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NH Department of
Environmental Services
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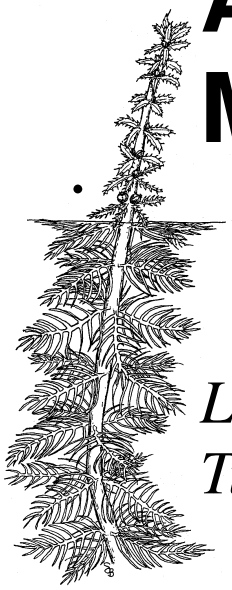
Long-Term Exotic Aquatic Plant Management Plan



Lake Winnipesaukee- Tuftonboro
Tuftonboro, 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. 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 and Phragmites Infestation in Tuftonboro

Variable milfoil (*Myriophyllum heterophyllum*) became established in Lake Winnipesaukee in 1965 in Moultonborough Bay, and the milfoil in this area is the longest standing infestation in New Hampshire. Because Tuftonboro areas of Lake Winnipesaukee are "downstream" of Moultonborough, many of the milfoil fragments drifting out of Moultonborough over the years has become established in portions of the lake in Tuftonboro. Fortunately much of the substrate in the Tuftonboro portion of the lake is very sandy or cobbled, and not generally conducive to supporting large stands of variable milfoil. Areas of growth tend to be in shallow backwater cove areas of the lake, near marinas, or in embayments.

It should be clearly understood that milfoil control efforts in Lake Winnipesaukee will need to be well-coordinate (both in town and with other towns), long-term, multi-faceted, and done using integrated plant management techniques that also include a substantial monitoring and reporting effort by Weed Watchers and Lake Hosts.

A half-acre patch of Phragmites is also established on the shoreline edge of Nineteen Mile Bay adjacent to Route 109. It is uncertain when the infestation began, but it is present as a thick stand of growth as of 2014.

Figure 1 illustrates a compilation of data on the distribution of variable milfoil in Tuftonboro as of the summer/fall mapping conducted in 2011, and Phragmites starting in 2014. A complete mapping of all areas of Lake Winnipesaukee within Tuftonboro town boundaries first took place between August and October 2011, and areas of documented growth have been surveyed at least once annually since.

Figure 2 illustrates the control activities that took place in Tuftonboro since 2012. The following table provides a summary of variable milfoil and Phragmites growth as shown in Figure 1.

Area	Location/Area Description	Year	Growth Description	% Cover Year End
A	**Lanes End Marina**	2011	Variable milfoil growth in this sandy/silty substrate is scattered as small patches around the marina docks, covering less than 0.02 acres. Hand pulling is recommended in this area.	10%
		2012	Hand pulling performed and sparse milfoil re-grew following hand removal work. Area will be targeted again in 2013 for hand pull to further reduce growth.	<5%
		2013	Scattered stems of milfoil, sparse	<1%
		2014	Scattered stems of milfoil this growing season	<1%
		2015	No milfoil growth observed in 2015	0%
B	**Town Dock/Launch**	2011	Small areas of dense growth in shallow water in the backwater area of this cove in silty/organic substrates. Milfoil growth covers only 0.23 acres in shallow water but due to the nature of the water depth and substrate type herbicides will be most successful in this area to begin to reduce density.	25%
		2012	Milfoil reduced by 90%, some small patches/stems of growth persisted, but hand removed by divers.	<1%
		2013	No milfoil growth observed	0%
		2014	No milfoil growth observed	0%
		2015	No milfoil growth observed in 2015	0%
C	**Melvin Village Marina**	2011	Scattered growths among the docks and channel areas related to this marina operation in silty/sandy substrates. Variable milfoil covers 0.8 acres in this area. Herbicide treatment followed by non-chemical means of control are recommended due to docks and boats in the area, making diving as a primary means of control a challenge.	30%
		2012	Scattered stems of growth, milfoil significantly reduced in this area.	10%
		2013	Scattered patches of growth around slips through mid-season, hand removed late season, most growth removed.	5%
		2014	Increase growth along inside edge of marine/boat slips and under many docked boats	25%
		2015	Scattered stems and patches of variable milfoil growth observed in 2015	20%

D	**Wingate Brook Inlet Cove**	2011	Large areas of dense growth along the shoreline of this cove, interspersed between docks and in small lagoon area of brook, totalling 1.4 acres. Silty/sandy substrates with organics mixed in. Herbicide treatment is recommended to reduce density of milfoil so that non-chemical means of control can be more feasible.	30%
		2012	Variable milfoil density and distribution reduced by 95% as a result of fall 2012 treatments.	5%
		2013	No milfoil observed this year	0%
		2014	No milfoil observed this year	0%
		2015	No milfoil observed in 2015	0%
E	**19 Mile Bay Docks and Launch**	2011	Larger area of moderately dense patchy growth around docks and boat launch in silty/sandy substrates. Total milfoil growth covers 1.2 acres. Herbicide treatment is recommended if Diver Assisted Suction Harvesting (DASH) is infeasible due to docks or other factors.	40%
		2012	Herbicide treatment performed in fall 2012. No milfoil observed by time of ice-in in 2012.	0%
		2013	Scattered stems observed in boat slips	<10%
		2014	Scattered milfoil stems observed in boat slips. Phragmites patch on shoreline where 19 Mile Brook enters bay, small but dense.	Milfoil <5% Phragmites <1%
		2015	Sparse scattered milfoil stems observed in 2015. Phragmites patch on shoreline where 19 Mile Brook enters bay, small but dense.	Milfoil <5% Phragmites <1%
F	**Chase Island**	2011	Small area of patchy growth off the island in sandy/cobbled substrate. Milfoil growth is sparse over roughly 1.3 acres in this area, and DASH is recommended.	<10%
		2012	Diver hand removal efforts and DASH efforts in this area removed all variable milfoil.	<5%
		2013	No variable milfoil obversed, native milfoil common throughout area	0%
		2014	No variable milfoil obversed, native milfoil common throughout area	0%
		2015	No milfoil observed in 2015	0%

G	**Farm Island**	2011	Small area of patchy growth off the island in sandy/cobbled substrate. Milfoil growth is generally sparse in this area that covers roughly 1.8 acres, and DASH if recommended here.	<10%
		2012	Diver hand removal efforts and DASH efforts in this area removed all variable milfoil.	<5%
		2013	No variable milfoil obversed, native milfoil common throughout area	0%
		2014	No variable milfoil obversed, native milfoil common throughout area	0%
		2015	No milfoil observed in 2015	0%
H	**Cow Island Cove**	2011	Areas of small low density growth in sandy/rocky substrate. Growth covers approximately 0.1 acres and is suitable for simple hand removal activities by divers or even waders.	<1%
		2012	Diver hand removal in this area resulted in removal of all variable milfoil from this site.	0%
		2013	None observed	0%
		2014	Reports of scattered growth but unable to get out there in 2014. Will plan to visit in 2015 to assess.	Unknown
		2015	None observed, will continue to check in 2016	0%
I	**The Basin**	2011	Dense growth of variable milfoil ringing much of the periphery of the cove. Milfoil growth covers approximately 38 acres of area in this small basin area and is in need of herbicide treatment before other non-chemical means of control can be feasibly used.	75%
		2012	98% reduction in variable milfoil in this cove by ice in. Only one small area of persistent stems in an inlet stream to the cove.	<5%
		2013	Patchy growth early season, necessitating follow-up herbicide treatment in some areas, and diving in others	Early season- 30% Late season- 0%
		2014	One or two stems observed over the course of the summer	<1%
		2015	Just a couple of scattered stems of milfoil found in 2015	<1%
J	**Winter Harbor**	2011	Small patches of growth interspersed between rocky substrates. Three areas are recommended for herbicide treatment (shown in red) that total 12.8 acres, but hand-removal activities can be tried with	15%

			herbicide as a back-up. Concerns exist about effectively removing root systems in the cobble substrate, so herbicides may be a more effective control in targeting root crowns in these spots. Two other areas (in green) in this cove support sparse patchy growth and can feasibly be hand-removed by divers. These two areas total less than 0.5 acres.	
		2012	Variable milfoil 100% controlled in these areas by end of 2012 growing season.	0%
		2013	Some scattered/patchy regrowth in the north end of Winter Harbor, near inflow from Mirror Lake, managed by herbicide and divers in 2013	Early season- 10% Late season- 0%
		2014	Some scattered/patchy regrowth in the north end of Winter Harbor, near inflow from Mirror Lake, managed by herbicide and divers in 2013	Early season- <10% Late season- <5%
		2015	Scattered single stems observed in 2015	<5%

Throughout this portion of the lake there are many public access sites, commercial businesses, marinas, a number of private residences and swim beaches. Town officials, residents, business owners and lake users have expressed concerns about milfoil and have illustrated a coordinated effort at reducing overall milfoil density and distribution through their planning initiatives.

Aquatic Invasive Plant Management Management Goals

The aquatic plant management plan for the portion of Lake Winnipesaukee that falls within Tuftonboro outlines actions to reduce growths (both density and distribution) of variable milfoil (*Myriophyllum heterophyllum*) while maintaining native plant communities whenever variable milfoil control actions are being implemented. Control efforts are also focused on reducing the Phragmites density in 19 Mile Bay, and preventing it from spreading farther along shore or out into the lake.

The project will take place over many years, and will rely on a coordinated effort with other towns focused on milfoil control efforts in the lake overall. This plan will incorporate integrated plant management activities, as well as prevention, early detection, and containment elements, and routine monitoring to measure progress and direct control efforts. It can be expected that herbicide use will be a needed tool to reduce larger and stubborn infestations of variable milfoil and Phragmites, due primarily to the nature of growth in

this portion of the lake, though several areas will use primarily non-chemical means of control to reduce growth.

Local Support

Town or Municipality Support

The Town of Tuftonboro (Selectmen and Conservation Commission) has been very supportive of planning milfoil control efforts. Fortunately no other waterbodies in town are infested, so this is a new process for most involved. The town is part of the tri-town effort to control milfoil infestations between Moultonborough, Tuftonboro and Wolfeboro, and the availability of a shared Diver Assisted Suction Harvesting unit (or two) will help facilitate those efforts in town.

