are made for variable milfoil control in the system:

Year	Action	Responsible Party	Schedule
2017	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June

Year	Action	Responsible Party	Schedule
	Herbicide treatment if needed	SOLitude Lake Management, LLC	June or September
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Local BLIMP Divers	May through September as needed
	Survey waterbody and planning for next season's control actions	DES	September
2018	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June
	Herbicide treatment if needed	SOLitude Lake Management, LLC	June or September
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Local BLIMP Divers	May through September as needed
	Survey waterbody and planning for next season's control actions	DES	September
2019	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June
	Herbicide treatment if needed	SOLitude Lake Management, LLC	June or September
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Local BLIMP Divers	May through September as needed

Year	Action	Responsible Party	Schedule
	Survey waterbody and planning for next season's control actions	DES	September
2020	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June
	Herbicide treatment if needed	SOLitude Lake Management, LLC	June or September
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Local BLIMP Divers	May through September as needed
	Survey waterbody and planning for next season's control actions	DES	September
2021	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June
	Herbicide treatment if needed	SOLitude Lake Management, LLC	June or September
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Local BLIMP Divers	May through September as needed
	Survey waterbody and planning for next season's control actions	DES	September
2022	Update and revise Long-Term Variable Milfoil Control Plan	DES and Interested Parties	Fall/ Winter

Notes

Target Specificity

It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner. To the extent feasible, the permitting authority favors the use of selective herbicides that, where used appropriately, will control the target plant with little or no impact to non-target species, such that the ecological functions of native plants for habitat, lake ecology, and chemistry/biology will be maintained. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

Adaptive Management

Because this is a natural system that is being evaluated for management, it is impossible to accurately predict a management course over five years that could be heavily dependent on uncontrolled natural circumstances (weather patterns, temperature, adaptability of invasive species, etc).

This long-term plan is therefore based on the concept of adaptive management, where current field data (from field survey work using DES established field survey standard operating procedures) drive decision making, which may result in modifications to the recommended control actions and timeframes for control. As such, this management plan should be considered a dynamic document that is geared to the actual field conditions that present themselves in this waterbody.

If circumstances arise that require the modification of part or all of the recommendations herein, interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil reduction in the subject waterbody.

Figure 1: Map of Variable Milfoil Infestations Over Time

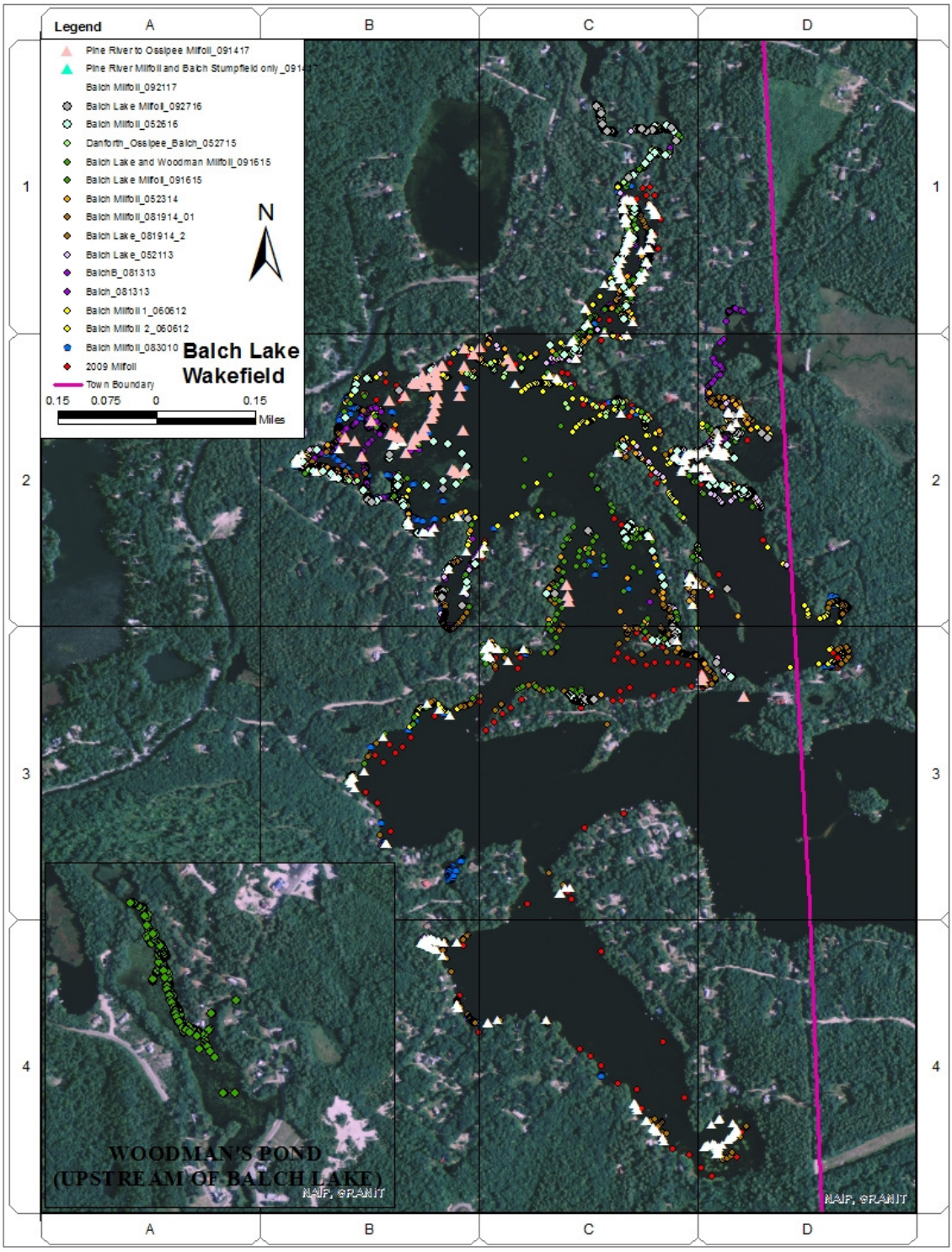
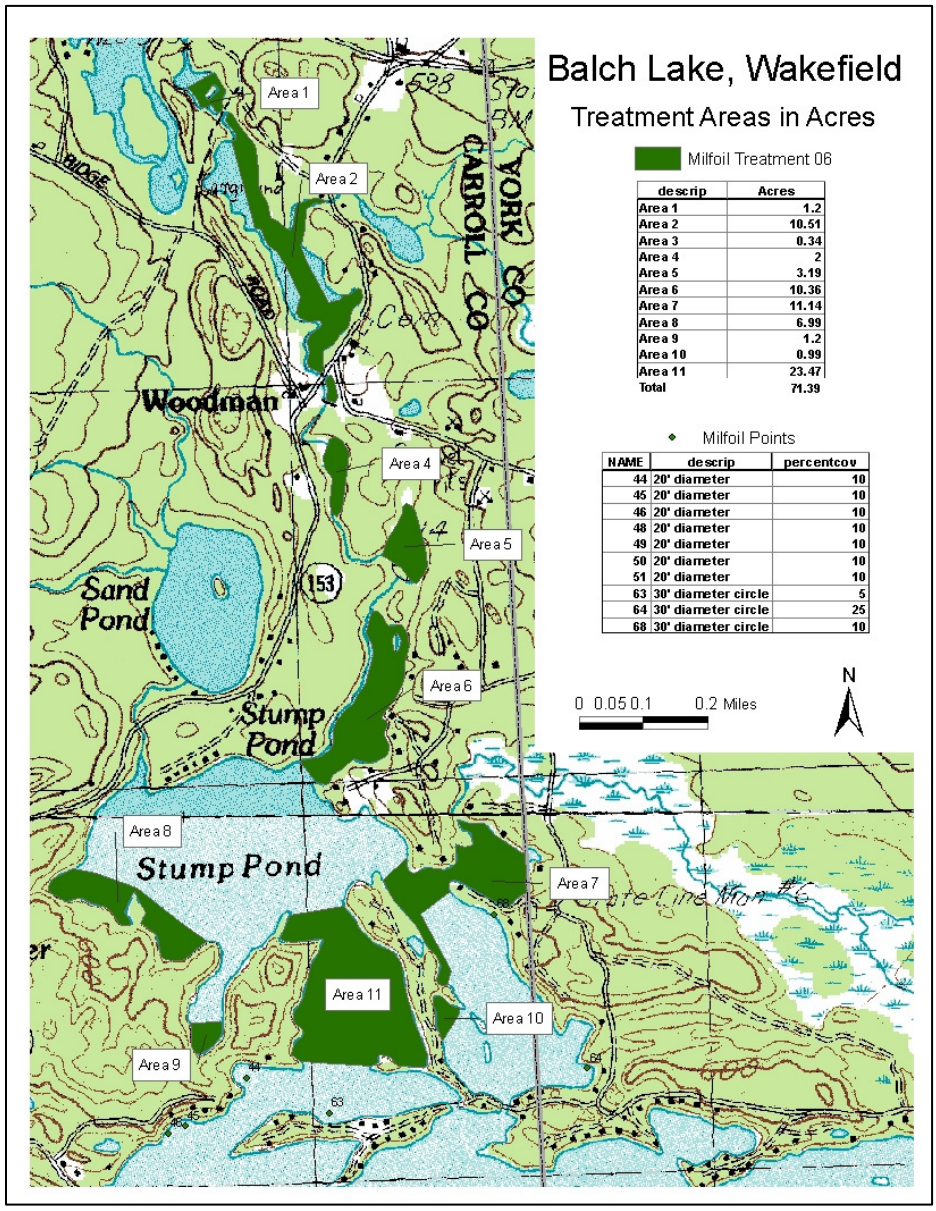


