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

Lake Winnipesaukee- Paugus
Laconia, 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 Infestation in Lake Winnipesaukee- Laconia

Variable milfoil (*Myriophyllum heterophyllum*) became established in Lake Winnipesaukee in 1965, where it was first documented in Moultonborough Bay, and the milfoil in this area is the longest standing infestation in New Hampshire. Because Laconia areas of Lake Winnipesaukee are "downstream" of Moultonborough, and actually the most downstream portion of the whole lake, it is at constant risk for receiving fragments of milfoil from the main body of the lake. Fortunately much effort has been put into lake-wide reductions of milfoil for the last five or more years, so that risk should be somewhat lessened.

Over the years, the milfoil fragments drifting out of Lake Winnipesaukee have become established in portions of the lake in Laconia. Much of the available habitat available for milfoil growth in Laconia has long been sustaining stands of milfoil growth, and variable milfoil surrounds much of Paugus Bay from shore to depths of up to 20 feet in some places. Many of the small coves of the bay are also infested.

Milfoil control efforts in Lake Winnipesaukee will need to be well-coordinated (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.

In 2021, a new potentially invasive aquatic plant, *Hottonia palustris (commonly known as water violet)*, was identified in portions of Paugus Bay, including expansive growth in Pickerel Cove, a cluster of stems in Langley Cove, and small patchy growth in Moulton (Chattel) Cove. NHDES and the Natural Heritage Bureau (NHB) are considering this plant a non-native invasive species, and this is the first sighting of the plant in New Hampshire. Populations in Langley Cove and Moulton Cove were targeted by divers, while the population in Pickerel Cove was treated as part of the milfoil control herbicide treatment. Unfortunately regrowth occurred in Pickerel Cove, and in Moulton Cove, and more work will be needed to address this plant, along with milfoil, in 2022 and beyond.

Figure 1 illustrates a compilation of data on the distribution of variable milfoil in Laconia. The following table provides a summary of variable milfoil growth as shown in Figure 1. The area labels in the table below relate to the grid overlay on the map in Figure 1.A complete mapping of all areas of Lake Winnipesaukee within Laconia town boundaries first took place during the summer of 2012, and other smaller areas have since been mapped annually, due to regular control practices being implemented. We expect survey work to occur throughout the Lake Winnipesaukee, Laconia areas at least once or twice annually throughout the time period covered by this Long-Term Management Plan.

Figure 2 illustrates the control activities that took place in Lake Winnipesaukee in Laconia over the last few years (GIS records only go back to 2009).

Area	Location/Area Description	Year	Growth Description
A1 B1 C1	Northern end of Paugus Bay, including channel from Lake Winnipesaukee, shoreline areas and Moulton and Pickerel Coves	2012	Variable milfoil common along bottom of channel, scattered along shoreline areas, and dense in both Pickerel and Moulton Coves.
		2013	Only Pickerel Cove was surveyed and dense variable milfoil was found in the northwestern end of the cove.
		2014	No surveys performed in 2014 in this area
		2015	Only Pickerel and Moulton Coves were surveyed as part of a milfoil control project.

Area	Location/Area Description	Year	Growth Description
			Pre-treatment in June showed widespread milfoil in both coves. No growth observed following treatment.
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common near shore and across shallow coves/embayments in these areas.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year. Dense to moderately dense milfoil growth observed in both Pickerel and Moulton Coves.
		2018	Minimal growth present as scattered stems in channel. Pickerel and Moulton Coves had expanded growth early season, reduced by herbicide and diving. No regrowth in Pickerel by end of season, scattered growth in Moulton two months post treatment, which was hand harvested by divers.
		2019	Scattered stems along channel. Pickerel Cove still had very low milfoil density, Moulton Cove showed rebounding milfoil growth.
		2020	Scattered stems along channel. Pickerel Cove had some areas of regrowth in the northern shallows, and a few patches in the cove; Moulton Cove showed rebounding milfoil growth.
		2021	Only a few scattered stems observed
B2 C2	Northern narrows	2012	Continuous and dense milfoil growth along much of the western shoreline. Sparse growth along eastern shoreline in this section.
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common near shore in this section, mostly on the western shoreline.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.
		2018	Minimal growth present as scattered stems
		2019	Minimal growth present as scattered stems
		2020	Small patchy growth, low density overall
		2021	Scattered stems
B3	Western shoreline in central part of Paugus Basin	2012	Large and dense patches of variable milfoil growth along western shoreline in this area, and patchy growth along southern and eastern shoreline of large island

Area	Location/Area Description	Year	Growth Description
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common near shore and scattered around the island.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.
		2018	Not managed in 2017, so growth is at historic levels.
		2019	Not managed in 2018, growth is at historic levels.
		2020	Patchy growth
		2021	Patchy to expansive growth targeted by divers
B4	Southwestern shoreline of main basin	2012	Dense patchy growth forming continuous band along western shoreline
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common along shore.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.
		2018	Not managed, growth is at historic levels.
		2019	Not managed, growth is at historic levels.
		2020	Not managed, growth is at historic levels.
		2021	Not managed, growth is at historic levels.
B5	Southern end of lake on western shoreline and outlet cove	2012	Patchy growth along southwestern shoreline, dense growth throughout marinas located in outlet basin on the western side of railroad crossing
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common near shore and across shallow coves/embayments.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.