The town has been supportive financially by seeking funds through a warrant article to contribute towards milfoil control efforts.

Lake Resident Support

While Tuftonboro does not have one individual lake association to assist with control efforts, the collaboration with the tri-town milfoil control committee will help to bolster local efforts, and several shoreline residents from the mainland and from the islands have been active in this endeavor.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of the Tuftonboro area of Lake Winnipesaukee, including the milfoil infestation. Note that a current review of the Natural Heritage Bureau (NHB) database was requested and the results from that search are included in the table below, as well as in other key sections of this report as they may pertain to the type of species (fish, wildlife, habitat, or macrophyte).

General Lake Information	
Shoreline Uses (residential, forested, agriculture)	Residential, some commercial, forested
Tuftonboro Area Max Depth (ft)	~60
Tuftonboro Area Mean Depth (ft)	~15-20
Trophic Status	Oligotrophic
Color (CPU) in Epilimnion	10
Clarity (ft)	23
Natural waterbody/Raised by Damming/Other	Natural

Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum*
Tuftonboro Infested Area (acres)	<100 acres
Distribution (ringing lake, patchy growth, etc)	Figure 1 illustrates a general map the milfoil infestation in Tuftonboro as of 2011
Sediment type in infested area (sand/silt/organic/rock)	Sandy/rocky/silty/mucky (varies by area but many areas of rock/gravel/cobbles)
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	2016 NHB Review Results: None listed Historically Listed Species in NHB Reviews Water marigold (*Bidens beckii*) Common Loon (*Gavia immer*) Pied-billed Grebe (*Podilymbus podiceps*)

An aquatic vegetation map (showing native vegetation) and key for Tuftonboro Bay is shown in Figure 3 (data from summer/fall 2011, checked annually). A bathymetric map is shown in Figure 4.

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

The principal fisheries of Lake Winnipesaukee include both warm and coldwater species. Coldwater species of primary interest are; landlocked Atlantic salmon, lake trout, and rainbow trout; coldwater species of less

interest are lake whitefish, round whitefish (species of concern in Wildlife Action Plan), burbot, brook trout, and rainbow smelt.

Warmwater species of primary interest are; largemouth bass, smallmouth bass, white perch, yellow perch, chain pickerel, black crappie, brown bullhead, and bluegill. The bass fishery is extremely popular with anglers as numerous fishing tournaments are held on the lake each year.

Numerous warmwater species are present in littoral areas of the lake and constitute the prey fish sought by larger gamefish (warmwater). These species include; banded killifish, common shiner, common white sucker, creek chubsucker, bridle shiner (species of concern in Wildlife Action Plan), fallfish, golden shiner, pumpkinseed, redbreast sunfish, rock bass, slimy sculpin, and yellow bullhead.

Fisheries Species of Concern/Interest:

American eel: The American eel is a catadromous species, and resides up to 4-9 years in our inland lakes, such as Lake Winnipesaukee, where they reach sexual maturity and migrate down the rivers and outlets of our large lakes to the Atlantic Ocean. While the American eel was not flagged as a species of concern in Lake Winnipesaukee, it has been in other waterbodies, so it was included here for reference. We do not anticipate any impacts to this species from targeted milfoil management efforts.

Bridled shiner: The bridled shiner was observed in several locations in cove/wetland areas on the periphery of Lake Winnipesaukee. Bridle shiners tend to inhabit areas of dense plant growth in the shallows of lakes and ponds. Native aquatic vegetation is not a target of the control actions recommended here, and many of the native submersed plant species will be present through and following treatment even within the treatment areas (water naiad, water marigold, various pondweeds, bladderwort, tape-grass, waterweed). In 2010, 2011 and 2012, Fish and Game biologists recommend against treating (or even hand removing) key habitat areas in June when the fish are spawning. In some cases spring treatment will help to maximize control of the variable milfoil, and because the herbicide can be target specific with variable milfoil, much native vegetation will remain in these areas. If feasible, June management efforts are preferred, but if it is deemed too much of a risk to the fish species then control actions can be delayed until after July 15.

Wildlife Species of Concern/Interest:

Historic Natural Heritage Inventory reviews yielded two species of concern in the Tuftonboro area, namely the common loon (*Gavia immer*) and the pied-billed Grebe (*Podilymbus podiceps*). Both are listed as threatened species in the state. Neither of these showed up in the 2015 review, but are maintained as part of the record for reference.

Common loon: DES has encouraged the town to make contact with the Loon Preservation Society, so that they can be notified of the proposed treatment. In the past, a Loon Preservation Society representative has been on site to observe treatments in loon habitat on other waterbodies. These representatives carry handheld radio to communicate with the applicator during the treatment of the subject areas. The loon staff member monitors the behavior of the loons (if they are in the area), and directs the actions of the applicator so as to minimize any stress on the loons. The herbicides that are used are not toxic to the loons at the dose used to control milfoil, so toxicity effects are not an issue.

The Fish and Game Department suggests that herbicidal milfoil treatments should not be permitted within 100 meters of any nests. 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.

Pied-billed grebe: The pied-billed Grebe is located on a waterbody that is hydrologically upstream of the proposed treatment area. Should any habitat for this species be identified in the vicinity of the proposed treatment areas, the NH Fish and Game Department requests that scrub shrub and emergent wetland coves during pied-billed grebe nesting season be avoided.

DES and the contractors are glad to work with the Fish and Game Department to identify strategies (timing, setback, etc) that are appropriate to protect the integrity of each of these species of concern while milfoil mitigation activities are conducted.

Figure 5 shows information on rare, threatened and endangered species and/or habitats of concerns yielded in an NHB review of the subject waterbody.

Recreational Uses and Access Points

Lake Winnipesaukee and Tuftonboro Bay proper are used for numerous recreational activities, including motor boating, canoeing, kayaking, fishing, swimming, sailing, and water skiing by both residents and transient boaters. There are some commercial establishments around the edge of Tuftonboro Bay that provide services for boaters and on-land visitors alike.

Public access can be achieved at a number of public (state or town owned) and private (marina) access sites throughout Tuftonboro, and other areas of this large lake.

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 native aquatic plant community in Lake Winnipesauke in the Tuftonboro area is represented by floating plants (yellow and white water-lilies, floating heart, watershield), emergent plants (bur-reed, pipewort, pickerelweed, water lobelia, cattail, spike rush) and submergent plans (native milfoil, several pondweeds, several bladderworts, elodea, grassy spike rush, water marigold, grassy arrowhead, coontail).

There is a record of one threatened plant species in the area. Specifically, water marigold (*Bidens beckii*) is located upstream of 19 Mile Bay in a tributary that flows into the bay. Control activities should not extend up into this tributary and therefore should not put this plant at risk. During a pre-treatment survey in 2012, DES did document water marigold in another location in Tuftonboro, specifically in Wingate Brook. The water marigold population there is present as small clumps of 10-12 stems each. The plant did persist through the herbicide treatment and was present at the end of the growing season in the stream. A slightly expanded population of the *Bidens* was documented in 2013 and again in 2014 in Wingate Brook, in similar locations to 2012, though the patches of growth appeared to have more stems and cover a slightly larger area now that the milfoil has been reduced. DES will continue to monitor this site through future control practices in this area.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the Danforth Ponds, 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 AMOUNT (GAL)	TARGET	CONTRACTOR
08-Jun-05	2,4-D	0.75 ACRES	VARIABLE MILFOIL	ACT
05-Jun-06	2,4-D	2 ACRES	VARIABLE MILFOIL	ACT
05-Sep-12	2,4-D (G)	55 ACRES	VARIABLE MILFOIL	ACT
JUNE 18-27, 2012	DIVING/DASH	490 GALLONS	VARIABLE MILFOIL	AB AQUATICS
10/9/2012	DIVING/DASH	15 GALLONS	VARIABLE MILFOIL	NE MILFOIL
7/9/2013	DIVING/DASH	50 GALLONS	VARIABLE MILFOIL	AQUALOGIC
7/10/2013	DIVING/DASH	200 GALLONS	VARIABLE MILFOIL	AQUALOGIC
7/11/2013	DIVING/DASH	100 GALLONS	VARIABLE MILFOIL	AQUALOGIC
7/12/2013	DIVING/DASH	450 GALLONS	VARIABLE MILFOIL	AQUALOGIC

DATE	ACTION	AREA (ac) OR AMOUNT (GAL)	TARGET	CONTRACTOR
7/16/2013	DIVING/DASH	10 GALLONS	VARIABLE MILFOIL	AQUALOGIC
7/29/2013	DIVING/DASH	120 GALLONS	VARIABLE MILFOIL	AQUALOGIC
7/30/2013	DIVING/DASH	120 GALLONS	VARIABLE MILFOIL	AQUALOGIC
7/31/2013	DIVING/DASH	390 GALLONS	VARIABLE MILFOIL	AQUALOGIC
12-Sep-13	2,4-D & TRICLOPYR (G)	29 ACRES	VARIABLE MILFOIL	ACT
09-Sep-14	2,4-D BEE	0.9 ACRES	VARIABLE MILFOIL	ACT
6/16/2014	DASH	135 GALLONS	VARIABLE MILFOIL	NEW ENGLAND MILFOIL
6/17/2014	DASH	30 GALLONS	VARIABLE MILFOIL	NEW ENGLAND MILFOIL
9/9/2014	NAVIGATE (2,4-D BEE) IN MELVIN VILLAGE MARINA	0.9 ACRES	VARIABLE MILFOIL	ACT
9/1/2014	MECHANICAL HARVEST OF PHRAGMITES	0.5 ACRES	PHRAGMITES	LOCAL RESIDENTS
10/15/2014	ATTEMPTED PLACEMENT OF BENTHIC BARRIER (ABORTED DUE TO SIZE OF GROWTH PATCH AND OTHER VARIOUS SITE FACTORS	0.5 ACRES	PHRAGMITES	DES
7/29/2015	HANDPULL	40 GALLONS	VARIABLE MILFOIL	NE MILFOIL
10/16/2015	DASH	15 GALLONS	VARIABLE MILFOIL	NE MILFOIL
9/17/2015	IMAZAPYR	<0.5 ACRES	PHRAGMITES	ACT

A DASH demonstration project took place in Tuftonboro in fall 2011 in 19 Mile Bay to evaluate the use of the DASH system in town, and to show the method to local interested resident.

wider and more focused use of divers and DASH were implemented in 2012, with good success in all areas slated for those control measures. Now that milfoil densities have been reduced in other areas through herbicide treatment, diver and DASH activities have replace herbicide in those areas.