Figure 2: Map of Control Actions Over Time

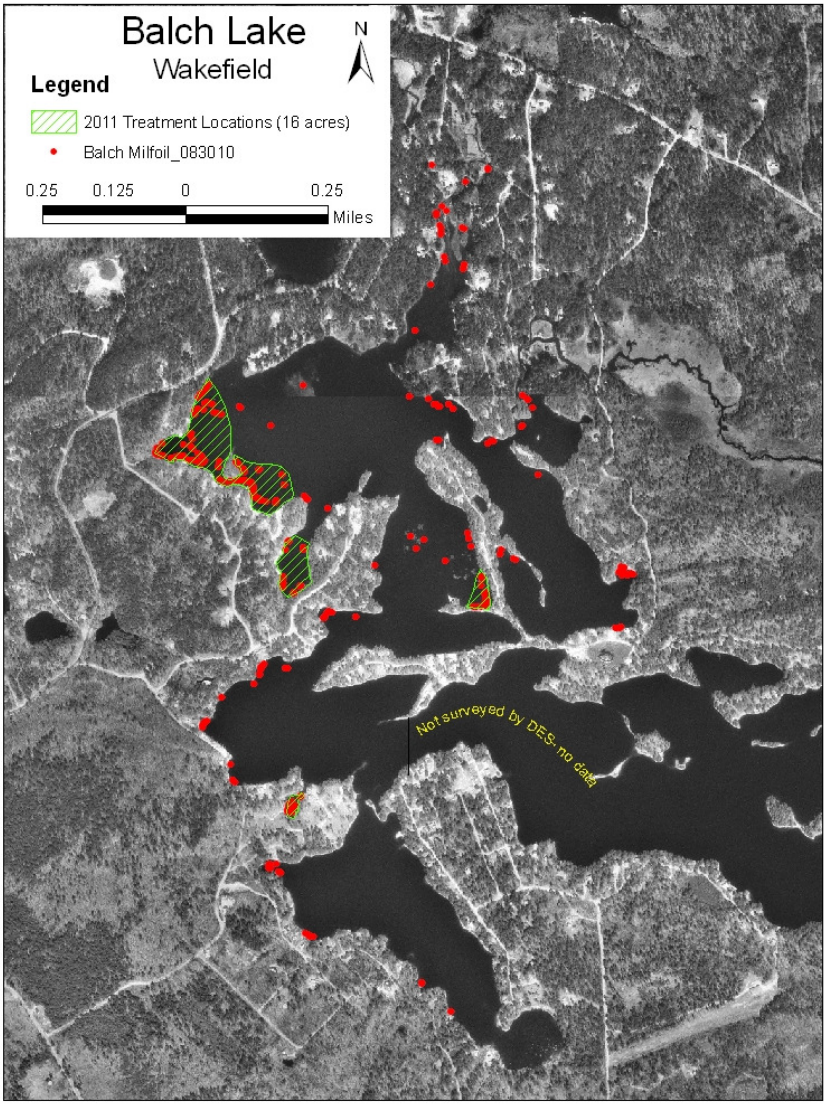
2006



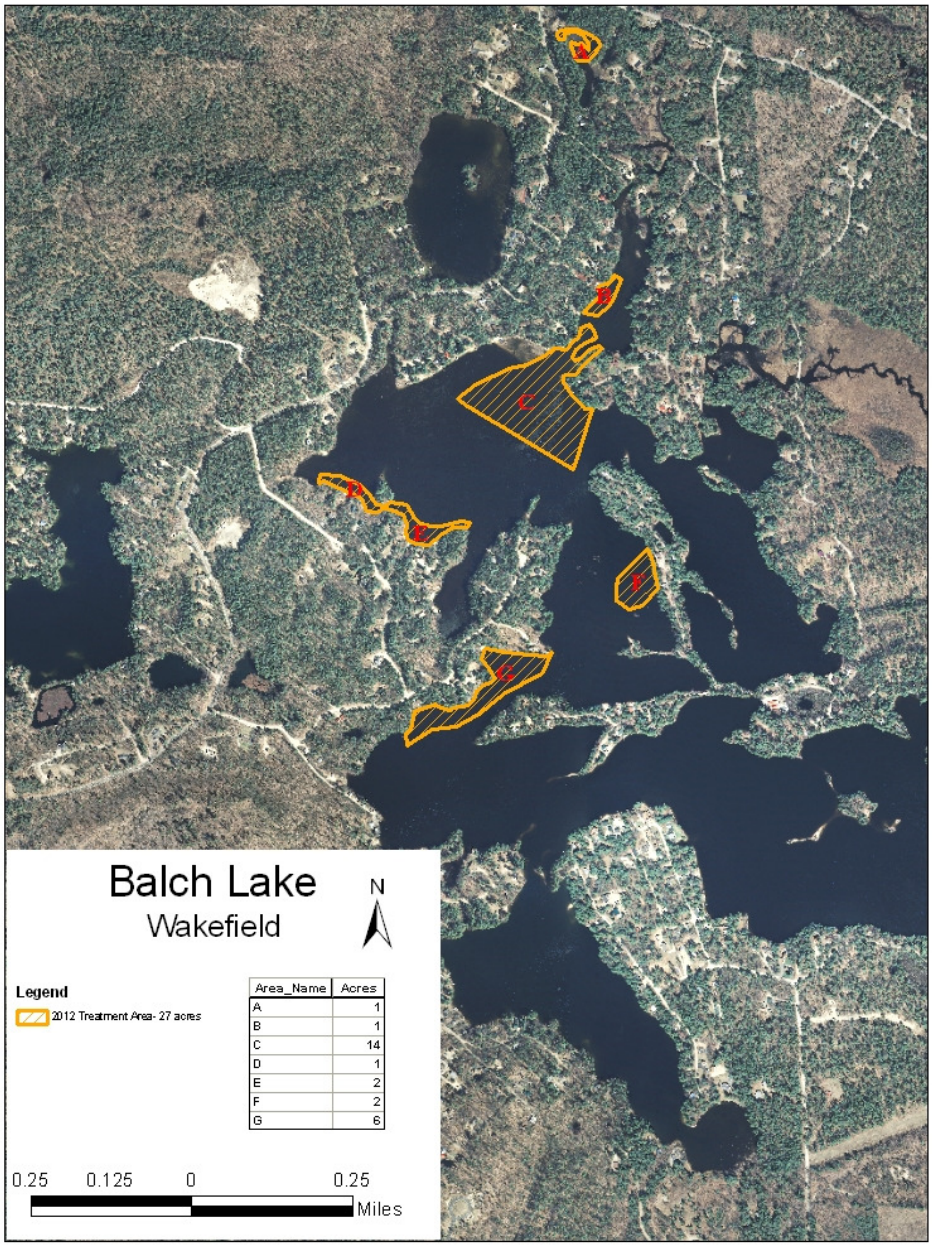
descrip	Acres
Area 1	1.2
Area 2	10.51
Area 3	0.34
Area 4	2
Area 5	3.19
Area 6	10.36
Area 7	11.14
Area 8	6.99
Area 9	1.2
Area 10	0.99
Area 11	23.47
Total	71.39

NAME	descrip	percentcov
44	20' diameter	10
45	20' diameter	10
46	20' diameter	10
48	20' diameter	10
49	20' diameter	10
50	20' diameter	10
51	20' diameter	10
63	30' diameter circle	5
64	30' diameter circle	25
68	30' diameter circle	10

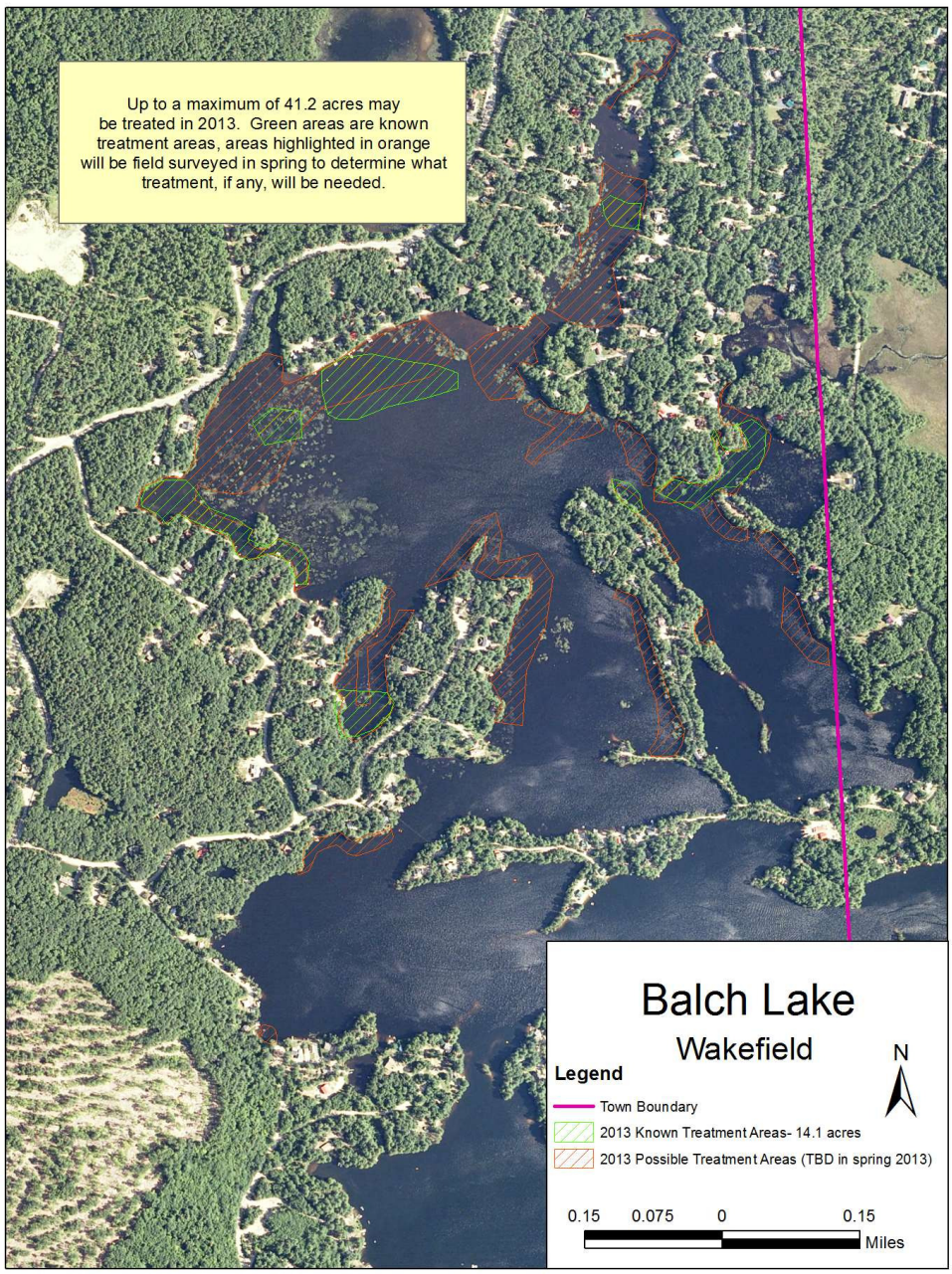
2011


Balch Lake
Wakefield
N
Legend
2011 Treatment Locations (16 acres)
Balch Milfoil_083010
0.25 0.125 0 0.25
Miles
Not surveyed by DES- no data

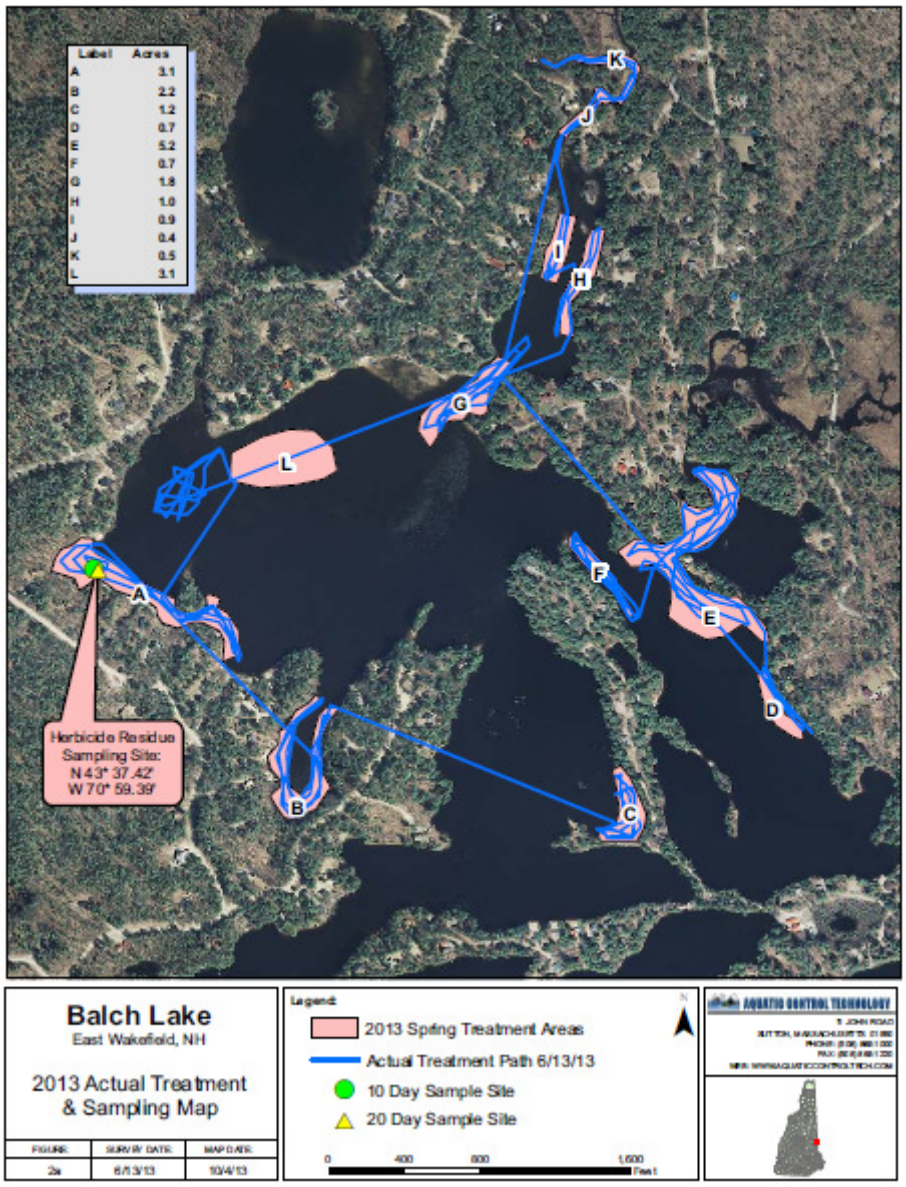
2012


A
B
C
D
E
F
G
Balch Lake
Wakefield
N
Legend
2012 Treatment Area- 27 acres
Area_Name | Acres
A | 1
B | 1
C | 14
D | 1
E | 2
F | 2
G | 6
0.25 0.125 0 0.25
Miles