Area	Location/Area Description	Year	Growth Description
		2018	Not managed, growth is at historic levels.
		2019	Not managed, growth is at historic levels.
		2020	Not managed, growth is at historic levels.
		2021	Abundant milfoil growth, worked on by divers
C2	Eastern Cove, also known as Langley Cove	2012	Dense milfoil growth within and surrounding Langley Cove
		2013	Reduced growth in Langley Cove, still dense growth surrounding cove in main basin of Paugus Bay
		2014	Not surveyed
		2015	Scattered milfoil growth in Langley Cove, further reduced by diving. Dense growth at mouth of cove and lake bottom outside of cove.
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common near shore and across shallow coves/embayments.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.
		2018	Reduced density due to diving and herbicide treatments in this area.
		2019	Diving has kept milfoil densities fairly low in this area, along with a localized herbicide treatment in 2019.
		2020	Scattered stems
		2021	No milfoil identified; however, a new plant, *Hottonia palustris*, was found present as a small cluster of stems, hand harvested by divers.
C3	Eastern shore of mid-basin of Paugus Bay	2012	Sparse growth compared to the rest of the basin. Only a couple patches of milfoil along the eastern shoreline.
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was fairly sparse throughout this area.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year. Low density growth observed in Langley Cove proper.
		2018	Not managed in 2017, so growth is at historic levels.
		2019	Not managed in 2018, growth is at historic levels.
		2020	Low density growth/scattered stems

Area	Location/Area Description	Year	Growth Description
		2021	Low density growth, harvested by divers
C4	Southeastern shoreline near sandbar	2012	Patchy growths of milfoil surrounding small island. No milfoil along much of shoreline until the area of the developed shoreline where restaurant docks/etc are located, and then dense growth in this area.
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was fairly sparse along this shoreline, increasing along the southern area of this section. Patchy growth around islands.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.
		2018	Not managed, growth at historic levels
		2019	Not managed, growth at historic levels
		2020	Not managed, growth at historic levels
		2021	Patchy growth, harvested byd ivers
C5	Southern cove of Paugus Bay, vicinity of restaurants, services, marinas and DWS intake	2012	Very dense growths along much of shoreline
		2013	Not surveyed
		2014	Not surveyed
		2015	Not surveyed
		2016	A full survey of Paugus Bay was done this summer. Variable milfoil was common near shore and across shallow coves/embayments/marinas.
		2017	Just Langley, Moulton and Pickerel Coves surveyed this year.
		2018	Not managed, growth at historic levels
		2019	Not managed, growth at historic levels
		2020	Not managed, growth at historic levels
		2021	Patchy growth, not targeted by divers yet, they are working more upstream to reduce growth there first

Throughout this portion of the lake there are many public access sites, commercial businesses, marinas, a number of private residences, cove and condominium associations and swim beaches. City officials, residents, business owners and lake users have expressed concerns about milfoil and about reducing the impact of this invasive aquatic plant on the basin and its designated uses.

Aquatic Invasive Plant Management Management Goals

The aquatic plant management plan for the portion of Lake Winnipesaukee that falls within Laconia 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.

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 City of Laconia is working to become more active in variable milfoil control in infested waterbodies in the City (Lake Winnipesaukee, Lake Opechee, and portions of Lake Winnisquam). The City has awarded funds to various groups in the City for control efforts, and is looking to effect a more strategic approach at management in the coming years, to reduce overall growth of variable milfoil in City waterbodies.

Lake Resident Support

While Laconia does not have one individual lake association to assist with control efforts, many cove associations or smaller organized groups have been active in milfoil control over the years, and are working through the Laconia Conservation Commission to expand efforts.

The Lake Winnipesaukee Watershed Association is also involved in discussions, as they play a large role throughout the Lake Winnipesaukee Watershed and Lake Winnipesaukee itself.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of the Laconia 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, commercial, minimal forested
Laconia Area Max Depth (ft)	80.52
Laconia Area Mean Depth (ft)	30.69
Trophic Status	Oligotrophic
Color (CPU) in Epilimnion	12
Clarity (ft)	25.08
Flushing Rate (times per year)	9.10
Natural waterbody/Raised by Damming/Other	Natural, raised by damming
Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum*
Laconia Infested Area (acres)	See figures
Distribution (ringing lake, patchy growth, etc)	See figures
Sediment type in infested area (sand/silt/organic/rock)	Mostly sandy, some sandy/silty
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	2022 NHB Review Results Results Pending Historically Listed Species Common loon (*Gavia immer*) Bald eagle (*Haliaeetus leucocephalus*)

An aquatic vegetation map (showing native vegetation) and key for Paugus 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.

Species of Concern/Interest:

A Natural Heritage Inventory review yielded two species of concern in the Laconia area, namely the common loon (*Gavia immer*) and the bald eagle (*Haliaeetus leucocephalus)* which is listed as a threatened species in the state.

Common loon: 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. Further, no chemical or non-chemical treatments, such as hand pulling should occur between May 15 and July 15th within 330 feet of any known or suspected loon nests to avoid "take" under RSA 212-Aof the Endangered Species Conservation Act.

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 in Laconia is 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 Lake Winnipesaukee in Laconia that provide services for boaters and on-land visitors alike.

Public access can be achieved at a number of public (state or City owned) and private (marina) access sites throughout Lake Winnipesaukee and in Laconia.

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 Winnipesaukee in the Laconia area is represented by a mix of native aquatic vegetation, as shown in the plant map and related table.

There are no records of rare, threatened or endangered plant species or aquatic communities of concern in Paugus Bay.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the Paugus Bay, 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	Location	Action	Amount (gal) or Area (ac)	Contractor
06/12/2001	SPINNAKER COVE	DIQUAT	6 ACRES	LYCOTT ENVIRONMENTAL
06/05/2002	CHRISTMAS ISLAND	DIQUAT	7.3 ACRES	ACT
06/23/2004	PICKEREL COVE	DIQUAT	20 ACRES	ACT
06/02/2005	PICKEREL COVE	DIQUAT	19 ACRES	ACT
06/08/2006	CHRISTMAS ISLAND	DIQUAT	7.3 ACRES	ACT
06/04/2008	LAKEPORT LANDING	2,4-D	7 ACRES	ACT
06/04/2008	PICKEREL COVE	2,4-D	18 ACRES	ACT
06/28/2010	DES GPS Coordinates	DIVER/DASH	10 GALLONS	AQUALOGIC
06/14/2011	LANGLEY COVE/CHRISTMAS ISLAND	2,4-D	8.3 ACRES	ACT
06/14/2012	PICKEREL COVE	2,4-D (G)	18 ACRES	ACT
06/05/2013	LANGLEY COVE/CHRISTMAS ISLAND	2,4-D (G)	6.2 ACRES	ACT