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 in the Tuftonboro area of Lake Winnipesaukee. The following table summarizes DES' control strategy recommendations for Tuftonboro.

Control Method	Lake Winnipesaukee Areas in Tuftonboro
Restricted Use Areas and/or Fragment Barriers	Restricted Use Areas (RUAs) and or fragment barriers may be used in areas identified as appropriate by DES based on field data.
Hand-pulling/Diver-Assisted Suction Harvesting (DASH)	Several areas around Tuftonboro have been identified as manageable primarily by diver/DASH activities. It is also expected that the need for diver/DASH work will increase as other larger and denser infestations are reduced over time. DASH and diving will be a regular control action in this portion of Lake Winnipesaukee.
Mechanical Harvesting/Removal	Mechanical harvesting is not recommended due to the threat of spreading variable milfoil to uninfested areas of the lake through

Control Method	Lake Winnipesaukee Areas in Tuftonboro
	the generation of fragments. While variable milfoil is widespread in Winnipesaukee as a whole, there is still much uninfested habitat, and the generation of fragments that may not be well-contained in a harvesting project could drift.
Benthic Barriers	Benthic barriers are recommended for areas where small growths are persistent, and where the barriers could feasibly be used (much of the lake bed in this area is rocky and not conducive to benthic barrier placement, but DES will recommend this technique as/if appropriate).
Herbicides	A target specific, systemic herbicide (like 2,4-D or similar) is recommended as needed to control larger and denser areas of growth and to reduce density/distribution of variable milfoil so that other non-chemical controls can be more feasibly used.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil and is not feasible in this location of the lake.
Dredge	Not recommended due to nature of exotic plant distribution, the cost, or the ancillary ecological impacts that the dredge could have.
Biological Control	There are no approved biological controls for variable milfoil at this time in New Hampshire.
No Control	We have seen over the years that a no control option only allows for the further distribution of this non-native exotic plant in NH. Fragments generated by variable milfoil perpetuate the problem in the lake as a whole, and many towns are rallying to reduce the overall presence of variable milfoil in Lake Winnipesaukee.

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	Recommended Schedule
2012	Herbicide treatment of areas indicated for treatment in Figure 1	Aquatic Control Technology, Inc.	June and/or September
	Weed Watcher Training	DES and interested parties	TBD, but early in the season
	Weed Watcher Monitoring and Reporting	Tuftonboro Weed Watchers	May through September

Year	Action	Responsible Party	Recommended Schedule
	DASH/Diver work in areas indicated from field survey work	Contract Divers	June through September
	Benthic Barrier and/or Fragment Barrier placement	DES	As needed/ appropriate
	Field survey and mapping of infested areas for 2013 planning	DES	September
2013	Herbicide treatment (if needed) of areas indicated for treatment based on fall survey	Aquatic Control Technology, Inc.	May/June and/or September
	Weed Watcher Monitoring and Reporting	Tuftonboro Weed Watchers	May through September
	DASH/Diver work in areas indicated from field survey work	Contract Divers	June through September
	Benthic Barrier and/or Fragment Barrier placement	DES	As needed/ appropriate
	Field survey and mapping of infested areas for next season	DES	September
2014	Field survey and mapping of infested areas for next season	DES	May/June
	Weed Watcher Monitoring and Reporting	Tuftonboro Weed Watchers	May through September
	DASH/Diver work in areas indicated from field survey work	Contract Divers	June through September

Year	Action	Responsible Party	Recommended Schedule
	Herbicide treatment (if needed) of areas indicated for treatment based on fall survey	Aquatic Control Technology, LLC	June or September
	Benthic Barrier and/or Fragment Barrier placement	DES	As needed/ appropriate
	Field survey and mapping of infested areas for next season	DES	September
2015	Field survey and mapping of infested areas for next season	DES	June and/or September
	Weed Watcher Monitoring and Reporting	Tuftonboro Weed Watchers	May through September
	DASH/Diver work in areas indicated from field survey work	Contract Divers	June through September
	Herbicide treatment to control Phragmites in 19 Mile Bay	Aquatic Control Technology, LLC	September
	Benthic Barrier and/or Fragment Barrier placement	DES	As needed/ appropriate
	Field survey and mapping of infested areas for next season	DES	September
2016	Weed Watcher Monitoring and Reporting	Tuftonboro Weed Watchers	May through September
	DASH/Diver work in areas indicated from field survey work	Contract Divers	June through September

Year	Action	Responsible Party	Recommended Schedule
	Herbicide treatment to control Phragmites in 19 Mile Bay	SOLitude Lake Management, LLC	September
	Benthic Barrier and/or Fragment Barrier placement	DES	As needed/ appropriate
	Field survey and mapping of infested areas for next season	DES	September
2017	Update Long-Term Management 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.*