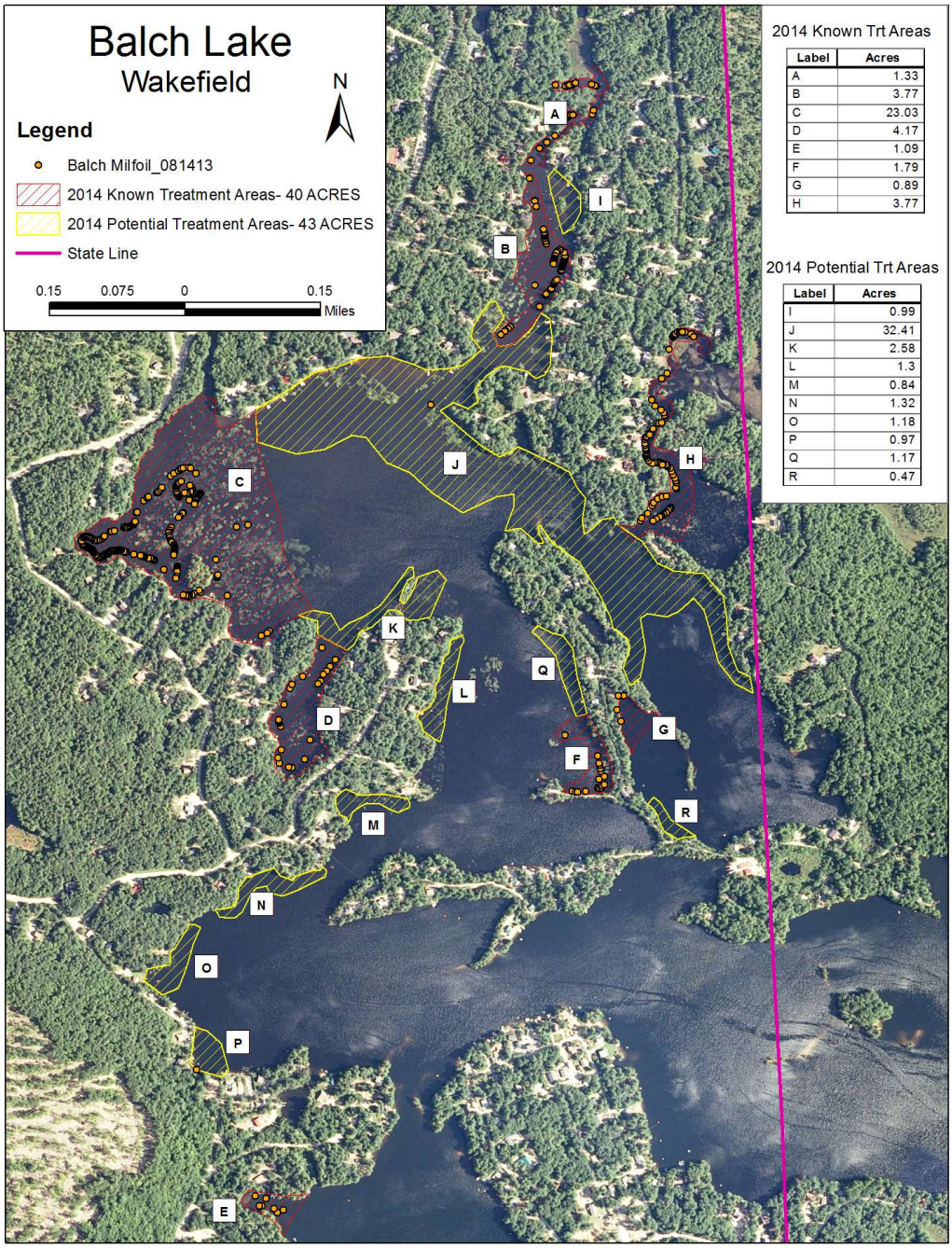
2013 (proposed)



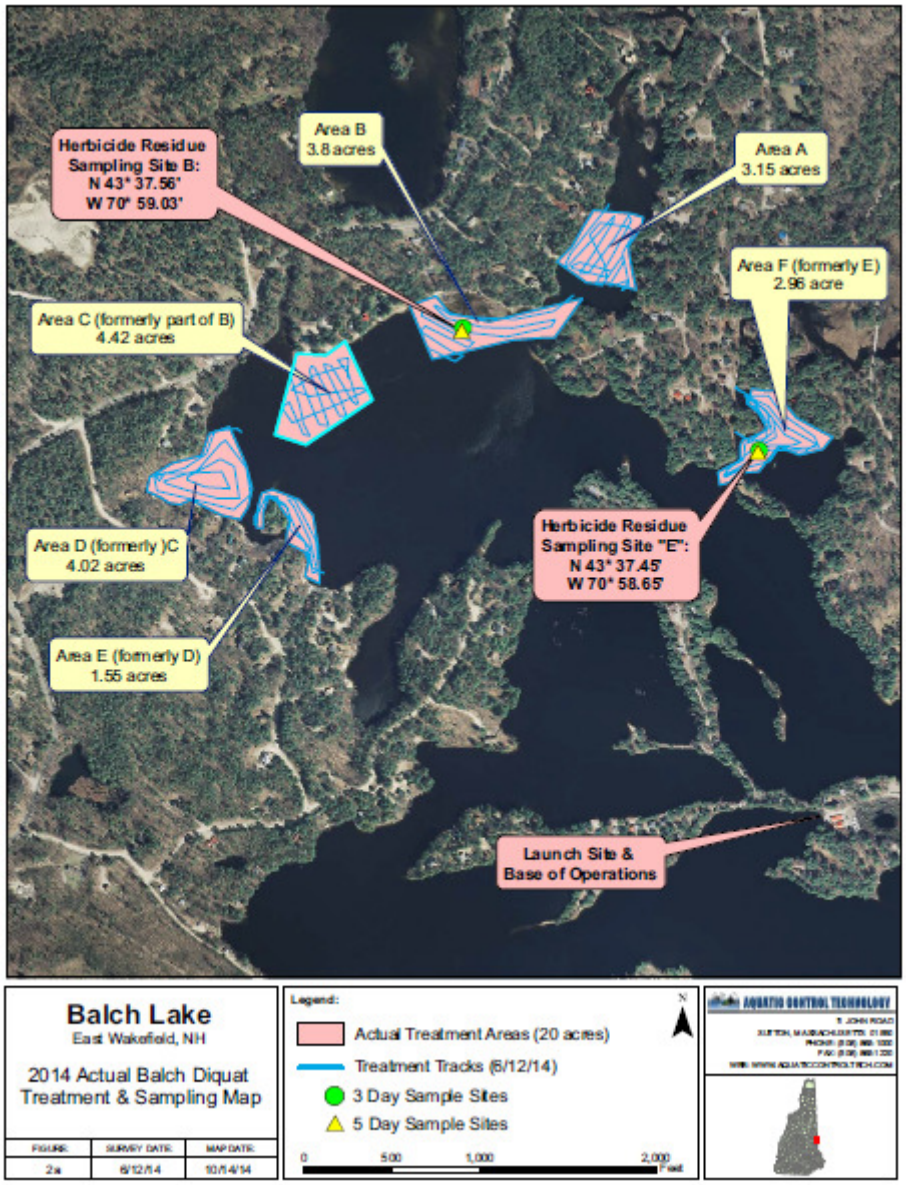
2013 (actual)


Label Acres
A 3.1
B 2.2
C 1.2
D 0.7
E 5.2
F 0.7
G 1.8
H 1.0
I 0.9
J 0.4
K 0.5
L 3.1
Herbicide Residue Sampling Site: N 43° 37.42' W 70° 59.39'
Balch Lake
East Wakefield, NH
2013 Actual Treatment & Sampling Map
FIGURE: 2a
SURVEY DATE: 6/13/13
MAP DATE: 10/4/13
Legend:
2013 Spring Treatment Areas
Actual Treatment Path 6/13/13
10 Day Sample Site
20 Day Sample Site
0 400 800 1,600 Feet
AQUATIC CONTROL TECHNOLOGY

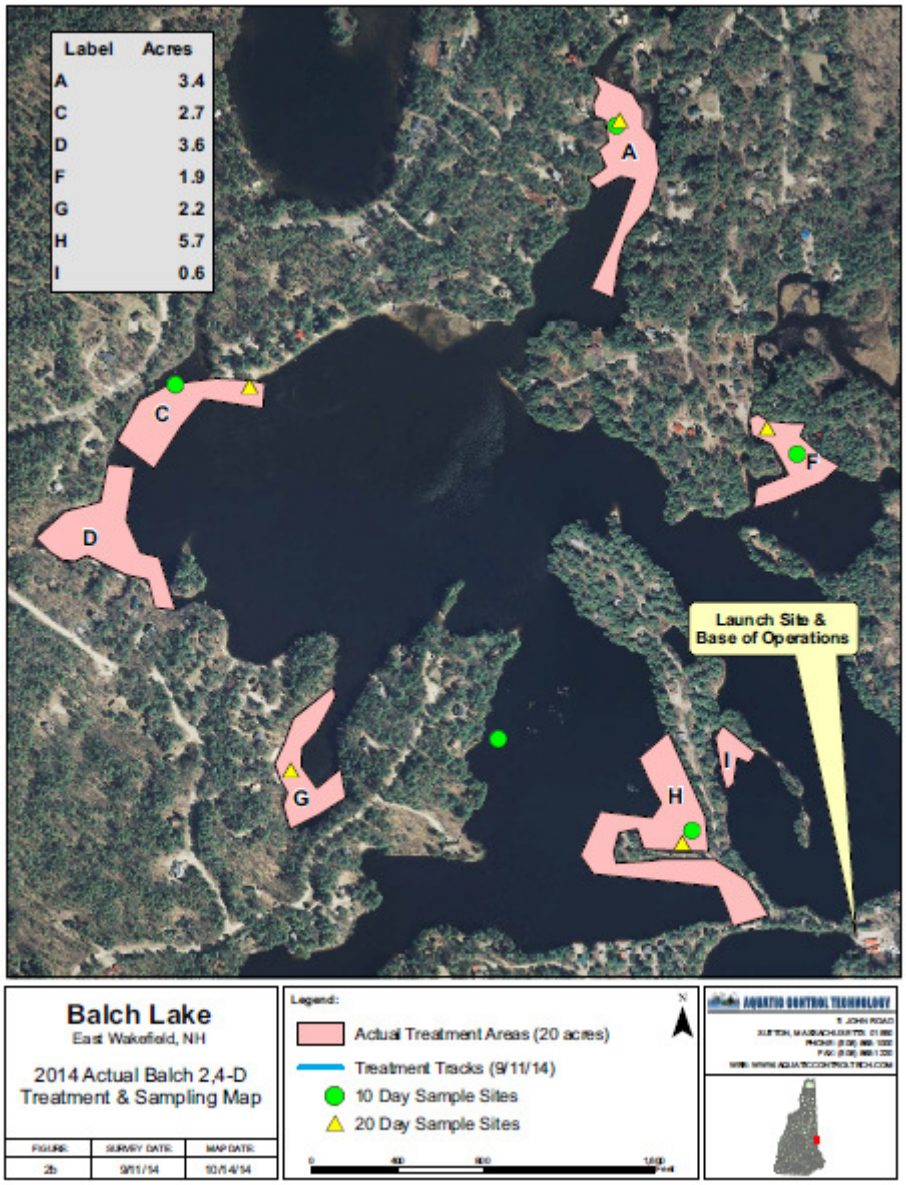
2014 (proposed)