Date	Location	Action	Amount (gal) or Area (ac)	Contractor
08/08/2013	MOULTON COVE/BRADY BEACH	HAND HARVEST	70 GALLONS	AQUALOGIC
08/09/2013	MOULTON COVE/BRADY BEACH	HAND HARVEST	180 GALLONS	AQUALOGIC
06/19/2014	PICKEREL COVE	SCULPIN G	18 ACRES	ABC CORP.
07/15/2015	MOULTON COVE	2,4-D BEE (G) & COPPER (G)	5 ACRES	ACT
07/15/2015	PICKEREL COVE	2,4-D BEE	5 ACRES	AQUALOGIC
07/07/2016	PICKEREL COVE	DASH	5 GALLONS	AQUALOGIC
07/11/2016	MOULTON COVE	DASH	15 GALLONS	AQUALOGIC
07/12/2016	MOULTON COVE	DASH	160 GALLONS	AQUALOGIC
07/13/2016	MOULTON COVE	DASH	240 GALLONS	AQUALOGIC
07/14/2016	MOULTON COVE	DASH	240 GALLONS	AQUALOGIC
07/15/2016	MOULTON COVE	DASH	160 GALLONS	AQUALOGIC
07/17/2016	MOULTON COVE	HAND HARVEST	815 GALLONS	AQUALOGIC
07/17/2016	PICKEREL COVE	HAND HARVEST	5 GALLONS	AQUALOGIC
07/18/2016	MOULTON COVE	DASH	320 GALLONS	AQUALOGIC
07/19/2016	MOULTON COVE	DASH	285 GALLONS	AQUALOGIC
07/20/2016	MOULTON COVE	DASH	220 GALLONS	AQUALOGIC
07/21/2016	MOULTON COVE	DASH	110 GALLONS	AQUALOGIC
07/22/2016	LANGLEY COVE	DASH	100 GALLONS	AQUALOGIC
07/25/2016	LANGLEY COVE	DASH	40 GALLONS	AQUALOGIC
07/26/2016	LANGLEY COVE	DASH	120 GALLONS	AQUALOGIC
07/27/2016	LANGLEY COVE	DASH	140 GALLONS	AQUALOGIC
07/28/2016	LANGLEY COVE	DASH	50 GALLONS	AQUALOGIC
07/01/2017	LANGLEY COVE	DASH	NO REPORT	NE MILFOIL
09/21/2017	VARIOUS	2,4-D (G)	8.5 ACRES	SOLitude
07/19/2018	MOULTON COVE	2,4-D BEE	7.87 ACRES	SOLitude
07/19/2018	PICKEREL COVE	PROCELLACOR EC	14.18 ACRES	SOLitude
09/10/2018	LANGLEY COVE	PROCELLACOR EC	6.02 ACRES	SOLitude
06/28/2019		PROCELLACOR EC	5 ACRES	SOLitude
08/22/2019		PROCELLACOR EC	17 ACRES	SOLitude
08/26/2020	Pickerel Cove	DASH	20 GALLONS	AB Aquatics

Date	Location	Action	Amount (gal) or Area (ac)	Contractor
08/26/2020	Wiers Channel South of bridge	DASH	280 GALLONS	AB Aquatics
08/27/2020	Wiers Channel South of bridge	DASH	440 GALLONS	AB Aquatics
08/27/2020	Wiers Channel South of bridge	DASH	20 GALLONS	AB Aquatics
08/28/2020	Wiers Channel South of bridge	DASH	15 GALLONS	AB Aquatics
08/28/2020	Wiers Channel South of bridge	DASH	90 GALLONS	AB Aquatics
08/31/2020	Wiers Channel South of bridge	DASH	900 GALLONS	AB Aquatics
08/31/2020	Wiers Channel South of bridge	DASH	240 GALLONS	AB Aquatics
09/01/2020	Wiers Channel South of bridge	DASH	280 GALLONS	AB Aquatics
09/01/2020	Wiers Channel South of bridge	DASH	140 GALLONS	AB Aquatics
09/02/2020	Paugus bay below Moulton's (Chattle) Cove	DASH	0 GALLONS	AB Aquatics
09/02/2020	Paugus bay SE of Plummer's island	DASH	0 GALLONS	AB Aquatics
09/02/2020	Paugus bay midway ESE shore marked pts	DASH	0 GALLONS	AB Aquatics
09/02/2020	Paugus bay midway West shore off beach	DASH	0 GALLONS	AB Aquatics
09/02/2020	Paugus bay midway West shore	DASH	0 GALLONS	AB Aquatics
06/22/2021	Pickerel and Moulton Coves	PROCELLACOR EC	20.22 ACRES	SOLitude
06/24/2021	DES GPS Coordinates	DIVER/DASH	3 GALLONS	AQUALOGIC
06/25/2021	DES GPS Coordinates	DIVER/DASH	3 GALLONS	AQUALOGIC
06/29/2021	DES GPS Coordinates	DIVER/DASH	70 GALLONS	AQUALOGIC
06/30/2021	DES GPS Coordinates	DIVER/DASH	100 GALLONS	AQUALOGIC
07/01/2021	DES GPS Coordinates	DIVER/DASH	150 GALLONS	AQUALOGIC
07/02/2021	DES GPS Coordinates	DIVER/DASH	180 GALLONS	AQUALOGIC

Date	Location	Action	Amount (gal) or Area (ac)	Contractor
07/07/2021	DES GPS Coordinates	DIVER/DASH	30 GALLONS	AQUALOGIC
07/08/2021	DES GPS Coordinates	DIVER/DASH	90 GALLONS	AQUALOGIC
07/09/2021	DES GPS Coordinates	DIVER/DASH	135 GALLONS	AQUALOGIC
07/12/2021	DES GPS Coordinates	DIVER/DASH	120 GALLONS	AQUALOGIC
07/13/2021	DES GPS Coordinates	DIVER/DASH	210 GALLONS	AQUALOGIC
07/14/2021	DES GPS Coordinates	DIVER/DASH	90 GALLONS	AQUALOGIC
07/15/2021	DES GPS Coordinates	DIVER/DASH	90 GALLONS	AQUALOGIC
07/16/2021	DES GPS Coordinates	DIVER/DASH	180 GALLONS	AQUALOGIC

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 Laconia area of Lake Winnipesaukee. The following table summarizes DES' control strategy recommendations for Laconia.