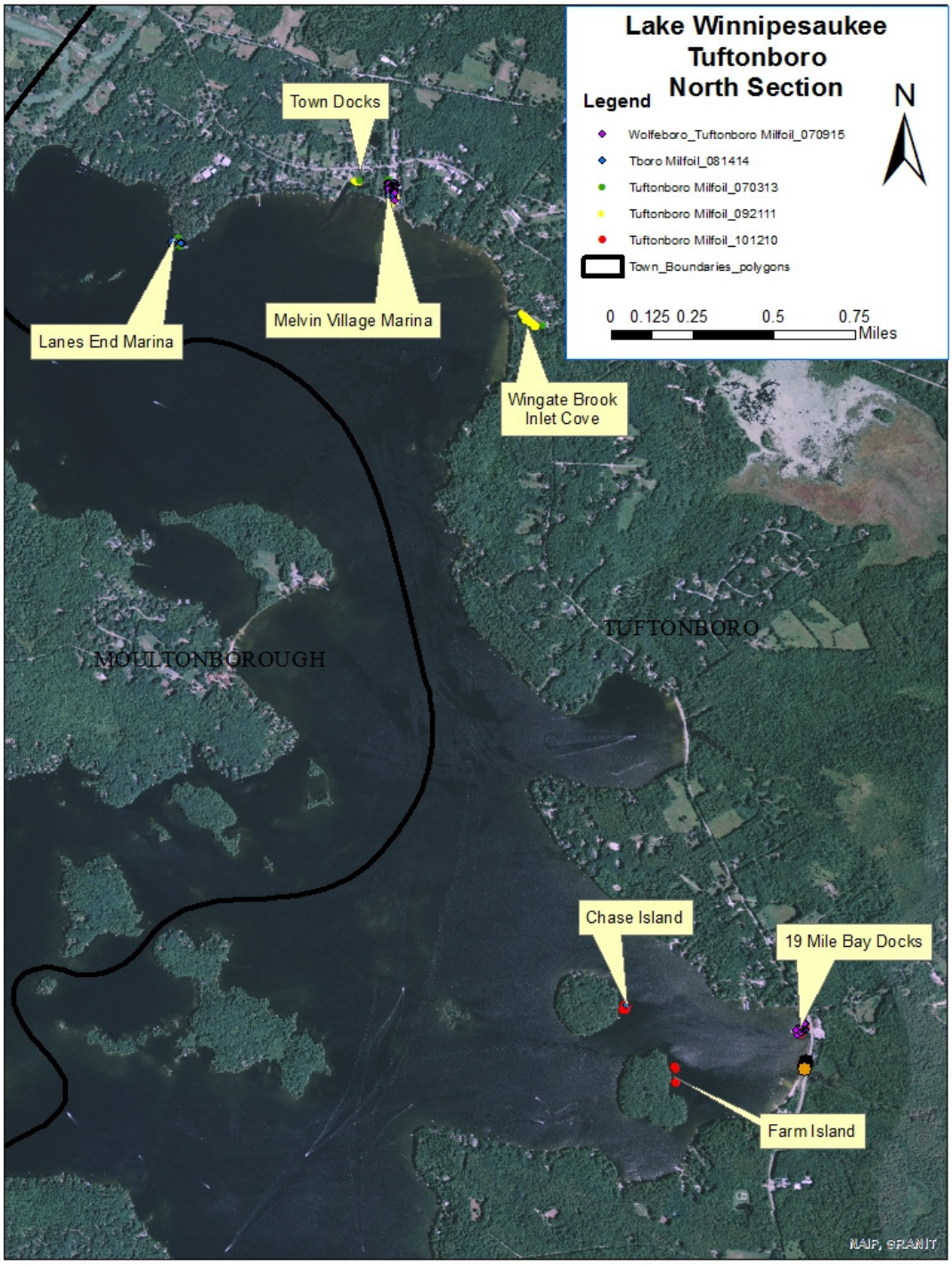
Adaptive Management

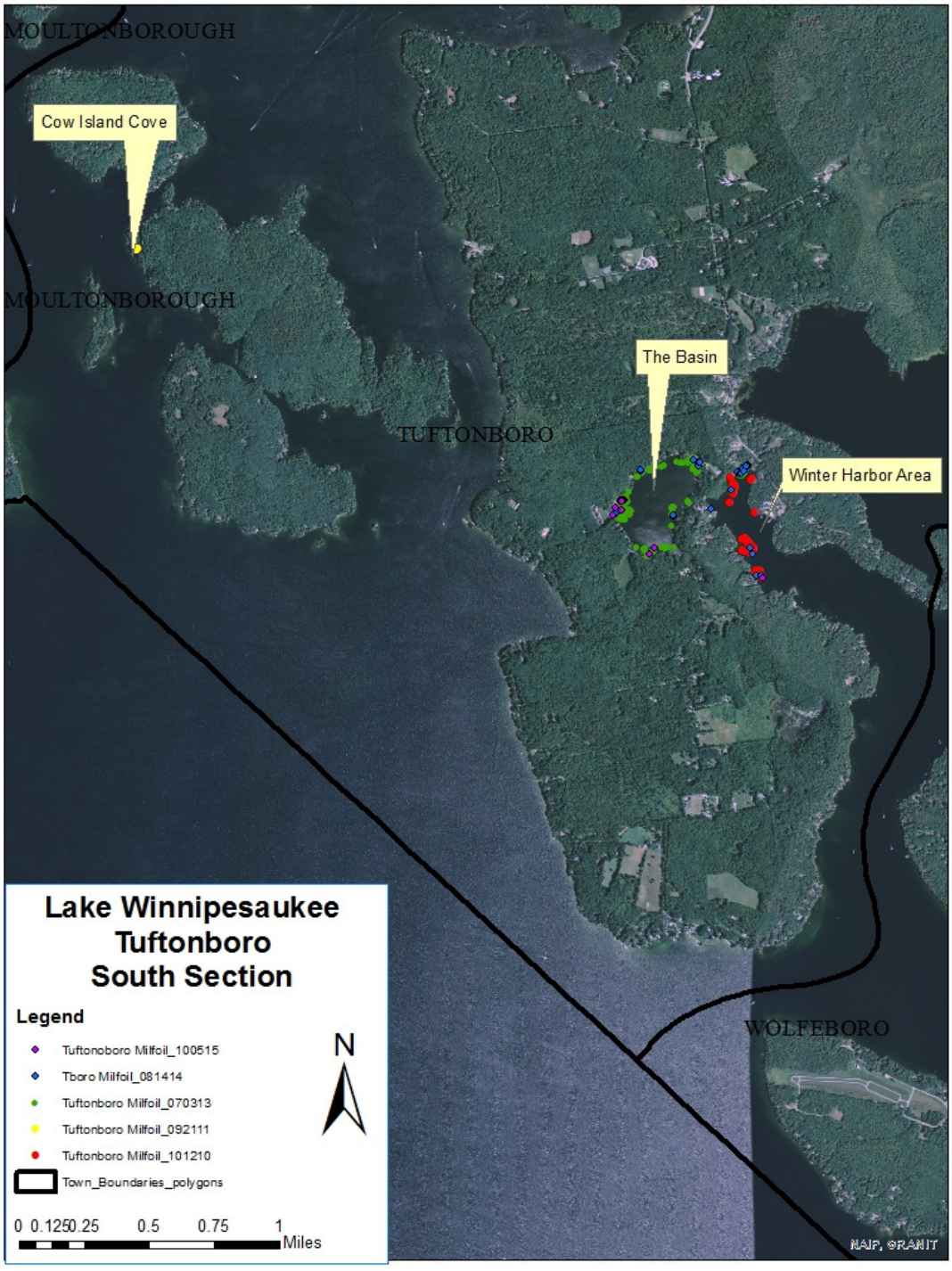
Because this is a natural system that is being evaluated for management, it is impossible to accurately predict a management course over five years that could be heavily dependent on uncontrolled natural circumstances (weather patterns, temperature, adaptability of invasive species, etc).

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.

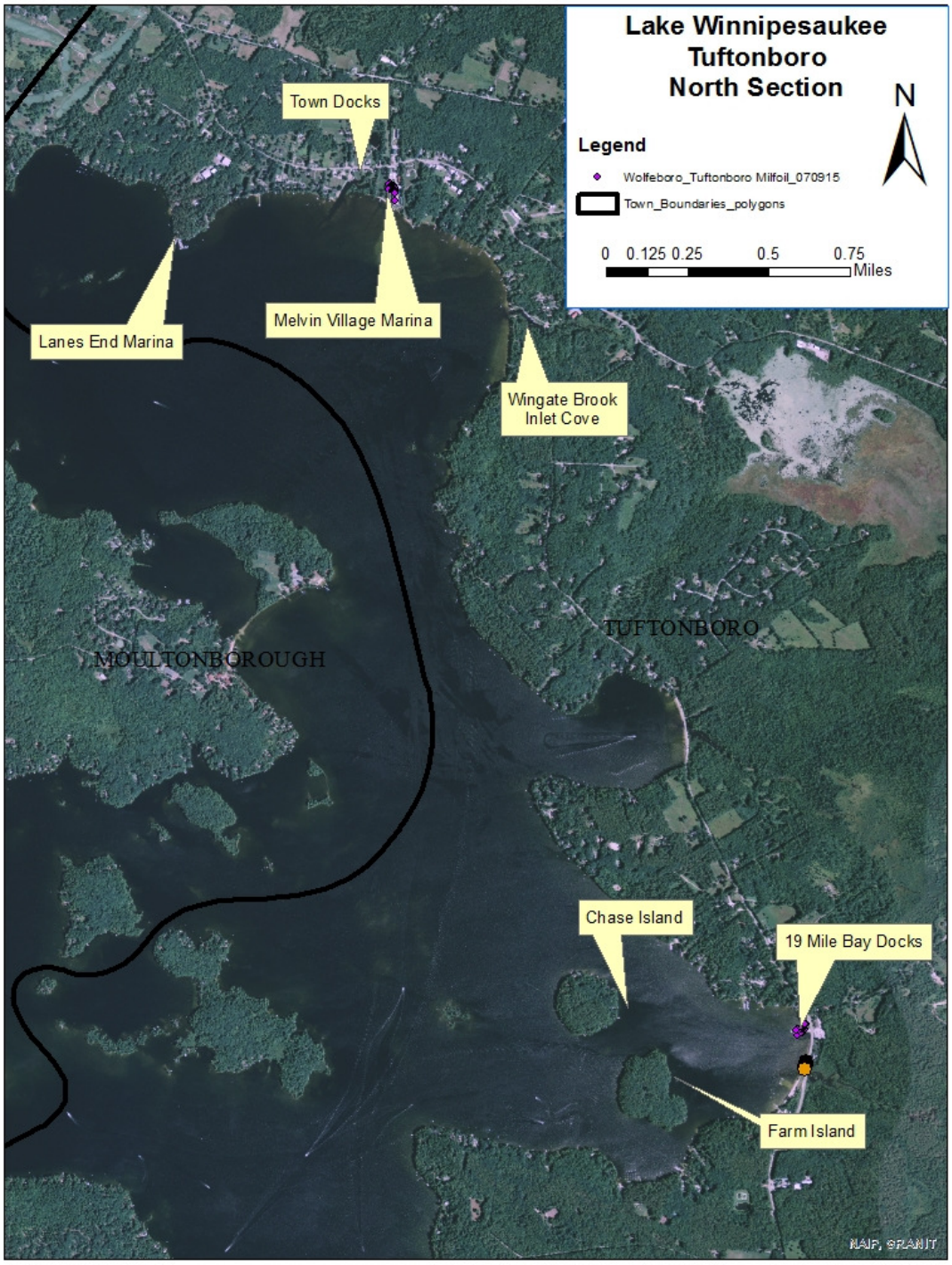
If circumstances arise that require the modification of part or all of the recommendations herein, interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil and fanwort management in the subject waterbody.

Figure 1: Map of Variable Milfoil Infestations Over Time




MOULTONBOROUGH
Cow Island Cove
MOULTONBOROUGH
The Basin
TUFTONBORO
Winter Harbor Area
WOLFEBORO
Lake Winnipesaukee
Tuftonboro
South Section
Legend
Tuftonoboro Milfoil_100515
Tboro Milfoil_081414
Tuftonboro Milfoil_070313
Tuftonboro Milfoil_092111
Tuftonboro Milfoil_101210
Town_Boundaries_polygons
N
0 0.1250.25 0.5 0.75 1
Miles
NAIP, GRANIT