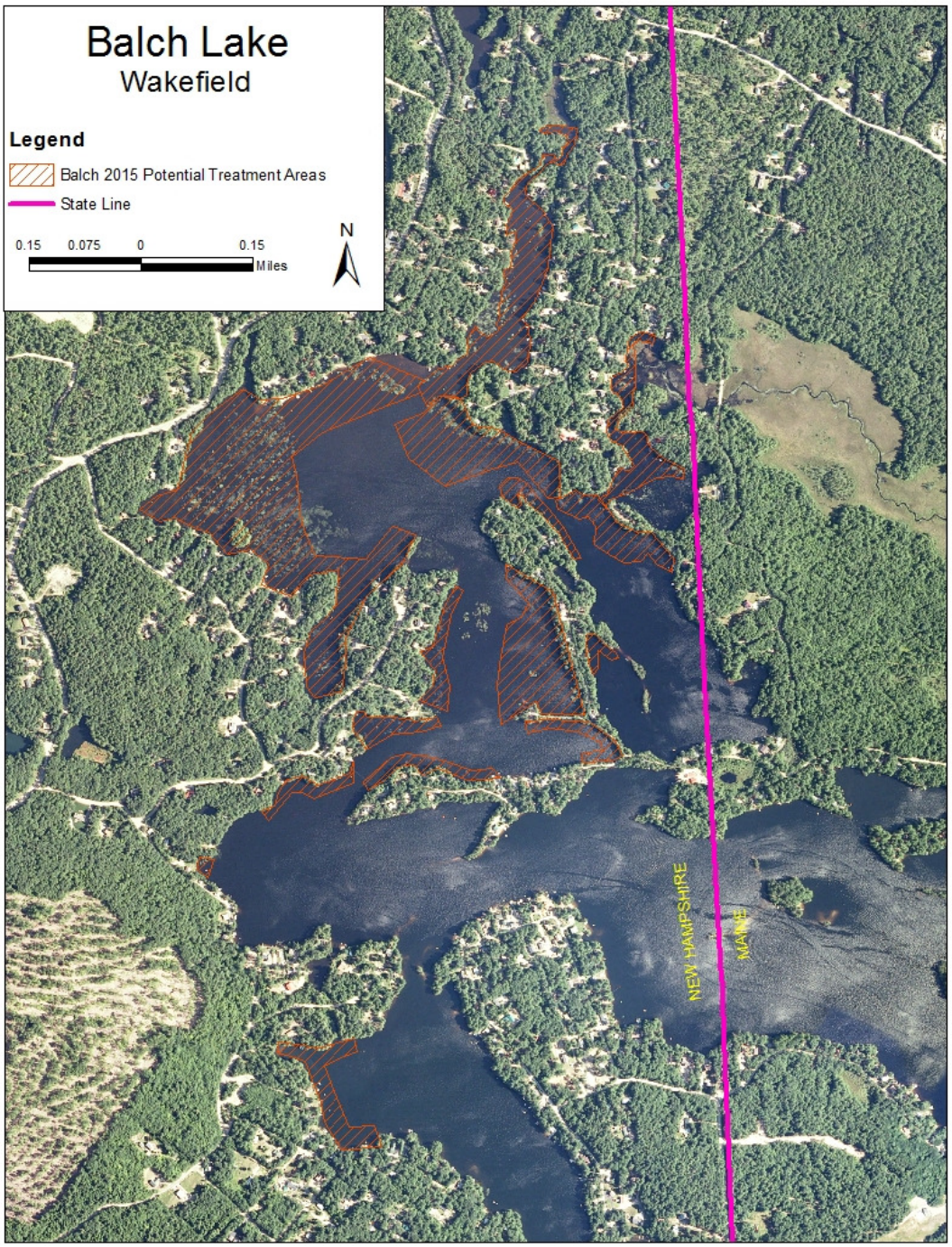
2014 (spring actual)



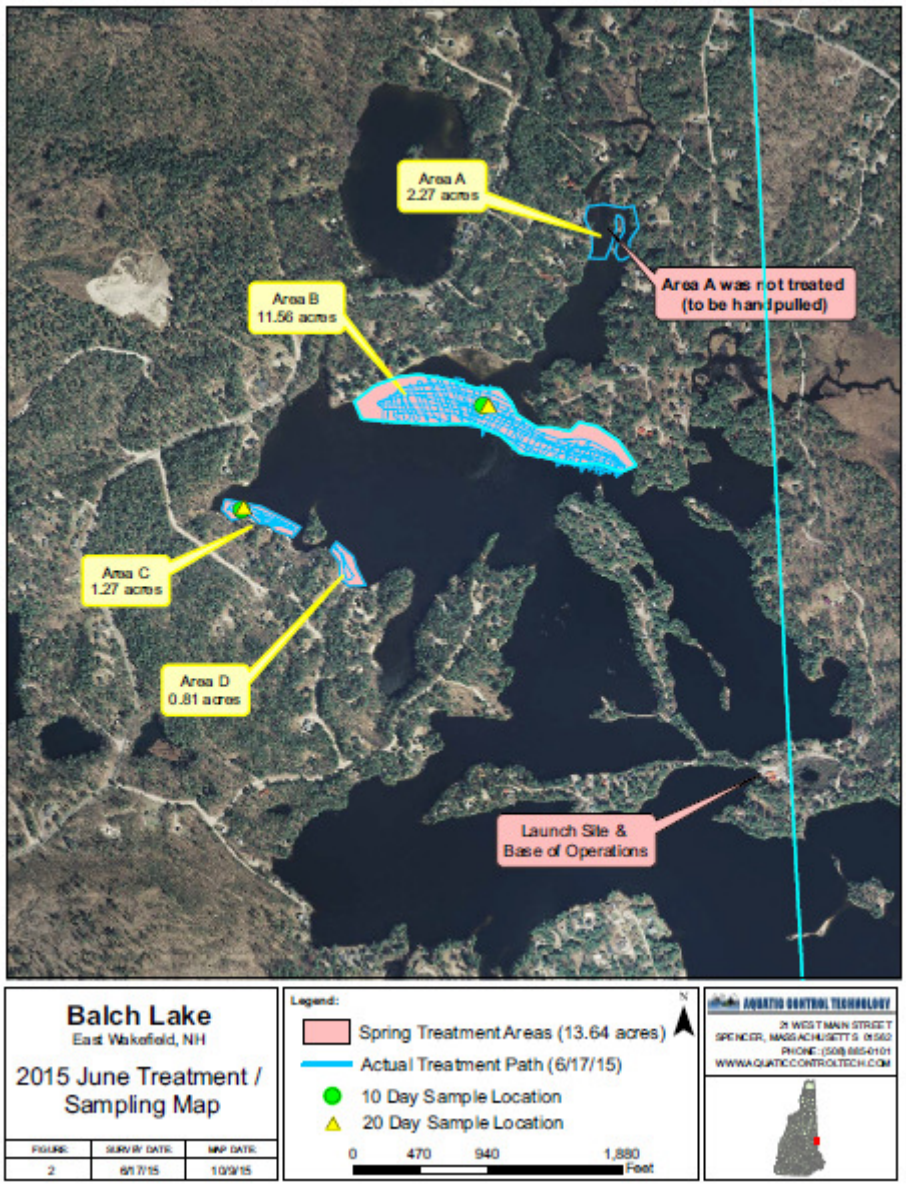
2014 (fall actual)



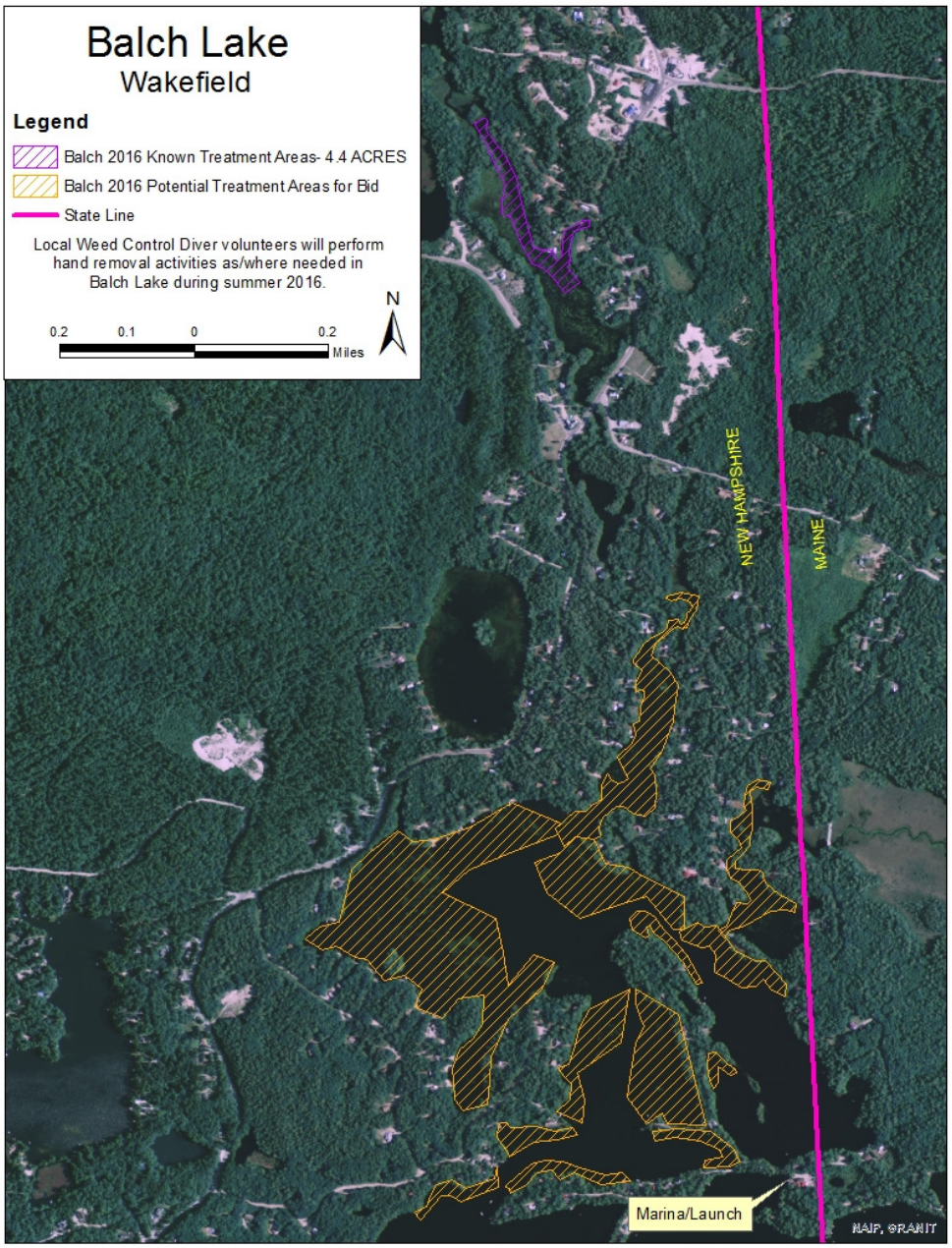
2015 (proposed)