Control Method	Lake Winnipesaukee Areas in Laconia
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 Laconia 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 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 ProcellaCOR) 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. With a municipal drinking water intake located at the southern end of Paugus Bay, limited use of herbicide will be allowed, and then only likely in the northern end of the Paugus Bay basin, providing distance and a dilution factor for any herbicide that is applied, before it reaches the intake.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil and is not feasible in this large lake system.
Dredge	Not recommended due to nature of exotic plant distribution, the cost, or the ancillary ecological impacts that the dredge could have.

Control Method	Lake Winnipesaukee Areas in Laconia
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
2021	Weed Watching/Lake Hosting	Local volunteers	Growing season/boating season
	Diving/Diver-Assisted Suction Harvesting in portions of Paugus Bay	Contract Divers	Growing season
	Herbicide Treatment if needed	SŌLitude Lake Management, LLC	June or August
	Full survey of Lake Winnipesaukee in Laconia	DES	Spring and Fall
	Planning for control practices during next growing season	DES and local entities	September/October
2022	Weed Watching/Lake Hosting	Local volunteers	Growing season/boating season

Year	Action	Responsible Party	Recommended Schedule
	Diving/Diver-Assisted Suction Harvesting in portions of Paugus Bay	Contract Divers	Growing season
	Herbicide Treatment if needed	SŌLitude Lake Management, LLC	June and/or August
	Full survey of Lake Winnipesaukee in Laconia	NHDES	Spring and Fall
	Planning for control practices during next growing season	DES and local entities	September/October
2023	Weed Watching/Lake Hosting	Local volunteers	Growing season/boating season
	Diving/Diver-Assisted Suction Harvesting in portions of Paugus Bay	Contract Divers	Growing season
	Herbicide Treatment if needed, including herbicide residue monitoring by NHDES	SŌLitude Lake Management, LLC	June or August
	Full survey of Lake Winnipesaukee in Laconia	NHDES	Spring and Fall
	Planning for control practices during next growing season	DES and local entities	September/October
2024	Weed Watching/Lake Hosting	Local volunteers	Growing season/boating season
	Diving/Diver-Assisted Suction Harvesting in portions of Paugus Bay	Contract Divers	Growing season

Year	Action	Responsible Party	Recommended Schedule
	Herbicide Treatment if needed, including herbicide residue monitoring by NHDES	SŌLitude Lake Management, LLC	June or August
	Full survey of Lake Winnipesaukee in Laconia	NHDES	Spring and Fall
	Planning for control practices during next growing season	DES and local entities	September/October
2025	Weed Watching/Lake Hosting	Local volunteers	Growing season/boating season
	Diving/Diver-Assisted Suction Harvesting in portions of Paugus Bay	Contract Divers	Growing season
	Herbicide Treatment if needed, including herbicide residue monitoring by NHDES	SŌLitude Lake Management, LLC	June or August
	Full survey of Lake Winnipesaukee in Laconia	NHDES	Spring and Fall
	Planning for control practices during next growing season	NHDES and local entities	September/October
2026	Updating of Long-Term Plan	NHDES and local entities	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