2015 Milfoil



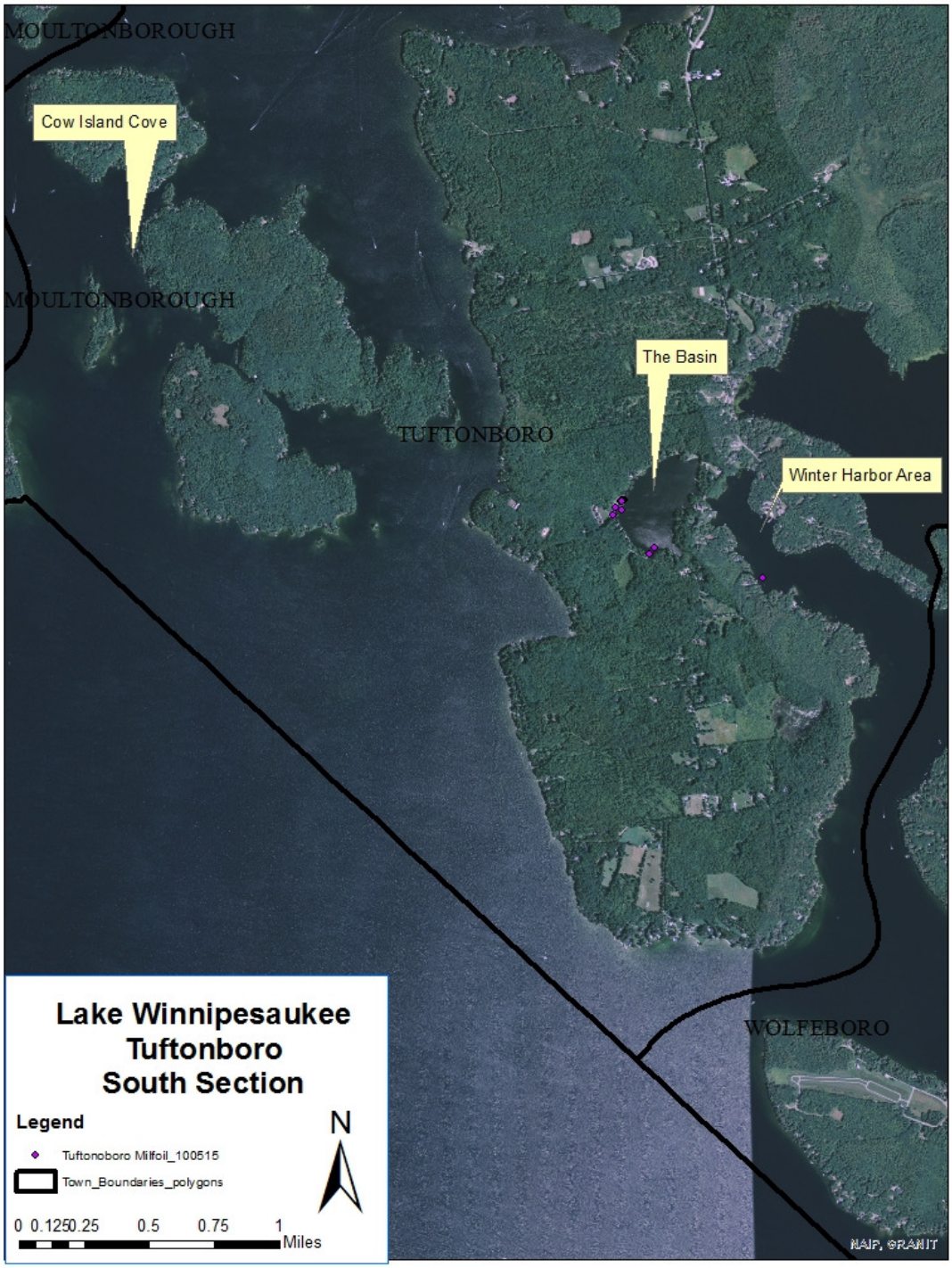
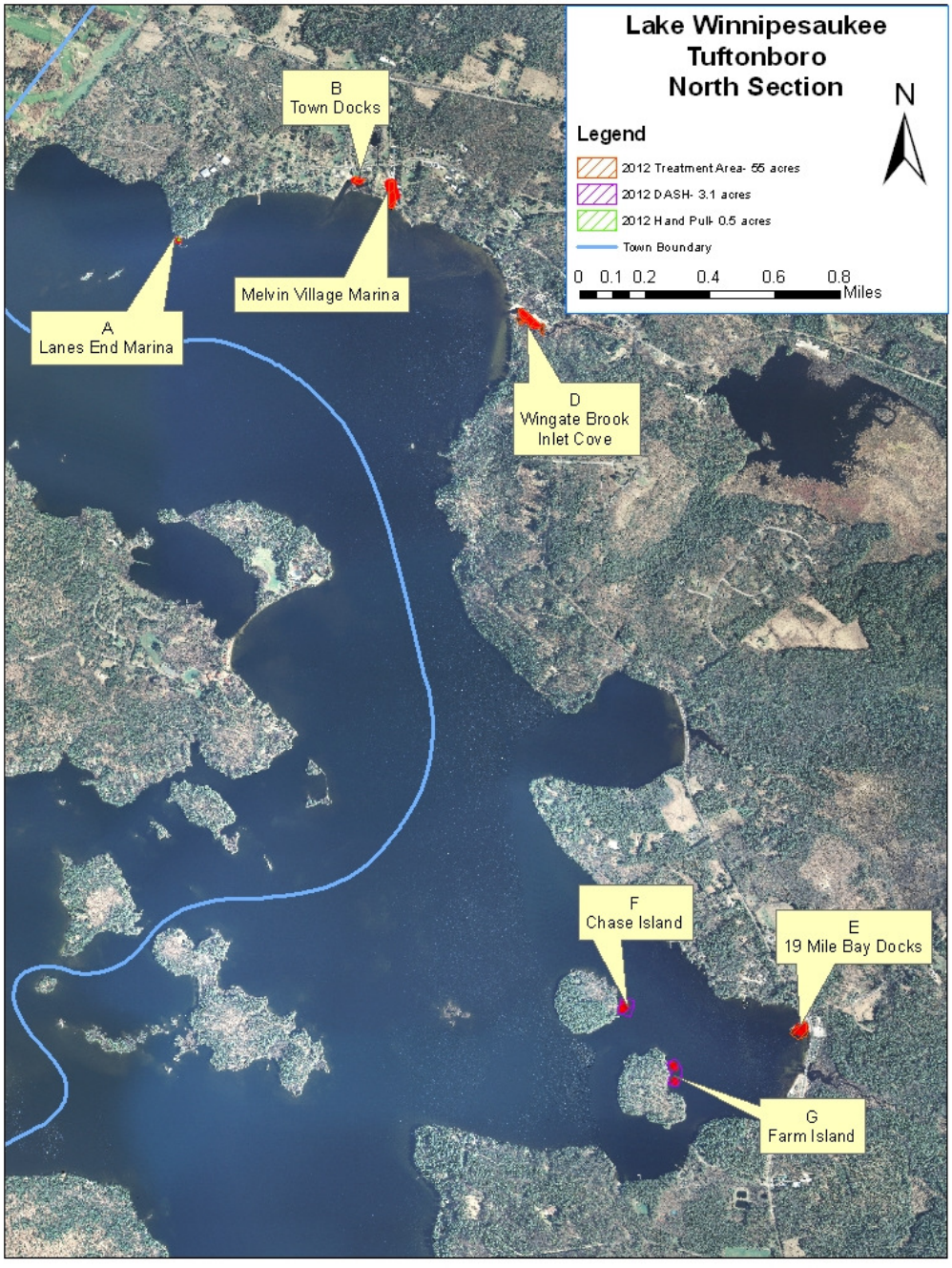
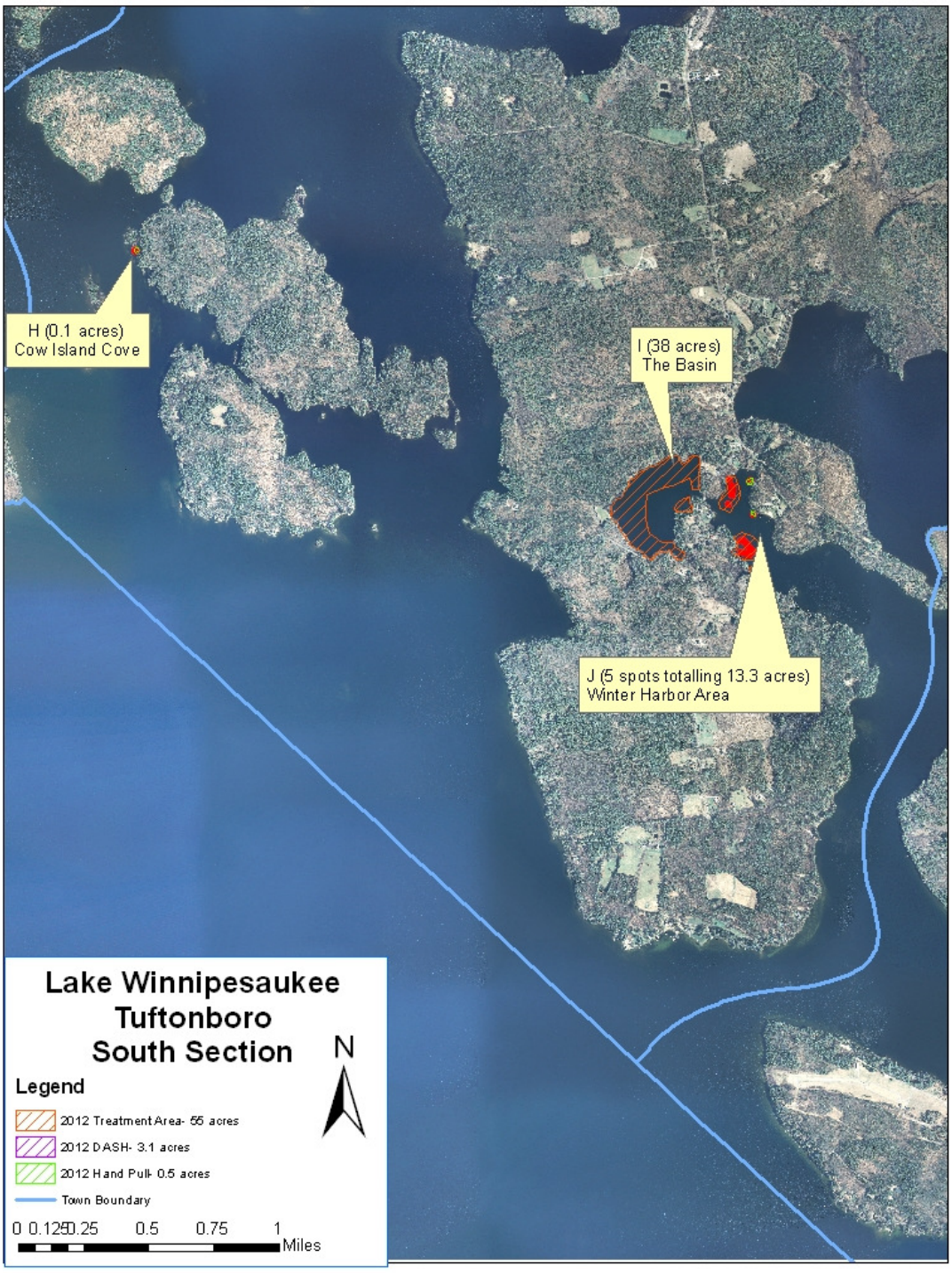

MOULTONBOROUGH
Cow Island Cove
MOULTONBOROUGH
The Basin
TUFTONBORO
Winter Harbor Area
WOLFEBORO
Lake Winnipesaukee
Tuftonboro
South Section
Legend
Tuftonoboro Milfoil_100515
Town_Boundaries_polygons
N
0 0.125 0.25 0.5 0.75 1
Miles
MAP, GRANIT