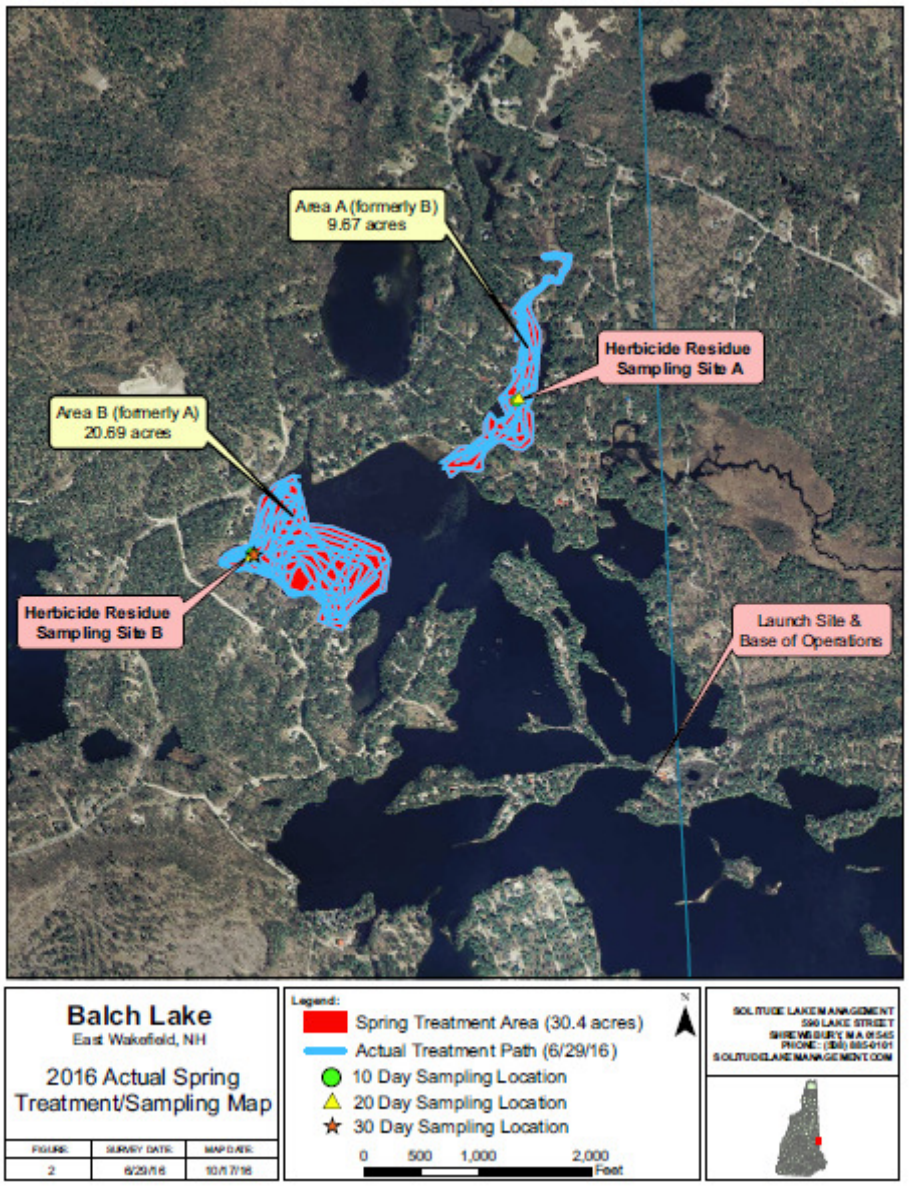
2015 (actual)


Area A
2.27 acres
Area A was not treated
(to be hand pulled)
Area B
11.56 acres
Area C
1.27 acres
Area D
0.81 acres
Launch Site &
Base of Operations
Balch Lake
East Wakefield, NH
2015 June Treatment / Sampling Map
FIGURE
SURVEY DATE
MAP DATE
2
6/17/15
10/9/15
Legend:
Spring Treatment Areas (13.64 acres)
Actual Treatment Path (6/17/15)
10 Day Sample Location
20 Day Sample Location
0
470
940
1,880
Feet
N
AQUATIC CONTROL TECHNOLOGY
21 WEST MAIN STREET
SPENCER, MASSACHUSETTS 01562
PHONE (508) 885-4101
WWW.AQUATICCONTROLTECH.COM

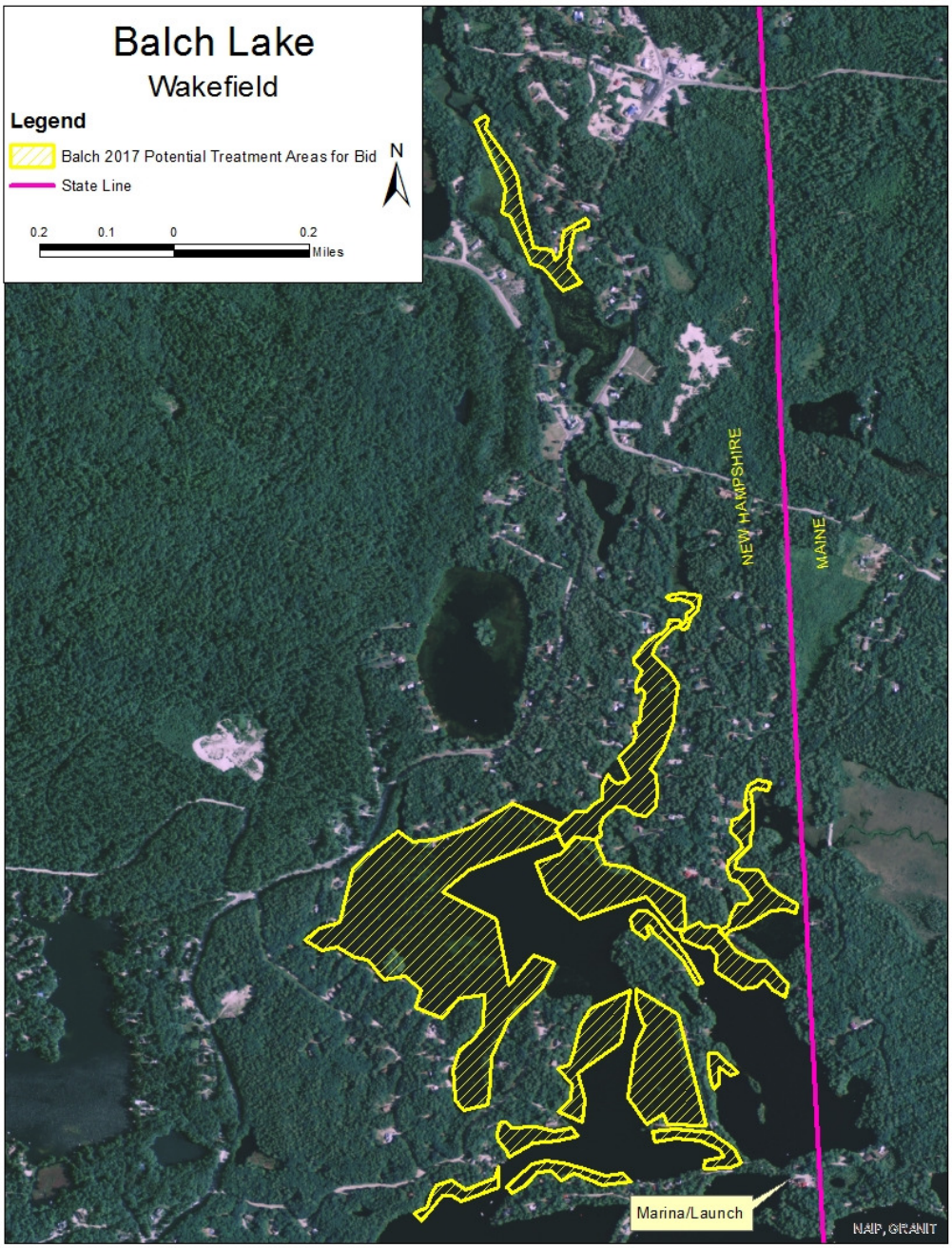
2016 (proposed)



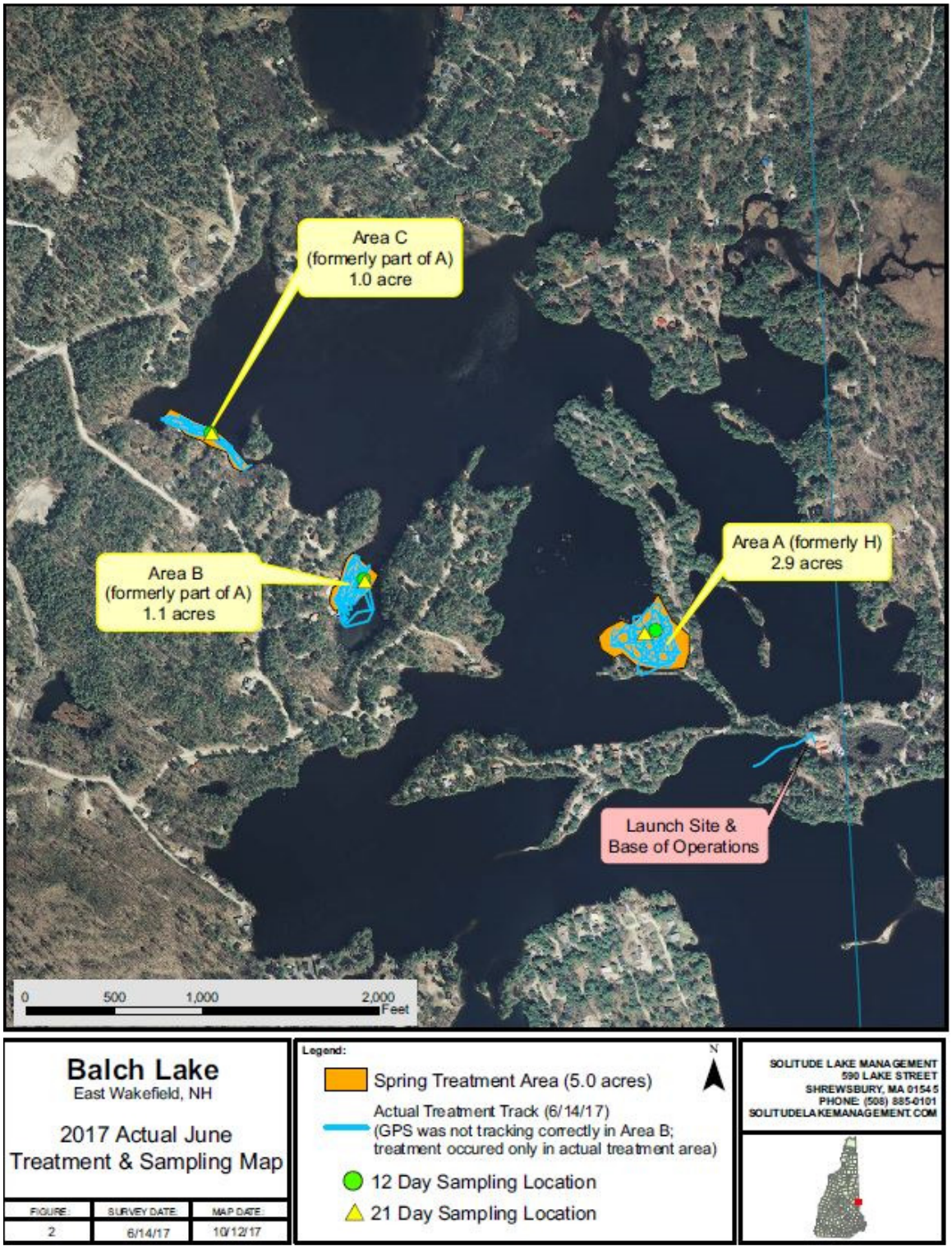
2016 (actual)


Area A (formerly B)
9.67 acres
Herbicide Residue
Sampling Site A
Area B (formerly A)
20.69 acres
Herbicide Residue
Sampling Site B
Launch Site &
Base of Operations
Balch Lake
East Wakefield, NH
2016 Actual Spring
Treatment/Sampling Map
FIGURE
SURVEY DATE
MAP DATE
2
6/29/16
10/17/16
Legend:
Spring Treatment Area (30.4 acres)
Actual Treatment Path (6/29/16)
10 Day Sampling Location
20 Day Sampling Location
30 Day Sampling Location
N
0
500
1,000
2,000
Feet
SOLITUDE LAKE MANAGEMENT
590 LAKE STREET
SHREWSBURY, MA 01545
PHONE: (888) 665-4101
SOLITUDELAKEMANAGEMENT.COM

2017 (potential treatment areas)