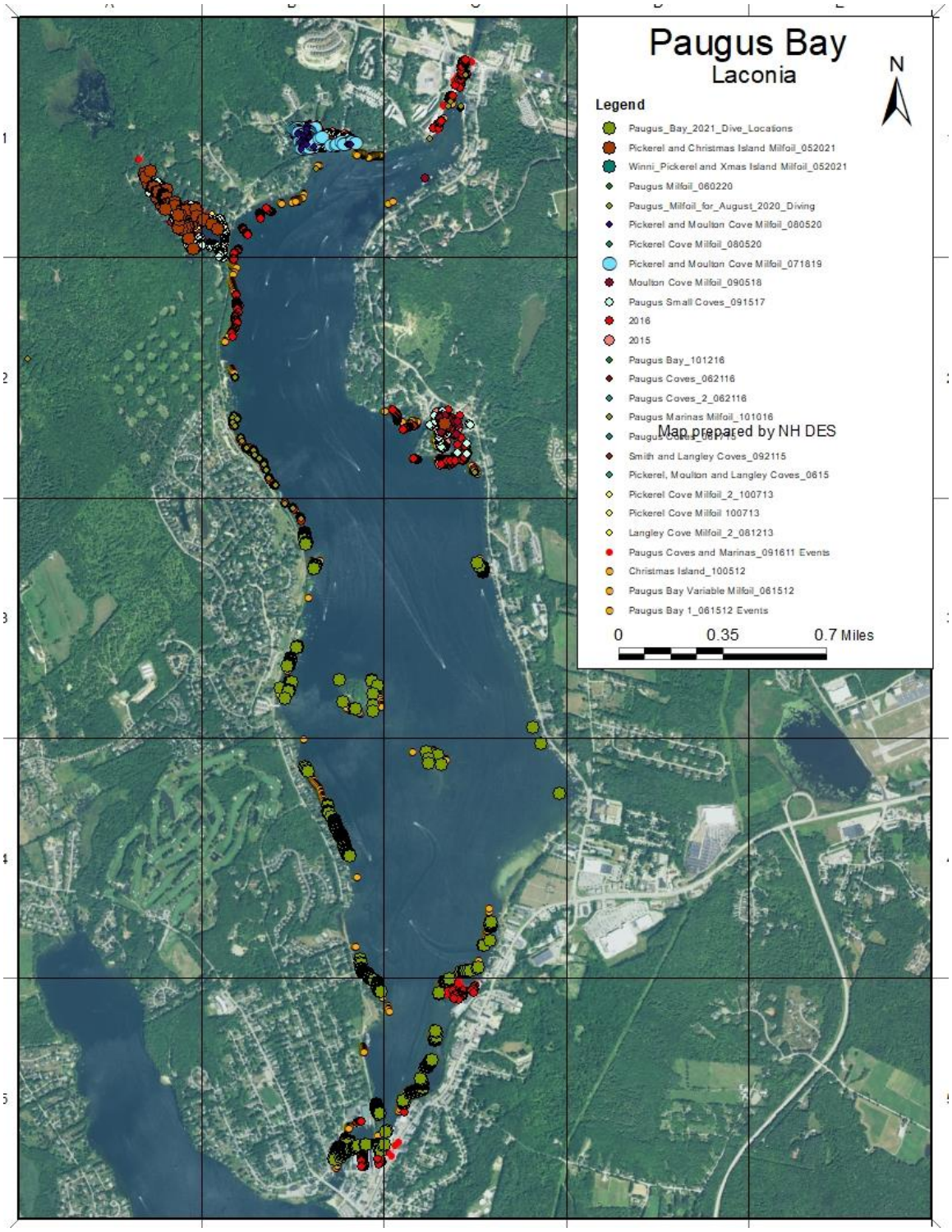
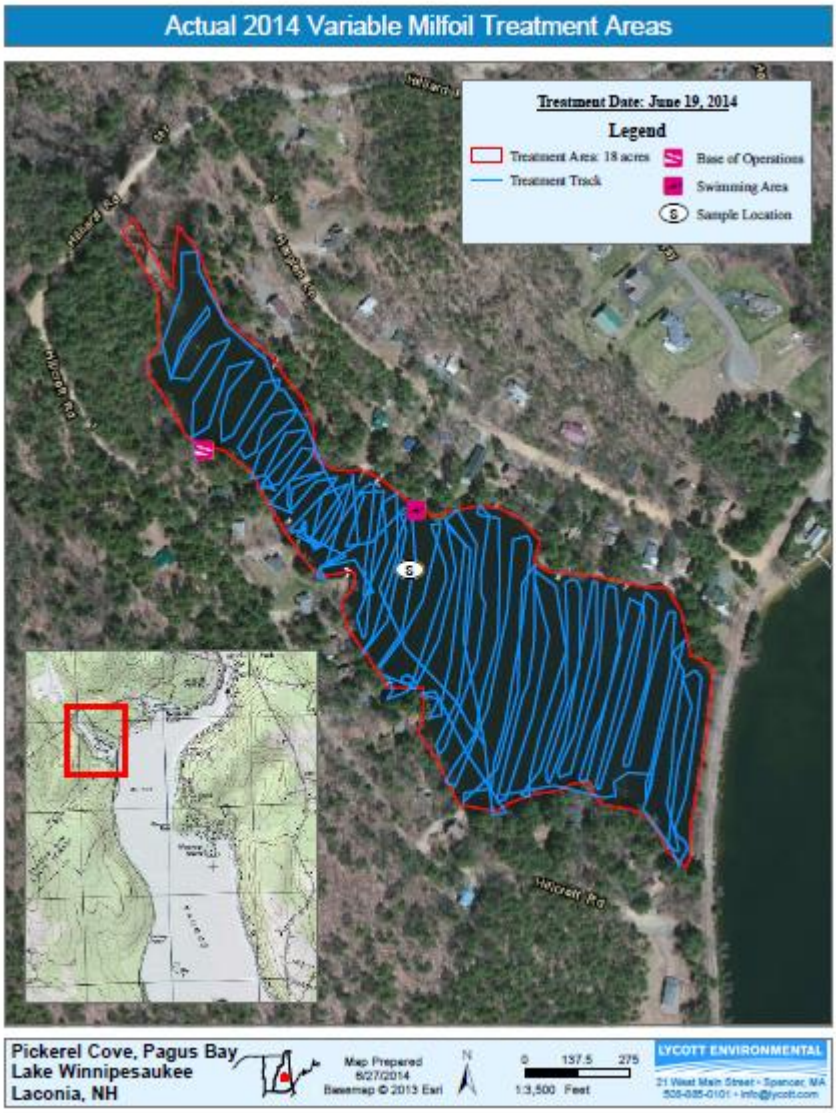