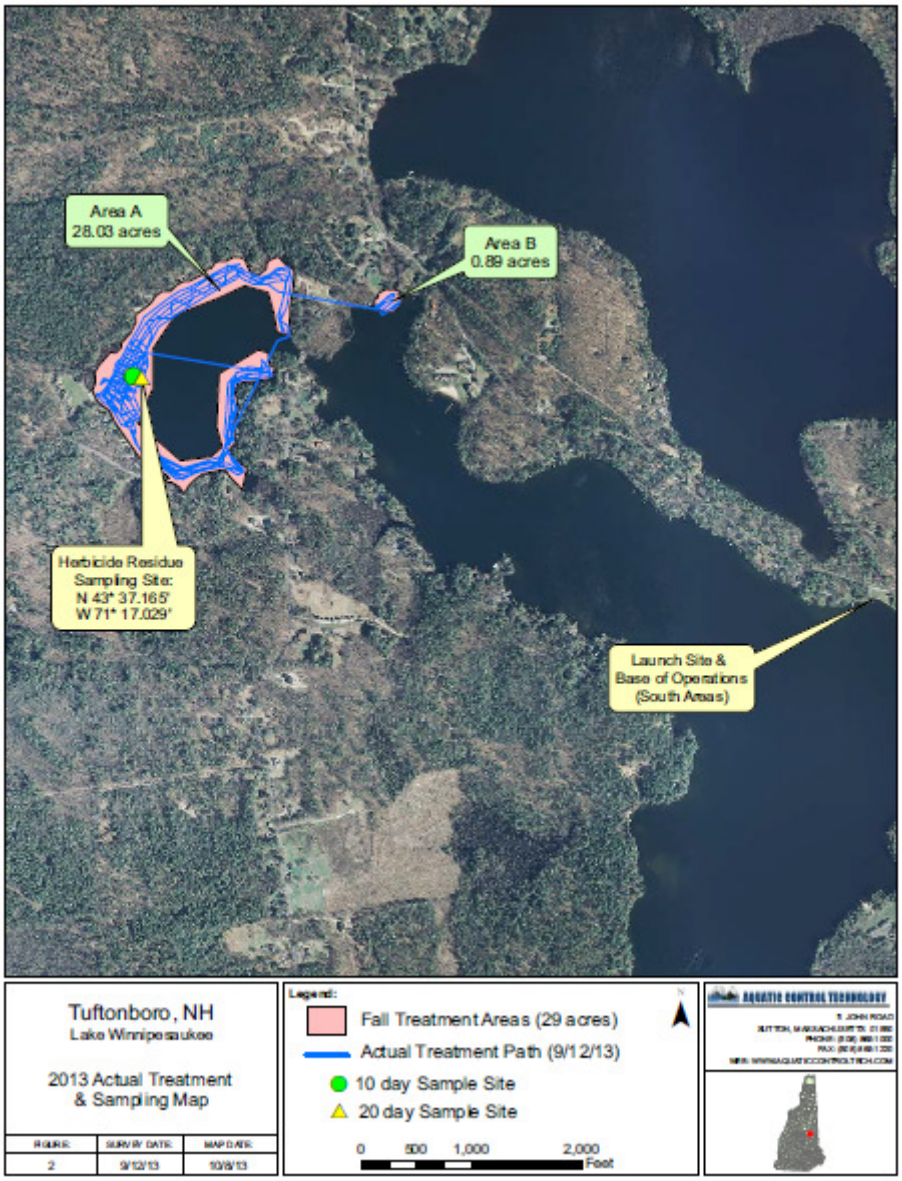
Figure 2: Map of Control Actions Over Time

2012 Work, and 2013/2014 Proposed (same proposal as 2012, actual to be determined based on field survey work at beginning of season)




H (0.1 acres)
Cow Island Cove
I (38 acres)
The Basin
J (5 spots totalling 13.3 acres)
Winter Harbor Area
Lake Winnipesaukee
Tuftonboro
South Section
N
Legend
2012 Treatment Area- 56 acres
2012 DASH- 3.1 acres
2012 Hand Pull- 0.5 acres
Town Boundary
0 0.125 0.25 0.5 0.75 1
Miles

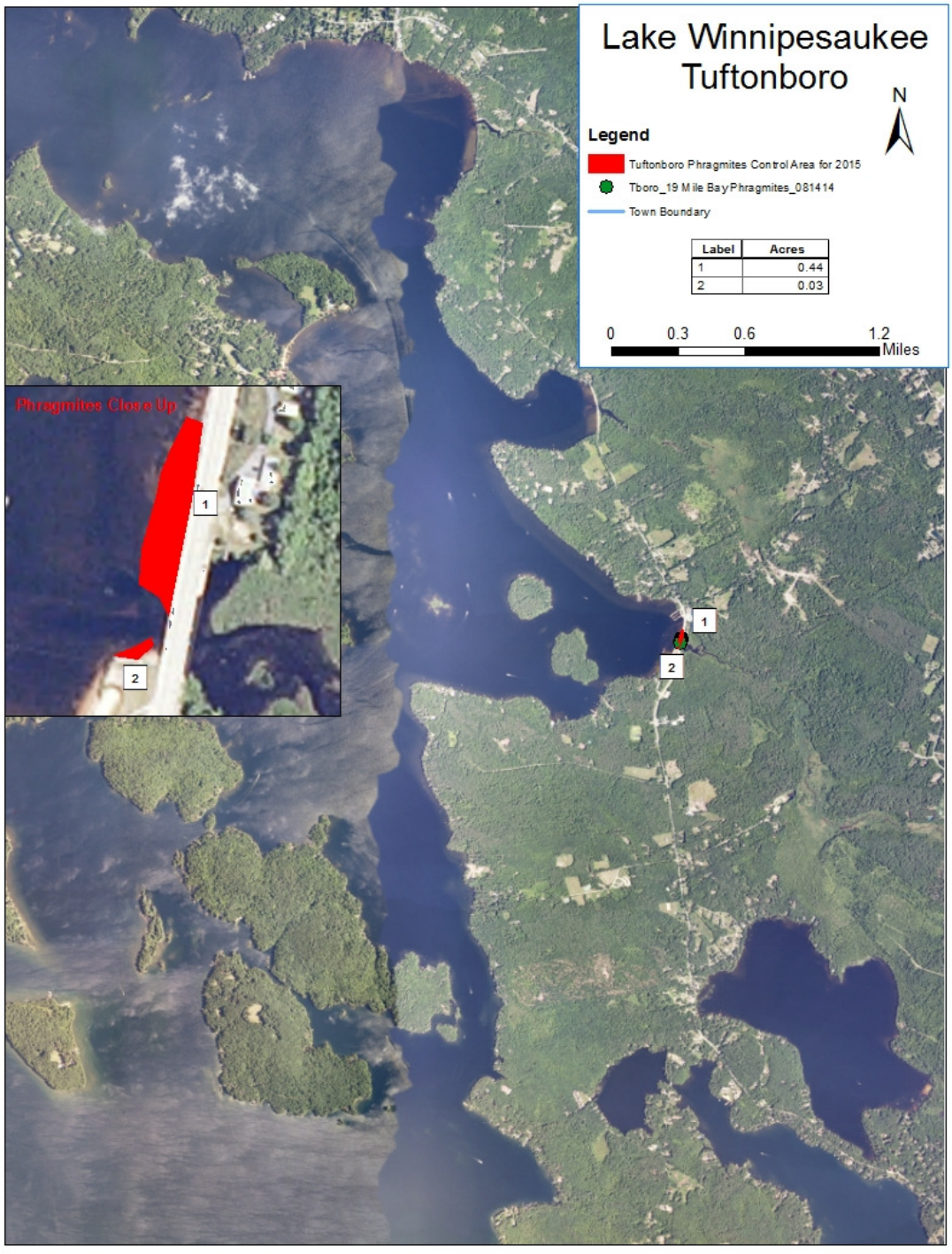
2013 Actual


Area A
28.03 acres
Area B
0.89 acres
Herbicide Residue
Sampling Site:
N 43° 37.165'
W 71° 17.029'
Launch Site &
Base of Operations
(South Areas)
Tuftonboro, NH
Lake Winnipesaukee
2013 Actual Treatment
& Sampling Map
FIGURE:
SURVEY DATE:
MAP DATE:
2
9/12/13
10/8/13
Legend:
Fall Treatment Areas (29 acres)
Actual Treatment Path (9/12/13)
10 day Sample Site
20 day Sample Site
0
500
1,000
2,000
Feet