2017 Actual


Area C
(formerly part of A)
1.0 acre
Area B
(formerly part of A)
1.1 acres
Area A (formerly H)
2.9 acres
Launch Site &
Base of Operations
0
500
1,000
2,000
Feet
Balch Lake
East Wakefield, NH
2017 Actual June
Treatment & Sampling Map
FIGURE:
2
SURVEY DATE:
6/14/17
MAP DATE:
10/12/17
Legend:
N
Spring Treatment Area (5.0 acres)
Actual Treatment Track (6/14/17)
(GPS was not tracking correctly in Area B;
treatment occured only in actual treatment area)
12 Day Sampling Location
21 Day Sampling Location
SOLITUDE LAKE MANAGEMENT
590 LAKE STREET
SHREWSBURY, MA 01545
PHONE: (508) 885-0101
SOLITUDELAKEMANAGEMENT.COM

2017 (proposed)

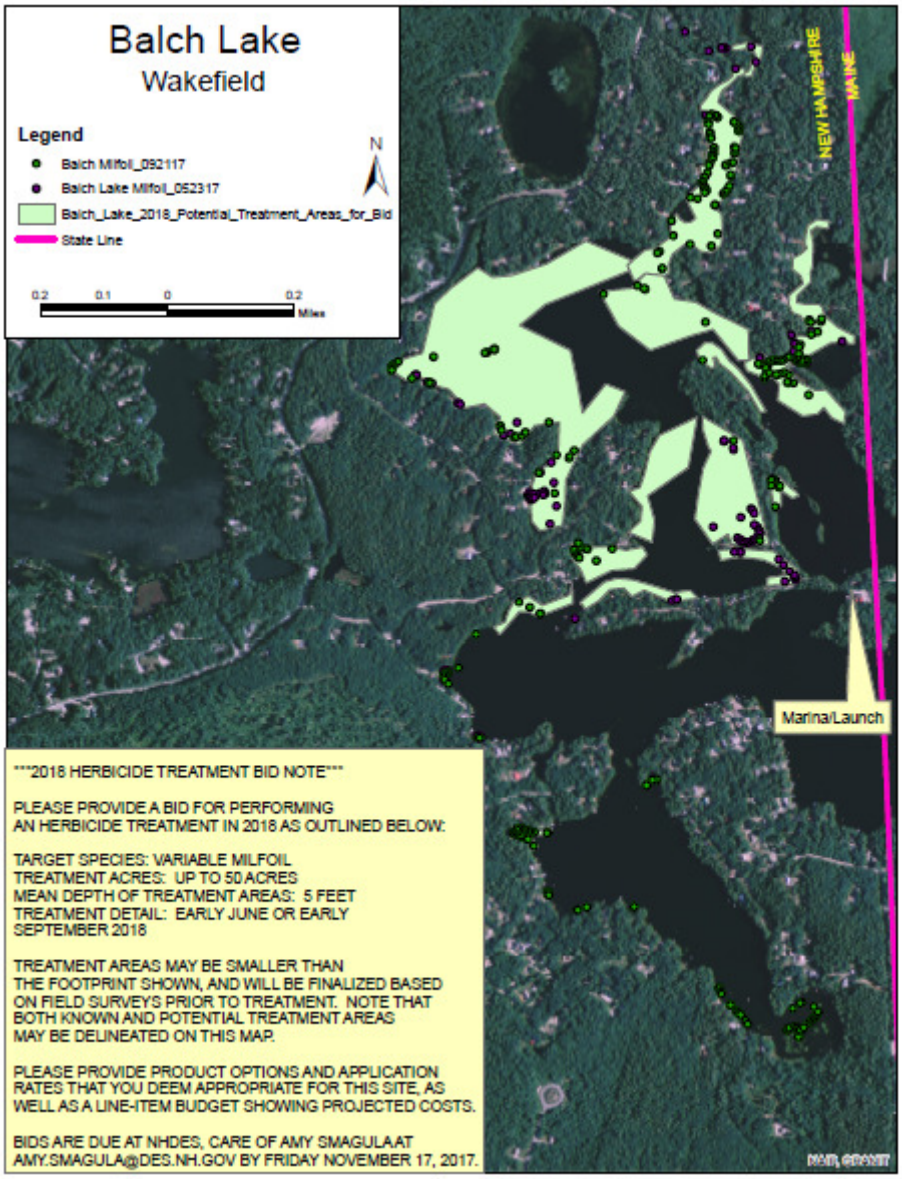
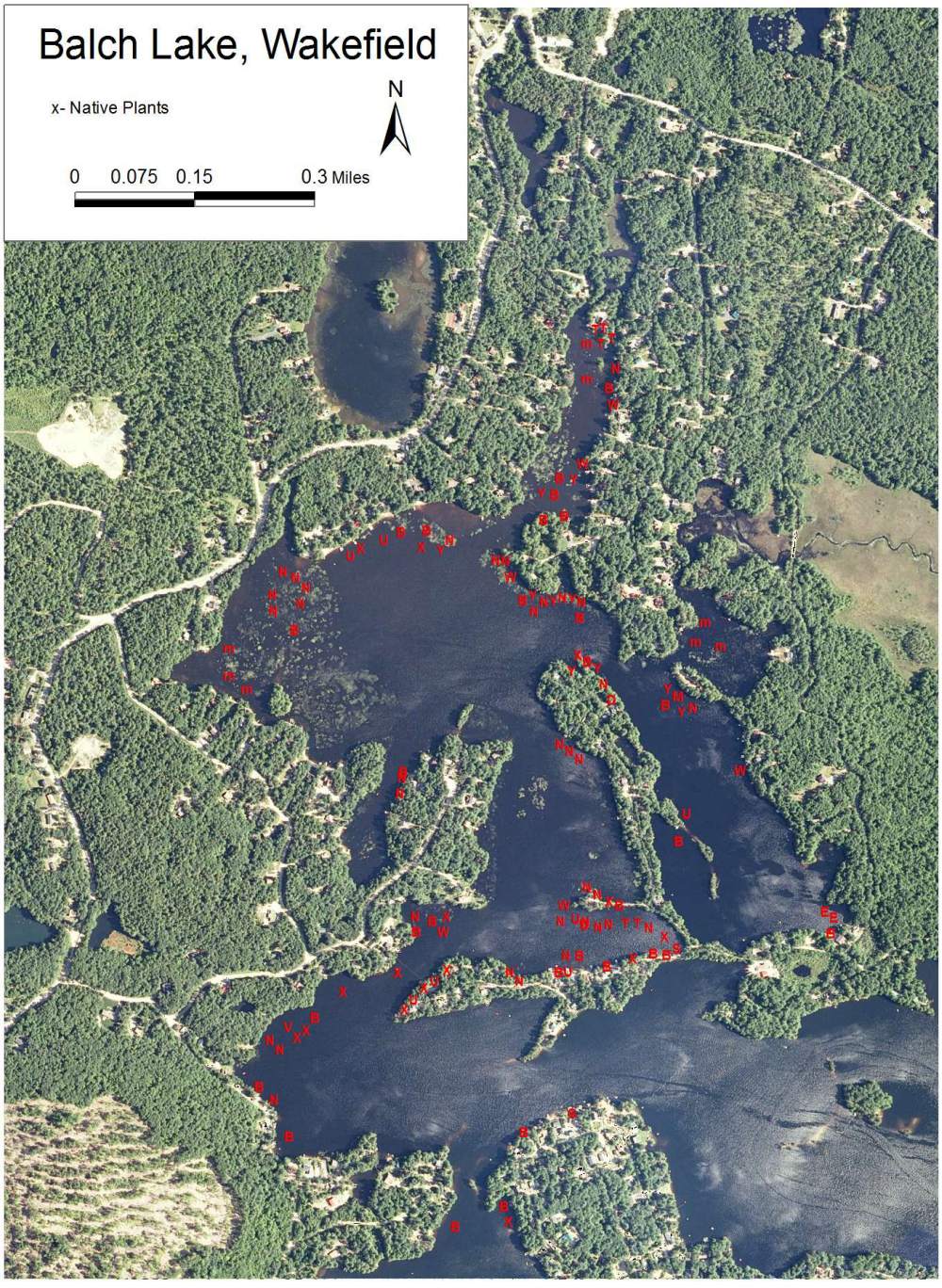


Figure 3: Map of Native Aquatic Macrophytes



Key to Macrophyte Map

Symbol	Common Name	Latin Name
b	Bassweed	*Potamogeton amplifolius*
X	Sterile thread-like bottom growth	*Eleocharis or Potamogeton spp.*
U	Bladderwort	*Utricularia*
N	White water-lily	*Nymphea*
B	Watershield	*Brasenia*
S	Bur-reed	*Sparganium*
T	Cattail	*Typha*
W	Pondweed	*Potamogeton*
Y	Yellow water-lily	*Nuphar*
E	Pipewort	*Eriocaulon*
m	Native milfoil	*Myriophyllum humile or M. verticillatum*