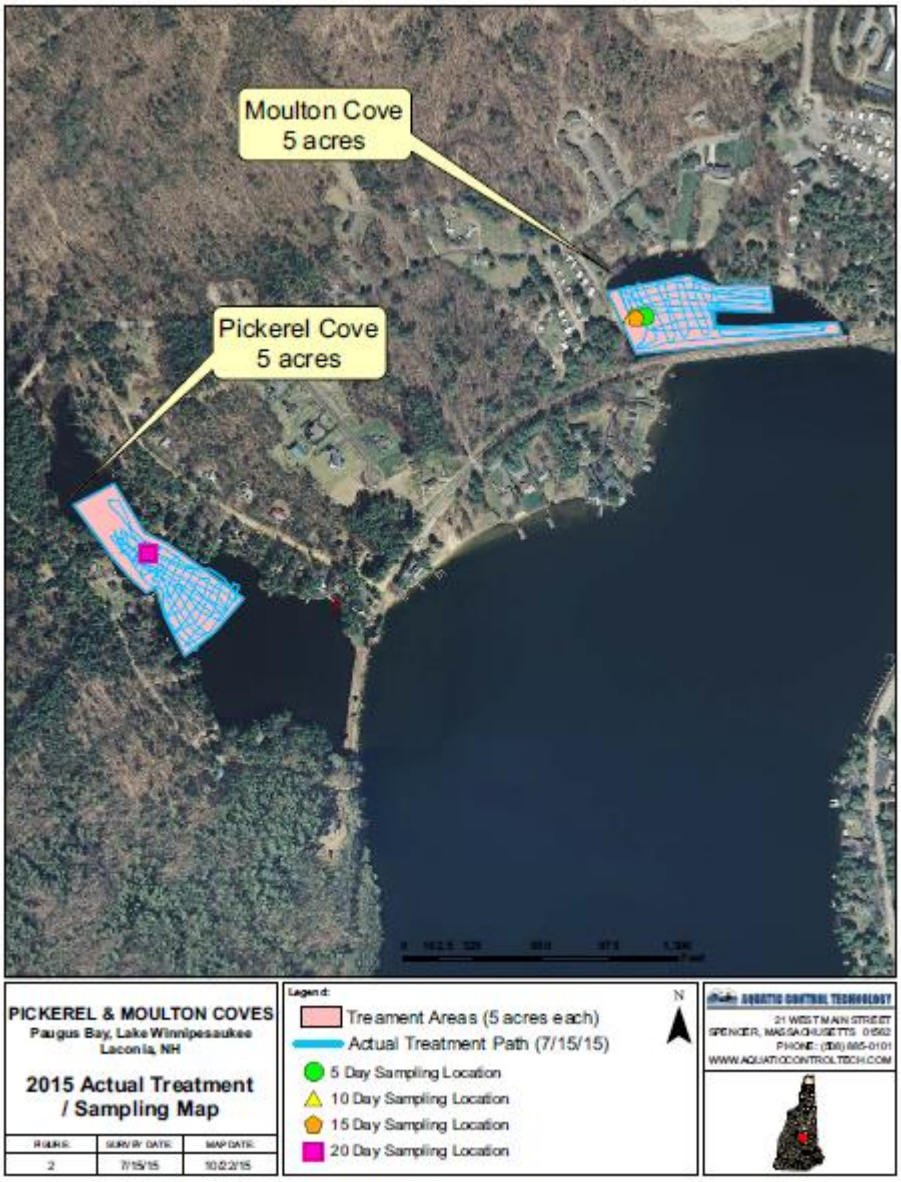
Figure 2: Map of Control Actions Over Time

2012 Actual

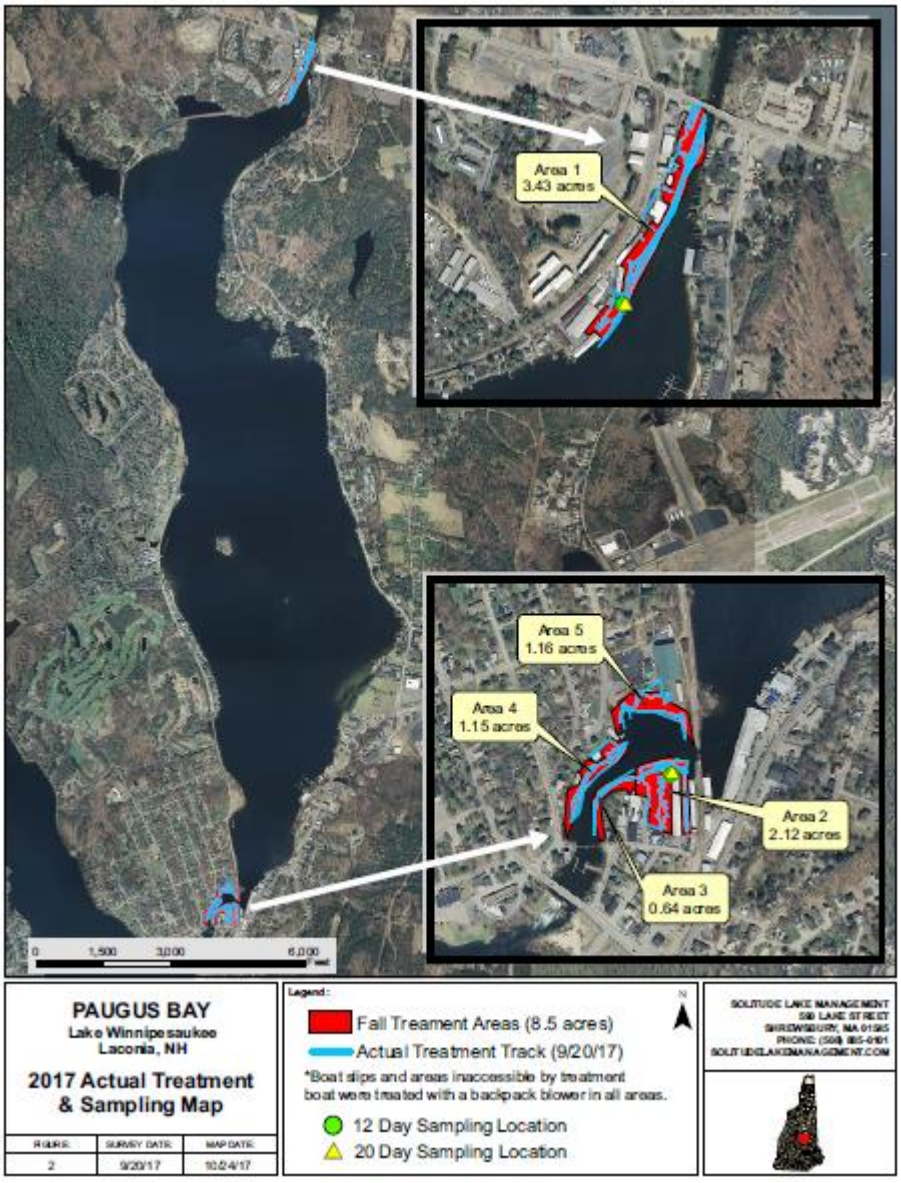
2014 Actual


Actual 2014 Variable Milfoil Treatment Areas
Treatment Date: June 19, 2014
Legend
Treatment Area: 18 acres
Treatment Track
Base of Operations
Swimming Area
Sample Location
Pickerel Cove, Pagus Bay
Lake Winnipesaukee
Laconia, NH
Map Prepared
6/27/2014
Basemap © 2013 Esri
N
0 137.5 275
1:3,500 Feet
LYCOTT ENVIRONMENTAL