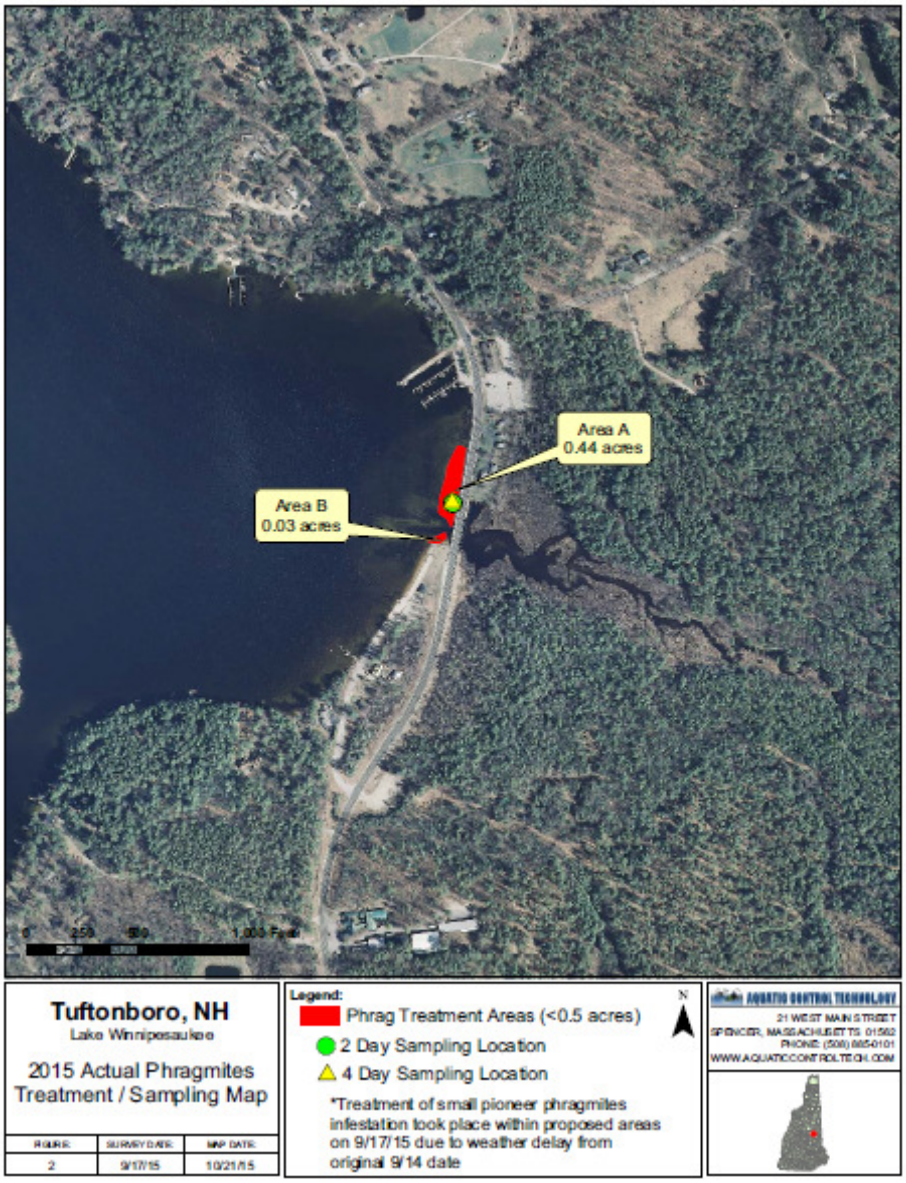
2014 Actual


Area B
0.9 acres
Tuftonboro, NH
Lake Winnipesaukee
2014 Actual Treatment
& Sampling Map
FIGURE: 2
SURVEY DATE: 9/8/14
MAP DATE: 10/13/14
Legend:
Fall Treatment Area (0.9 acres)
Actual Treatment Path (9/9/14)
10 Day Sample Site
20 Day Sample Site
N
0
100
200
400 Feet
AQUATIC CONTROL TECHNOLOGY

2015 Proposed

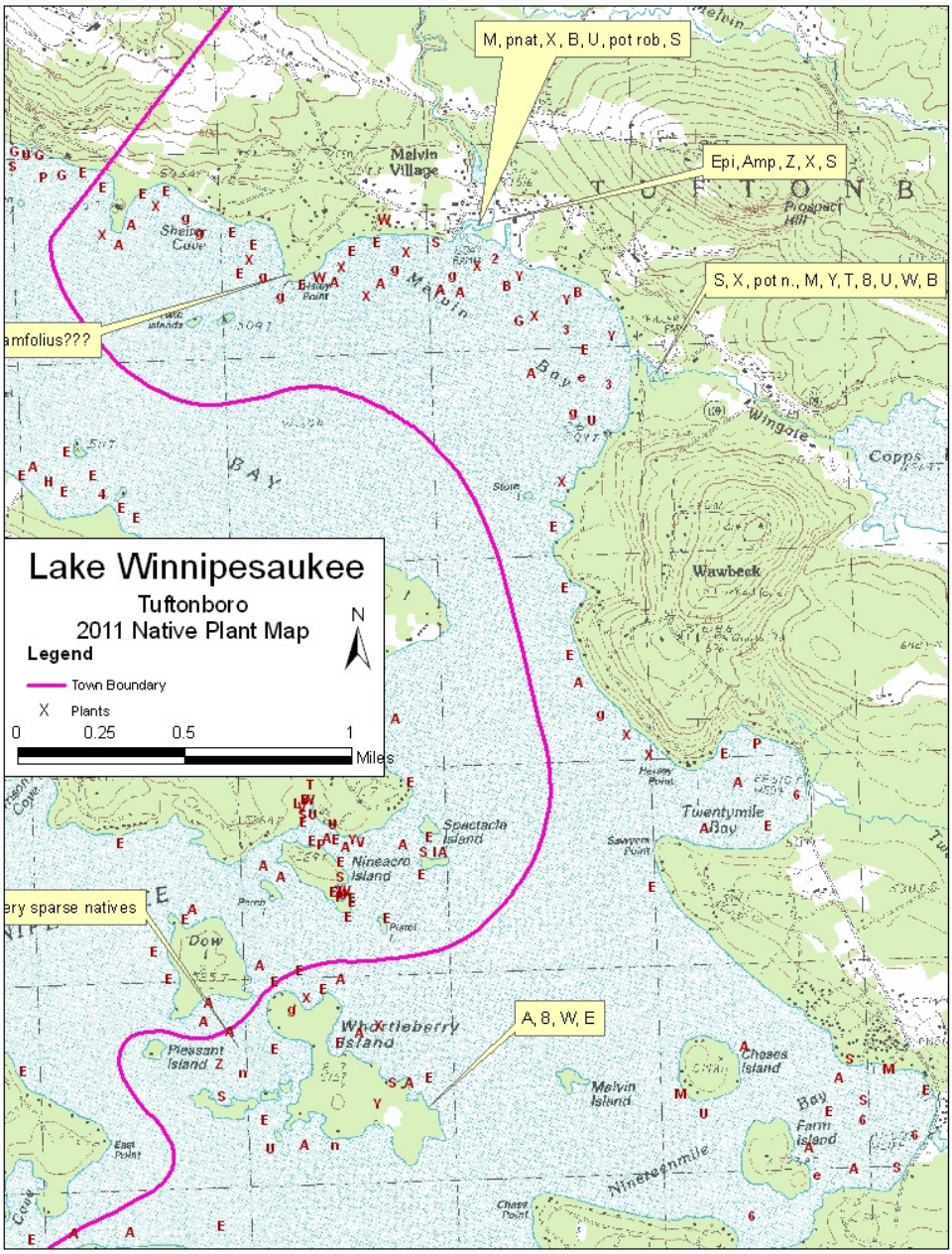


2015 Actual


Area A
0.44 acres
Area B
0.03 acres
Tuftonboro, NH
Lake Winnipesaukee
2015 Actual Phragmites
Treatment / Sampling Map
FIGURE
2
SURVEY DATE
9/17/15
MAP DATE
10/21/15
Legend:
Phrag Treatment Areas (<0.5 acres)
2 Day Sampling Location
4 Day Sampling Location
*Treatment of small pioneer phragmites infestation took place within proposed areas on 9/17/15 due to weather delay from original 9/14 date
N
AQUATIC CONTROL TECHNOLOGY
21 WEST MAIN STREET
SPENCER, MASSACHUSETTS 01562
PHONE: (508) 885-0101
WWW.AQUATICCONTROLTECH.COM

2016 Proposed

Figure 3: Map of Native Aquatic Macrophytes




Lake Winnipesaukee
Tuftonboro
2011 Native Plant Map
Legend
Town Boundary
X Plants
0 0.25 0.5 1
Miles
N
Scattered native milfoils and pondweeds
Tuftonboro Neck
Mirror Lake
Cow Island
Orchard Cove
Barbers Pole
The Basin
TUFTONBORO NECK
Wingate Cove
Fox Point
Pick Point
Sewalls Point
Mirror Lake
Winter Harbor
Ayers Point

Key to Macrophyte Map

Symbol*	Common Name	Latin Name
n	**Naiad**	***Najas sp.***
l	**Water lobelia**	***Lobelia dortmanna***
E	**Pipewort**	***Eriocaulon septangulare***
S	**Bur-reed**	***Sparganium***
B	**Watershield**	***Brasenia schreberi***
W	**White water-lily**	***Nymphaea***
Y	**Yellow water-lily**	***Nuphar***
A	**Bassweed**	***Potamogeton amplifolius***
P	**Pickerelweed**	***Pontedaria cordata***
U	**Bladderwort**	***Utricularia***
X/4	**Pondweed species**	***Potamogeton***
T	**Cattail**	***Typha***
J	**Rush**	***Juncus***
G	**Grassy pondweed**	***Potamogeton gramineus***
p/2	**Clasping-leaf pondweed**	***Potamogeton perfoliatus***
8/g	**Grassy arrowhead**	***Sagittaria sp.***
V	**Tapegrass**	***Vallisneria americana***
e	**Waterweed**	***Elodea***
H	**Floating heart**	***Nymphoides cordata***
7	**Nitella**	***Nitella***
C	**Coontail**	***Ceratophyllum***
9	**Water marigold**	***Megalodonta bechii***
L	**Purple loosestrife**	***Lythrum salicaria***

*Note that some plants may be depicted by two symbols as mapping was done over time and alternate symbols may have been used to depict the same plant.