Figure 4: Bathymetric Map

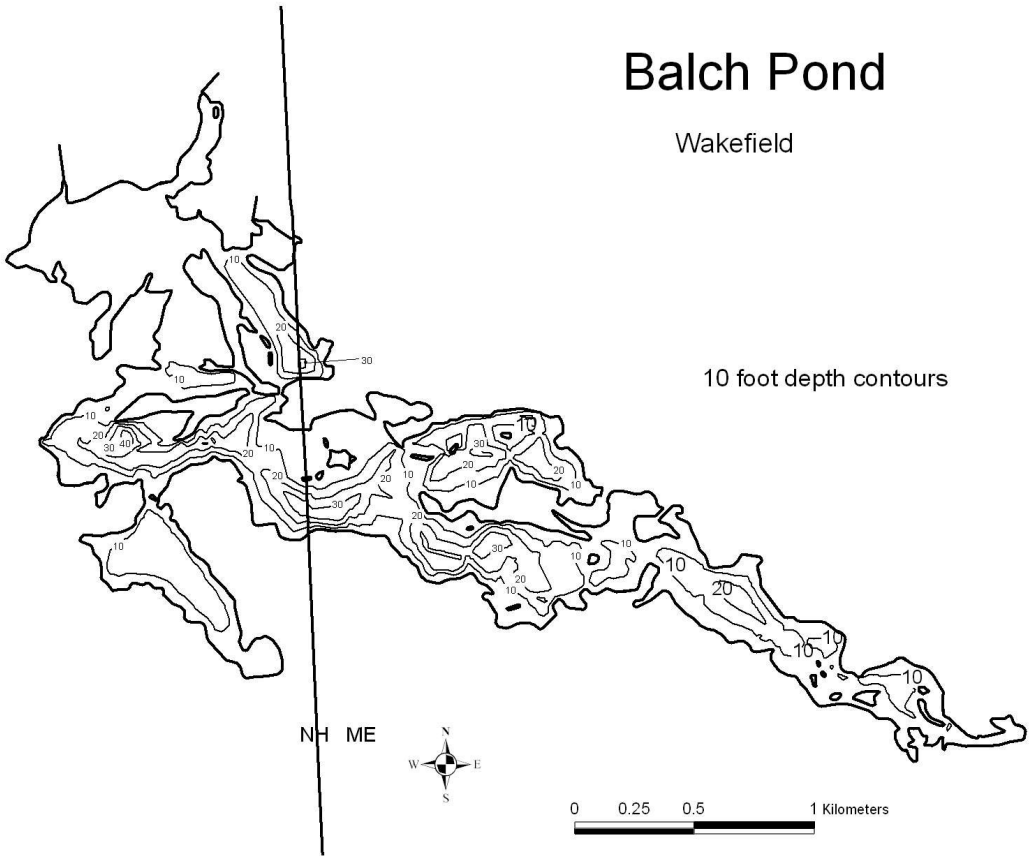


Figure 5: Critical Habitats or Conservation Areas

NHB18-0128

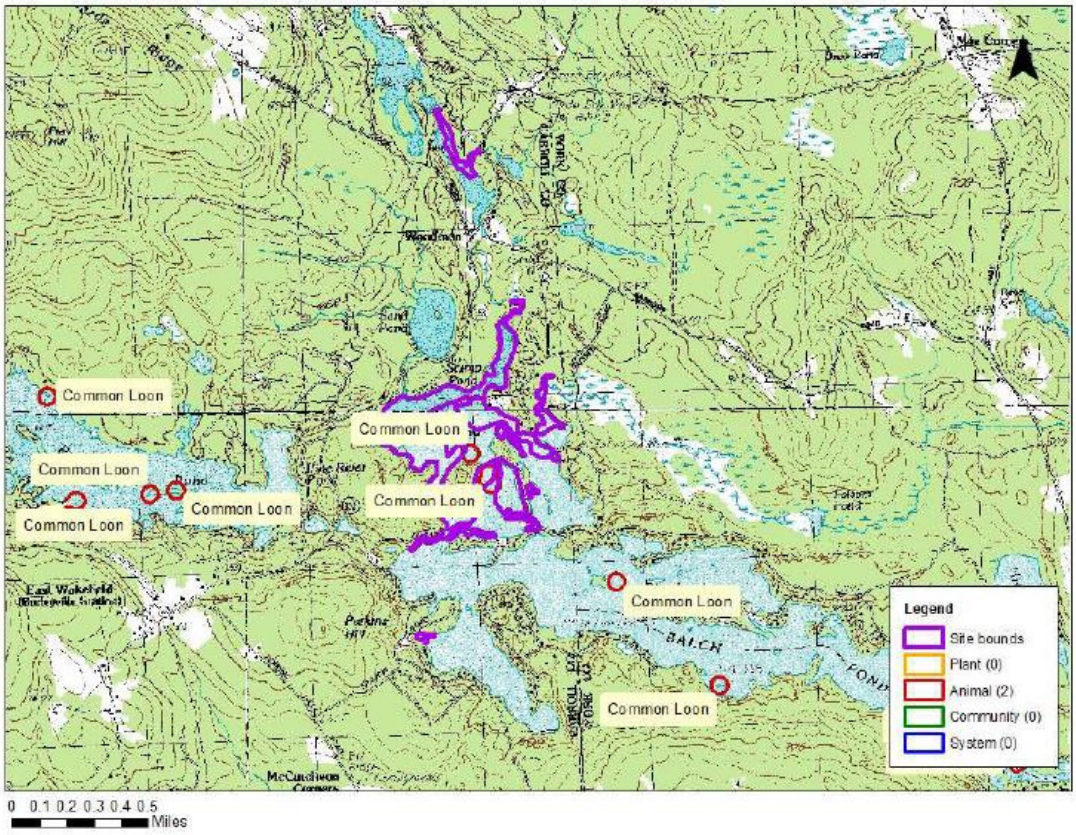


Figure 6: Public Access Site, Swim Areas

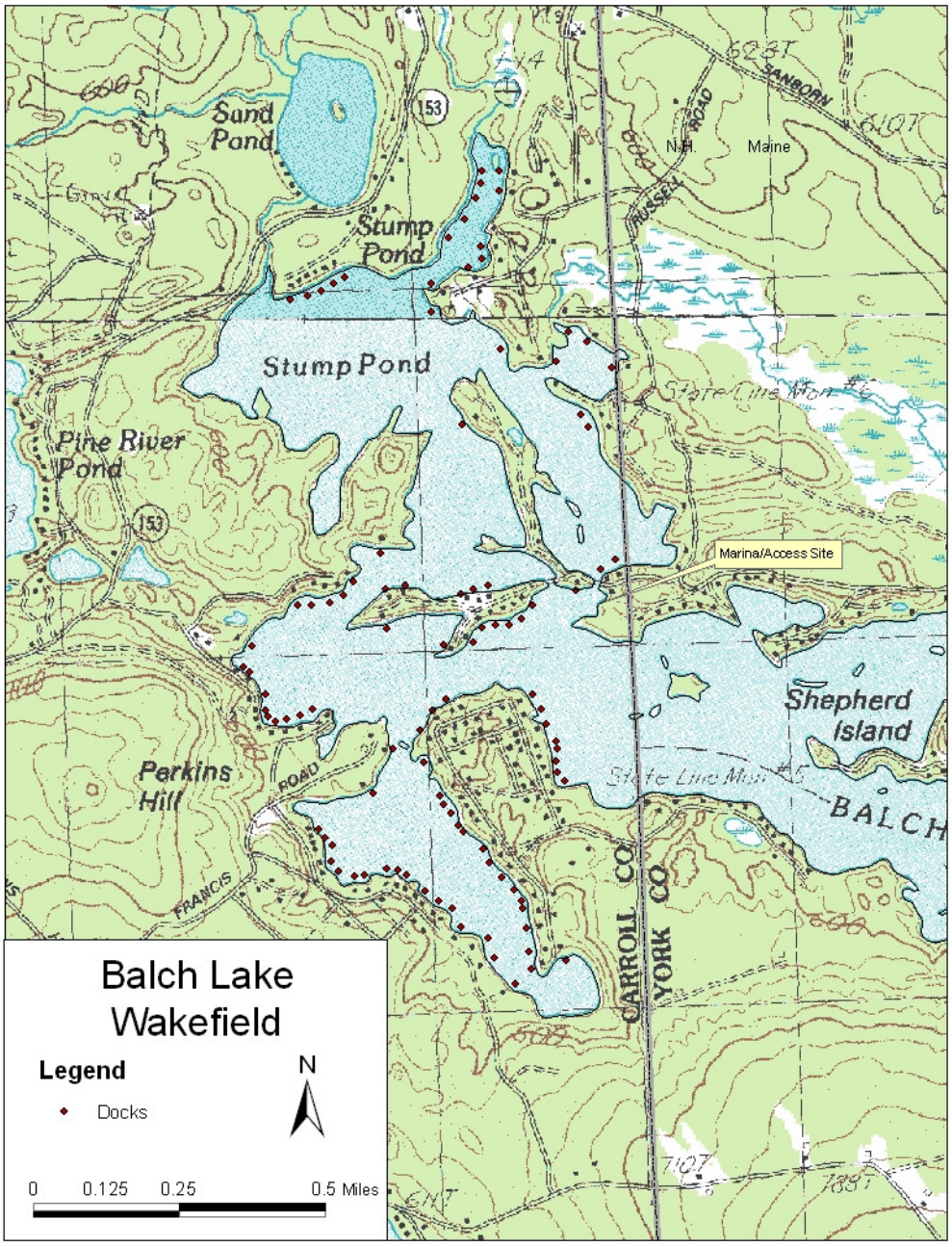
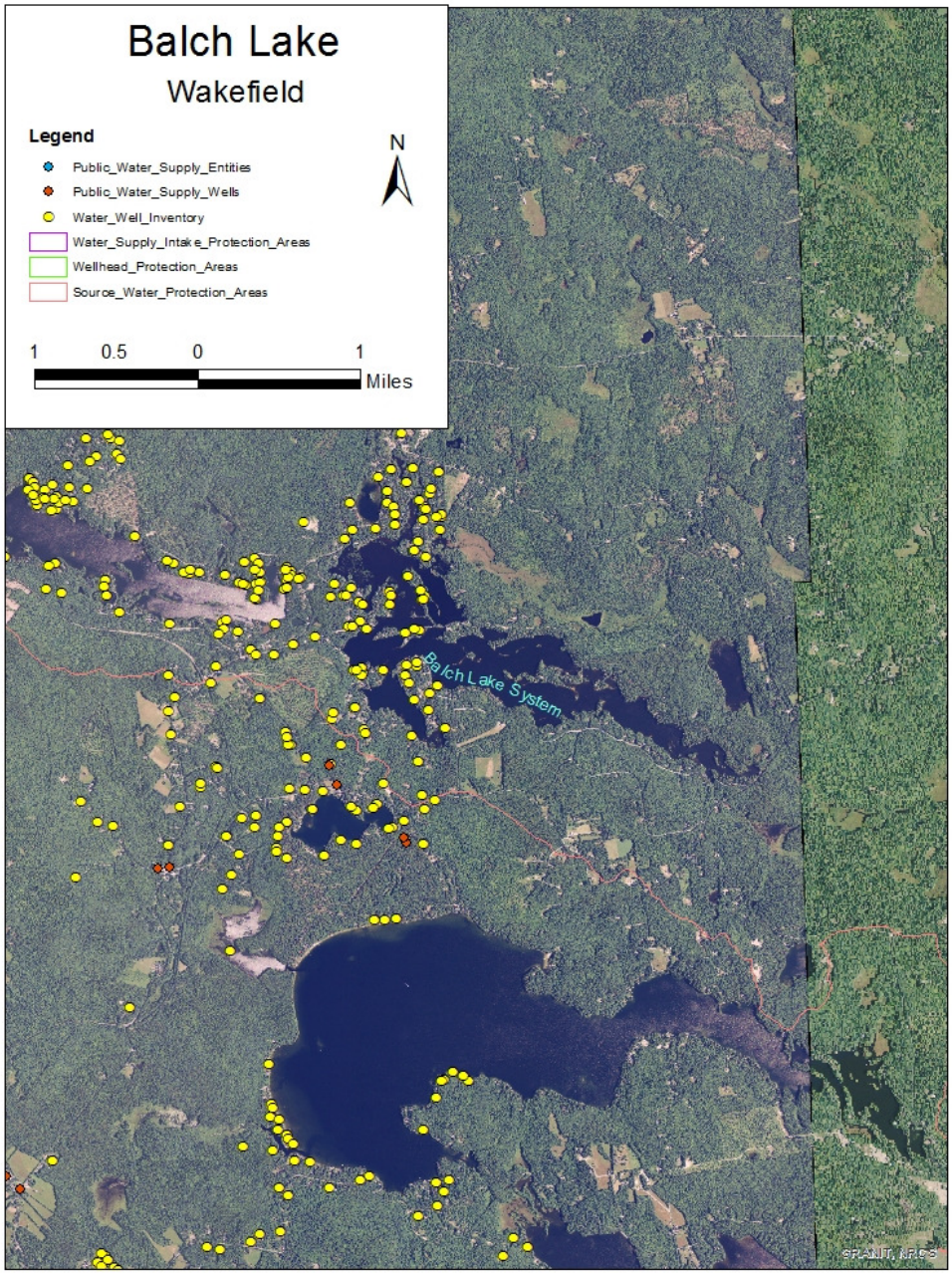


Figure 7: Wells and Water Supplies



Appendix A Aquatic Plant Control Techniques

Preliminary Investigations

I. Field Site Inspection

- Verify genus and species of the plant.
- Determine if the plant is a native or exotic species per RSA 487:16, II.
- Map extent of the exotic aquatic plant infestation (area, water depth, height of the plant, density of the population).
- Document any native plant abundances and community structure around and dispersed within the exotic/nuisance plant population (provide updated native plant map after review of milfoil in the Fall or after treatment)

II. Office/Laboratory Research of Waterbody Characteristics

- Contact the appropriate agencies to determine the presence of rare or endangered species in the waterbody or its prime wetlands.
- Determine the basic relevant limnological characteristics of the waterbody (size, bathymetry, flushing rate, nutrient levels, trophic status, and type and extent of adjacent wetlands).
- Determine the potential threat to downstream waterbodies from the exotic aquatic plant based on limnological characteristics (water chemistry, quantity, quality as they relate to movement or support of exotic plant growth).

Overall Control Options

For any given waterbody that has an infestation of exotic plants, one of four options will be selected, based on the status of the infestation, the available management options, and the technical knowledge of the DES Limnologists and other key resource managers who have conducted the field work and who are preparing or contributing to this plan. The options are as follows:

1) Eradication: The goal is to completely remove the exotic plant infestation over time. In some situations this may be a rapid response that results in an eradication event in a single season (such as for a new infestation), in other situations a longer-term approach may be warranted given the age and distribution of the infestation. Eradication is more feasible in smaller systems without extensive expanded growth (for example, Lake Winnipesaukee is unlikely to achieve eradication of its variable milfoil), or without upstream sources of infestation in other connected systems that continually feed the lake.