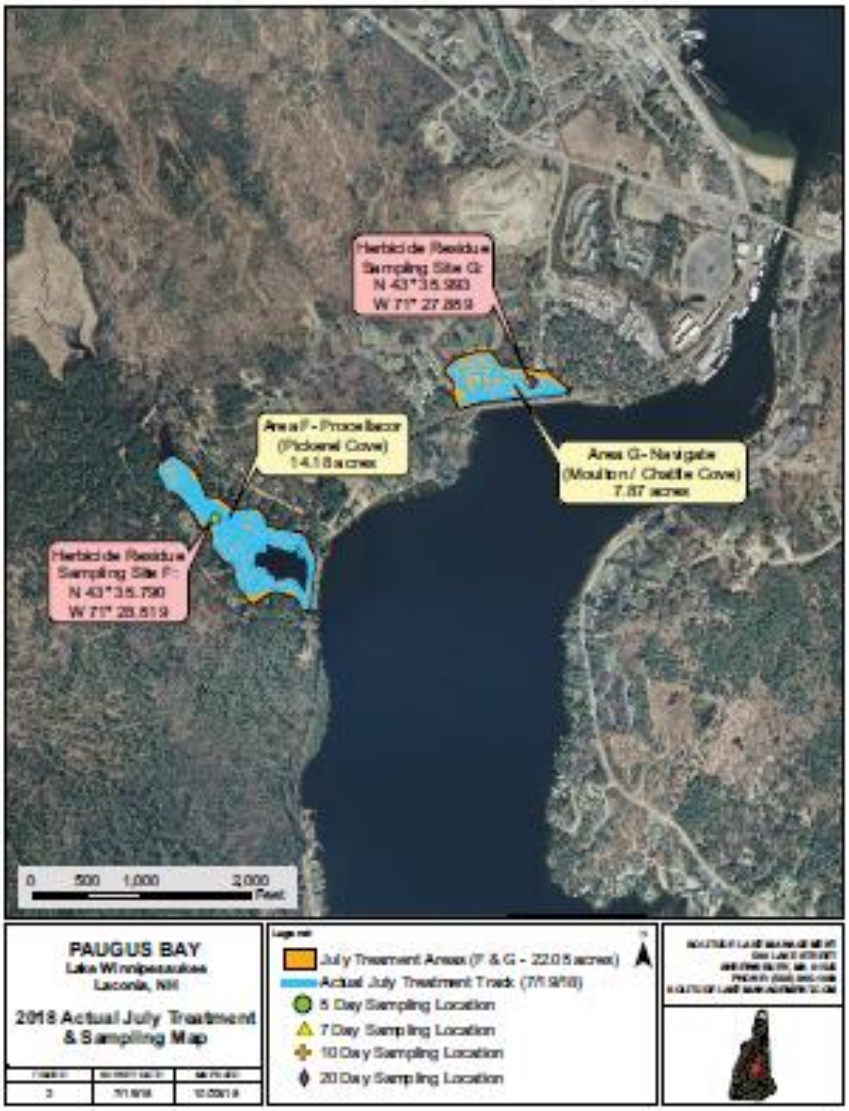
2015 Actual


Moulton Cove
5 acres
Pickerel Cove
5 acres
PICKEREL & MOULTON COVES
Paugus Bay, Lake Winnipesaukee
Laconia, NH
2015 Actual Treatment
/ Sampling Map
FIGURE
SURVEY DATE
MAP DATE
2
7/15/15
10/22/15
Legend:
Treament Areas (5 acres each)
Actual Treatment Path (7/15/15)
5 Day Sampling Location
10 Day Sampling Location
15 Day Sampling Location
20 Day Sampling Location
N
AQUATIC CONTROL TECHNOLOGY
21 WEST MAIN STREET
SPENCER, MASSACHUSETTS 01562
PHONE: (508) 885-0101
WWW.AQUATICCONTROLTECH.COM