Figure 4: Bathymetric Map

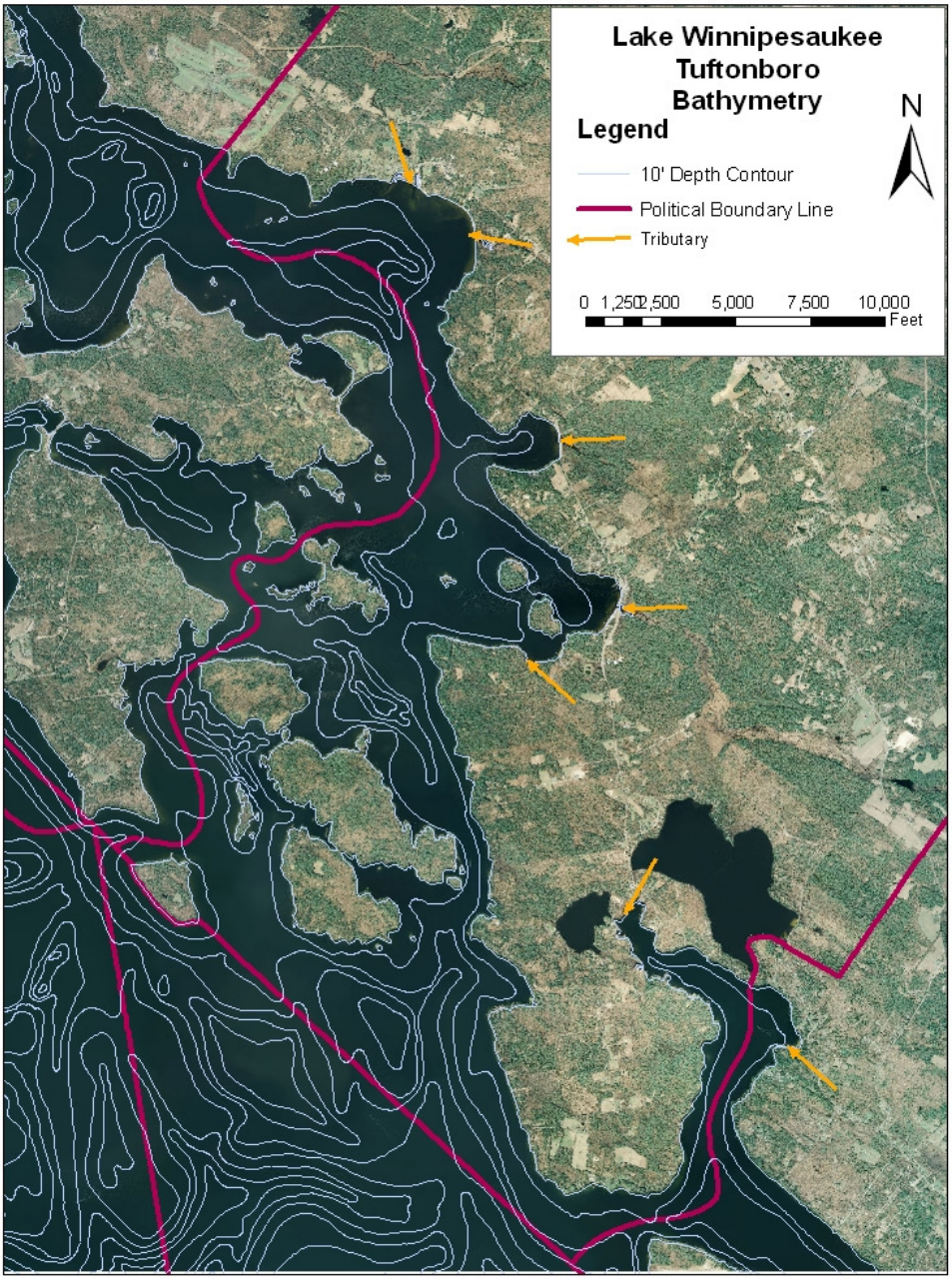


Figure 5: Critical Habitats or Conservation Areas

NEW HAMPSHIRE NATURAL HERITAGE BUREAU
NHB DATACHECK RESULTS LETTER

To: Amy Smagula, DES-Biology Section
29 Hazen Drive
Concord, NH 03301

From: NH Natural Heritage Bureau

Date: 3/30/2015 (valid for one year from this date)

Re: Review by NH Natural Heritage Bureau of request submitted 2/25/2015

NHB File ID: NHB15-1106 **Applicant:** Amy Smagula

Location: Tuftonboro
Winnipesaukee

Project Description: exotic plant control: DASH/Diver and herbicide

The NH Natural Heritage database has been checked by staff of the NH Natural Heritage Bureau and/or the NH Nongame and Endangered Species Program for records of rare species and exemplary natural communities near the area mapped below. The species considered include those listed as Threatened or Endangered by either the state of New Hampshire or the federal government.

It was determined that, although there was a NHB record (e.g., rare wildlife, plant, and/or natural community) present in the vicinity, we do not expect that it will be impacted by the proposed project. This determination was made based on the project information submitted via the NHB Datacheck Tool on 2/25/2015, and cannot be used for any other project.

Department of Resources and Economic Development
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DRED/NHB
PO Box 1856
Concord NH 03302-1856

Historic NHB

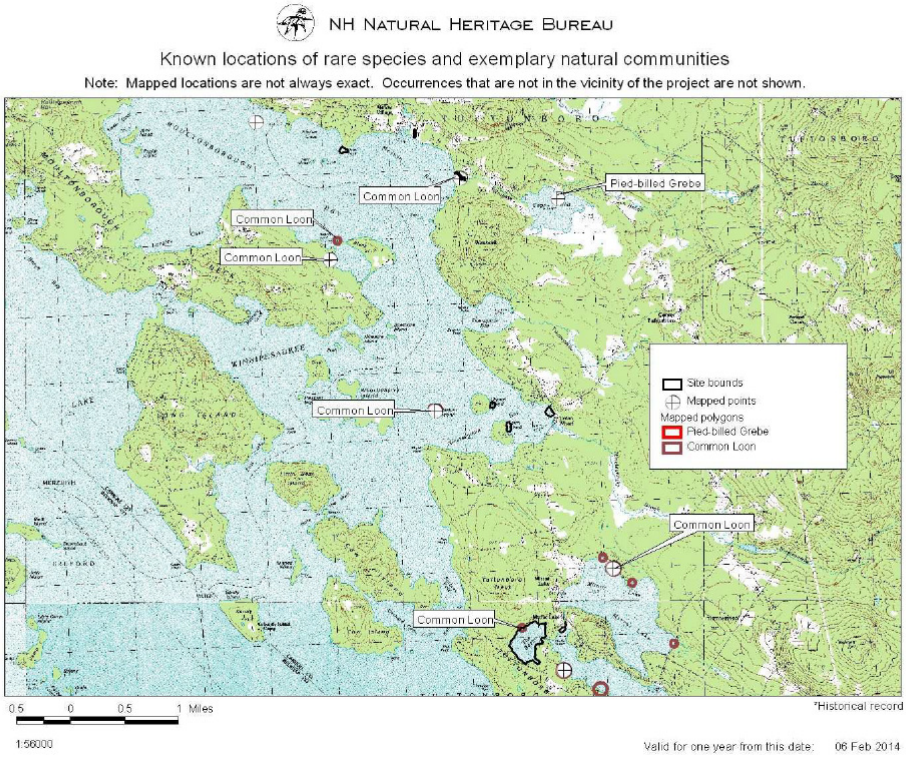
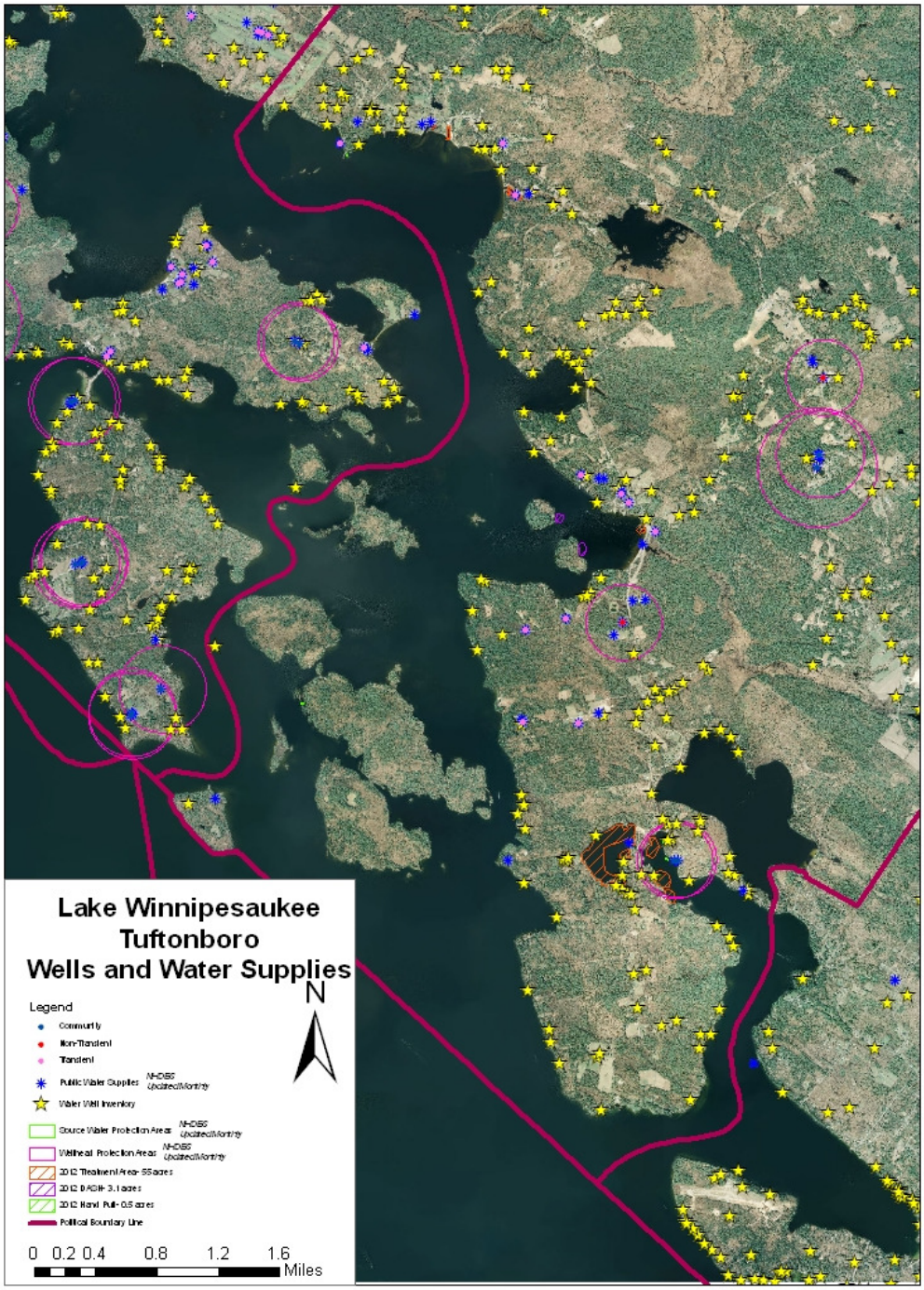


Figure 6: Public Use/Access Sites

No comprehensive map is available for these items at this time.

Figure 7: Wells and Water Supplies, 1:48,000 scale



Appendix A Criteria to Evaluate Selection of 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.

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 not 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 Summary of Control Practices

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). Although the final report has not been completed for this study, preliminary results suggest that all three products worked well, but that Navigate formation may be the most target specific of all three.

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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