2) Maintenance: Waterbodies where maintenance is specified as a goal are generally those with expansive infestations, that are larger systems, that have complications of extensive wetland complexes on their periphery, or that have upstream sources of the invasive plant

precluding the possibility for eradication. For waterbodies where maintenance is the goal, control activities will be performed on the waterbody to keep an infestation below a desirable threshold. For maintenance projects, thresholds of percent cover or other measurable classification will be indicated, and action will occur when exotic plant growth exceeds the threshold.

3) Containment: The aim of this approach is to limit the size and extent of the existing infestation within an infested waterbody if it is localized in one portion of that waterbody (such as in a cove or embayment), or if a whole lake is infested action may be taken to prevent the downstream migration of fragments or propagules. This could be achieved through the use of fragment barriers and/or Restricted Use Areas or other such physical means of containment. Other control activities may also be used to reduce the infestation within the containment area.

4) No action. If the infestation is too large, spreading too quickly, and past management strategies have proven ineffective at controlling the target exotic aquatic plant, DES, in consultation with others, may elect to recommend 'no action' at a particular site. Feasibility of control or control options may be revisited if new information, technologies, etc., develop.

If eradication, maintenance or containment is the recommended option to pursue, the following series of control techniques may be employed. The most appropriate technique(s) based on the determinations of the preliminary investigation will be selected.

Guidelines and requirements of each control practice are suggested and detailed below each alternative, but note that site specific conditions will be factored into the evaluation and recommendation of use on each individual waterbody with an infestation.

A. Hand-Pulling and Diver-Assisted Suction Harvesting

- Hand-pulling can be used if infestation is in a small localized area (sparsely populated patch of up to 5' X 5', single stems, or dense small patch up to 2' X 2'). For larger areas Diver-Assisted Suction Harvesting (DASH) may be more appropriate.
- Can be used if plant density is low, or if target plant is scattered and not dense.
- Can be used if the plant could effectively be managed or eradicated by hand-pulling or DASH
- Use must be in compliance with the Wetlands Bureau rules.

B. Mechanically Harvest or Hydro-Rake

- Can not be used on plants which reproduce vegetatively by fragmentation (e.g., milfoil, fanwort, etc.) unless containment can be ensured.
- Can be used only if the waterbody is accessible to machinery.

- Can be used if there is a disposal location available for harvested plant materials.
- Can be used if plant depth is conducive to harvesting capabilities (~ <7 ft. for mower, ~ <12 ft. for hydro-rake).
- If a waterbody is fully infested and no other control options are effective, mechanical harvesting can be used to open navigation channel(s) through dense plant growth.

C. Herbicide Treatment

- Can be used if application of herbicide is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or density and type of plant.
- Can be used for treatment of exotic plants where fragmentation is a high concern.
- Can be used where species specific treatment is necessary due to the need to manage other plants
- Can be used if other methods used as first choices in the past have not been effective.
- A licensed applicator should be contacted to inspect the site and make recommendations about the effectiveness of herbicide treatment as compared with other treatments.

D. Restricted Use Areas (per RSA 487:17, II (d))

- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other transient activities may cause fragmentation to occur.
- Can <u>not</u> be used when there are several "patches" of an infestation of exotic aquatic plants throughout a waterbody.
- Can be used as a temporary means of control.

E. Bottom Barrier

- Can be used in small areas, preferably less than 10,000 sq. ft.
- Can be used in an area where the current is not likely to cause the displacement of the barrier.
- Can be used early in the season before the plant reaches the surface of the water.
- Can be used in an area to compress plants to allow for clear passage of boat traffic.
- Can be used in an area to compress plants to allow for a clear swimming area.
- Use must be in compliance with the Wetlands Bureau rules.

F. Drawdown

- Can be used if the target plant(s) are susceptible to drawdown control.
- Can be used in an area where bathymetry of the waterbody would be conducive to an adequate level of drawdown to control plant growth, but where extensive deep habits exist for the maintenance of aquatic life such as fish and amphibians.
- Can be used where plants are growing exclusively in shallow waters where a drawdown would leave this area "in the dry" for a suitable period of time (over winter months) to control plant growth.
- Can be used in winter months to avoid encroachment of terrestrial plants into the aquatic system.
- Can be used if it will not significantly impact adjacent or downstream wetland habitats.
- Can be used if spring recharge is sufficient to refill the lake in the spring.
- Can be used in an area where shallow wells would not be significantly impacted.
- Reference RSA 211:11 with regards to drawdown statutes.

G. Dredge

- Can be used in conjunction with a scheduled drawdown.
- Can be used if a drawdown is not scheduled, though a hydraulic pumping dredge should be used.
- Can only be used as a last alternative due to the detrimental impacts to environmental and aesthetic values of the waterbody.

H. Biological Control

- Grass carp cannot be used as they are illegal in New Hampshire.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant unless approved by Department of Agriculture.
- Research should be conducted on a potential biological control prior to use to determine the extent of target specificity.

Appendix B Control Practices Used New Hampshire

Restricted Use Areas and Fragment Barrier:

Restricted Use Areas (RUAs) are a tool that can be use to quarantine a portion of a waterbody if an infestation of exotic aquatic plants is isolated to a small cove, embayment, or section of a waterbody. RUAs generally consist of a series of buoys and ropes or nets connecting the buoys to establish an enclosure (or exclosure) to protect an infested area from disturbance. RUAs can be used to prevent access to these infested areas while control practices are being done, and provide the benefit of restricting boating, fishing, and other recreational activities within these areas, so as to prevent fragmentation and spread of the plants outside of the RUA.

Hand-pulling:

Hand-pulling exotic aquatic plants is a technique used on both new and existing infestations, as circumstances allow. For this technique divers carefully hand-remove the shoots and roots of plants from infested areas and place the plant material in mesh dive bags for collect and disposal. This technique is suited to small patches or areas of low density exotic plant coverage.

For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 1-2 years or until no re-growth is observed. For existing infestations, hand-pulling may be done to slow the expansion of plant establishment in a new area or where new stems are removed in a section that may have previously been uninfested. It is often a follow-up technique that is included in most management plans.

In 2007 a new program was created through a cooperative between a volunteer monitor that is a certified dive instructor, and the DES Exotic Species Program. A Weed Control Diver Course (WCD) was developed and approved through the Professional Association of Dive Instructors (PADI) to expand the number of certified divers available to assist with hand-pulling activities. DES has only four certified divers in the Limnology Center to handle problems with aquatic plants, and more help was needed. There is a unique skill involved with hand-removing plants from the lake bottom. If the process is not conducted correctly, fragments could spread to other waterbody locations. For this reason, training and certification are needed to help ensure success. Roughly 100 divers were certified through this program through the 2010 season. DES maintains a list of WCD divers and shares them with waterbody groups and municipalities that seek diver assistance for controlling exotic aquatic plants. Classes are offered two to three times per summer.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is an emerging and evolving control technique in New Hampshire. The technique employs divers that perform hand removal actions as described above, however, instead of using a dive bag a mechanical suction device is used to entrain the plants and bring them topside where a tender accumulates and bags the material for disposal. Because of this variation divers are able to work in moderately dense stands of plants that cover more bottom area, with increased efficiency and accuracy.

Mechanical Harvesting

The process of mechanical harvesting is conducted by using machines which cut and collect aquatic plants. These machines can cut the plants up to twelve feet below the water surface. The weeds are cut and then collected by the harvester or other separate conveyer-belt driven device where they are stored in the harvester or barge, and then transferred to an upland site.

The advantages of this type of weed control are that cutting and harvesting immediately opens an area such as boat lanes, and it removes the upper portion of the plants. Due to the size of the equipment, mechanical harvesting is limited to water areas of sufficient size and depth. It is important to remember that mechanical harvesting can leave plant fragments in the water, which if not collected, may spread the plant to new areas. Additionally harvesters may impact fish and insect populations in the area by removing them in harvested material. Cutting plant stems too close to the bottom can result in re-suspension of bottom sediments and nutrients. This management option is only recommended when nearly the entire waterbody is infested, and harvesting is needed to open navigation channels through the infested areas.

Benthic Barriers:

Benthic barriers are fiberglass coated screening material that can be applied directly to the lake bottom to cover and compress aquatic plant growth. Screening is staked or weighted to the bottom to prevent it from becoming buoyant or drifting with current. The barriers also serve to block sunlight and prevent photosynthesis by the plants, thereby killing the plants with time. While a reliable method for small areas of plants (roughly 100 sq. ft. or less), larger areas are not reasonably controlled with this method due to a variety of factors (labor intensive installation, cost, and gas accumulation and bubbling beneath the barrier).

Targeted Application of Herbicides:

Application of aquatic herbicides is another tool employed for controlling exotic aquatic plants. Generally, herbicides are used when infestations are too

large to be controlled using other alternative non-chemical controls, or if other techniques have been tried and have proven unsuccessful. Each aquatic plant responds differently to different herbicides and concentrations of herbicides, but research performed by the Army Corps of Engineers has isolated target specificity of a variety of aquatic herbicides for different species.

Generally, 2,4-D (Navigate formulation) is the herbicide that is recommended for control of variable milfoil. Based on laboratory data this is the most effective herbicide in selectively controlling variable milfoil in New Hampshire's waterbodies.

A field trial was performed during the 2008 summer using the herbicide Renovate to control variable milfoil. Renovate is a systemic aquatic herbicide that targets both the shoots and the roots of the target plant for complete control. In this application it was dispersed as a granular formulation that sank quickly to the bottom to areas of active uptake of the milfoil plants. A small (<5 acre) area of Captains Pond in Salem was treated with this systemic herbicide. The herbicide was applied in pellet form to the infested area in May 2008, and showed good control by the end of the growing season. Renovate works a little more slowly to control aquatic plants than 2,4-D and it is a little more expensive, but presents DES with another alternative that could be used in future treatments.

During the summer of 2010, DES worked with other researchers to perform field trials of three different formulations of 2,4-D in Lake Winnisquam, to determine which product was most target-specific to the variable milfoil. Navigate formulation was used, as were a 2,4-D amine formulation, and a 2,4-D amine and triclopyr formulation (MaxG). All three formulations worked well at reducing milfoil growth.

Another herbicide, Fluridone, is sometimes also used in New Hampshire, mainly to control growths of fanwort (*Cabomba caroliniana*). Fluridone is a systemic aquatic herbicide that inhibits the formation of carotenoids in plants. Reduced carotenoids pigment ultimately results in the breakdown of chlorophyll and subsequent loss of photosynthetic function of the plants.

Other aquatic herbicides are also used in New Hampshire when appropriate (glyphosate, copper compounds, etc). The product of choice will be recommended based on what the target species is, and other waterbody-specific characteristics that are important to consider when selecting a product.

Extended Drawdown

Extended drawdown serves to expose submersed aquatic plants to dessication and scouring from ice (if in winter), physically breaking down plant tissue.

Some species can respond well to drawdown and plant density can be reduced, but for invasive species drawdown tends to yield more disturbance to bottom sediments, something to which exotic plants are most adapted. In waterbodies where drawdown is conducted exotic plants can often outcompete native plants for habitat and come to dominate the system.

Some waterbodies that are heavily infested with exotic plants do conduct drawdowns to reduce some of the invasive aquatic plant density. During this reporting period both Northwood Lake (Northwood) and Jones Pond (New Durham) coordinated deep winter drawdowns to reduce growths of variable milfoil (the drawdown on Northwood Lake is primarily for flood control purposes, but they do see some ancillary benefits from the technique for variable milfoil control).

Dredging

Dredging is a means of physical removal of aquatic plants from the bottom sediments using a floating or land-based dredge. Dredging can create a variety of depth gradients creating multiple plant environments allowing for greater diversity in lakes plant, fish, and wildlife communities. However due to the cost, potential environmental effects, and the problem of sediment disposal, dredging is rarely used for control of aquatic vegetation alone.

Dredging can take place in to fashion, including drawdown followed by mechanical dredging using an excavator, or using a diver-operated suction dredge while the water level remains up.

Biological Control

There are no approved biological controls for submersed exotic aquatic plant at this time in New Hampshire.

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