2017 Actual

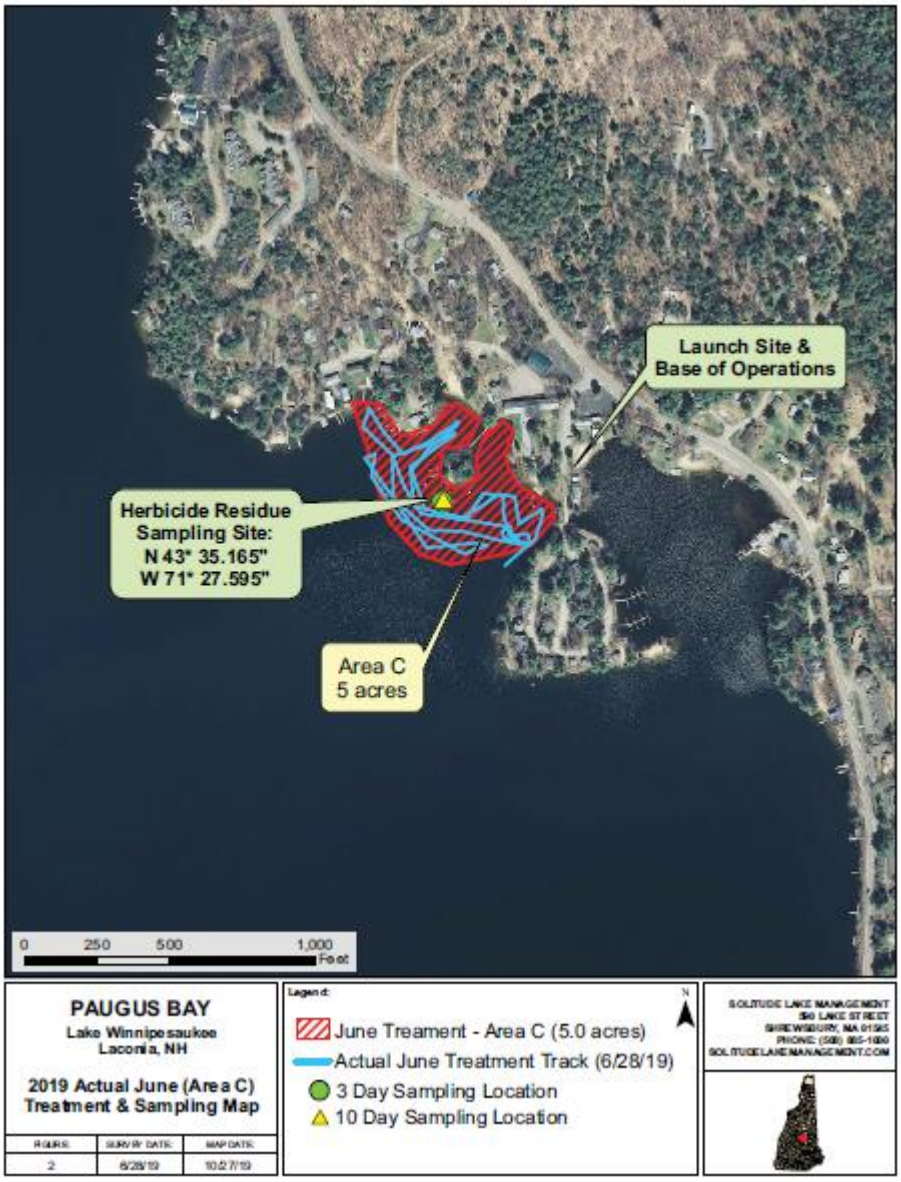

Area 1
3.43 acres
Area 5
1.16 acres
Area 4
1.15 acres
Area 2
2.12 acres
Area 3
0.64 acres
0
1,500
3,000
6,000
PAUGUS BAY
Lake Winnipesaukee
Laconia, NH
2017 Actual Treatment & Sampling Map
FIGURE:
SURVEY DATE:
MAP DATE:
2
9/20/17
10/24/17
Legend:
Fall Treament Areas (8.5 acres)
Actual Treatment Track (9/20/17)
*Boat slips and areas inaccessible by treatment boat were treated with a backpack blower in all areas.
12 Day Sampling Location
20 Day Sampling Location
N
SOLITUDE LAKE MANAGEMENT
PHONE: (508) 885-0101

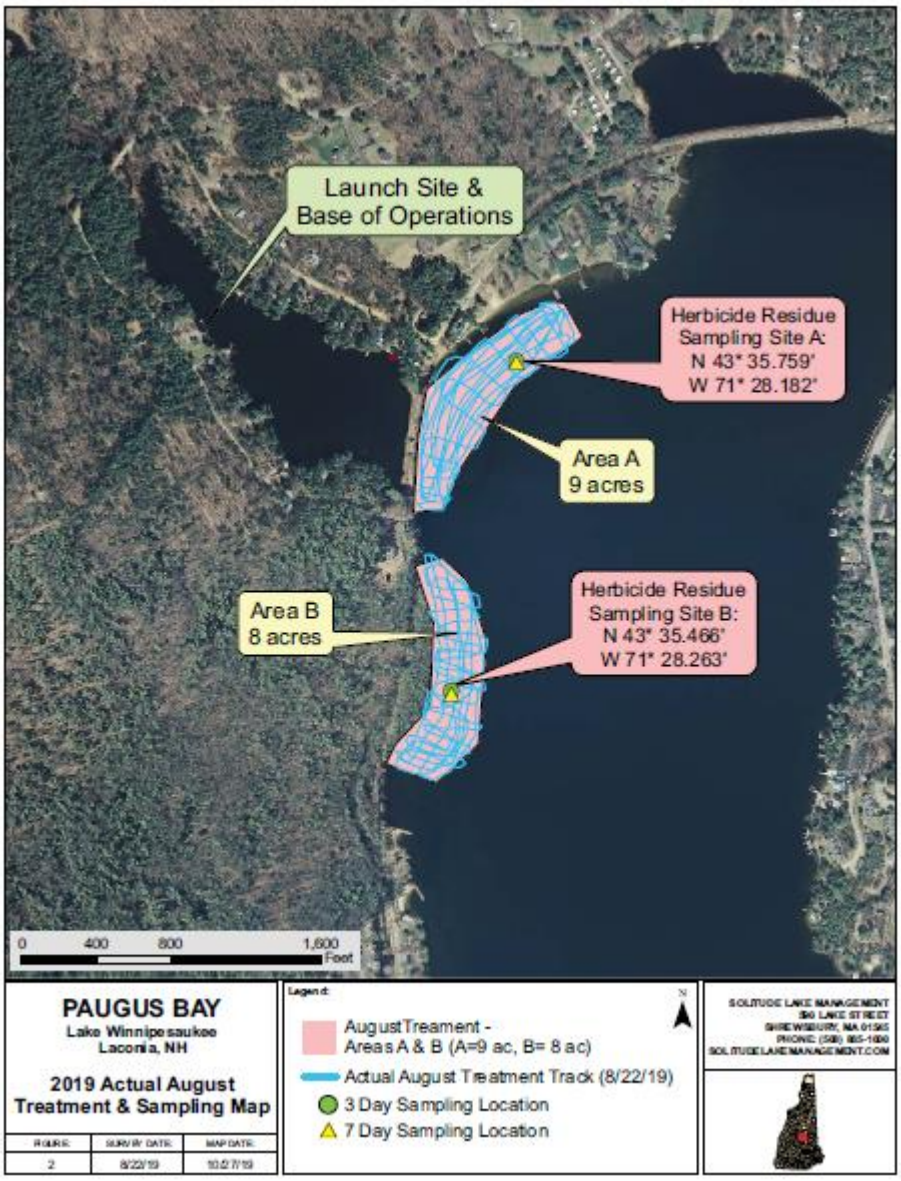
2018 Actual


Herbicide Residue
Sampling Site G
N 43° 35.993
W 71° 27.859
Area F - Procellacor
(Pickerel Cove)
14.18 acres
Area G - Navigate
(Moulton / Chaffin Cove)
7.87 acres
Herbicide Residue
Sampling Site F
N 43° 35.790
W 71° 28.519
0 500 1,000 2,000
Feet
PAUGUS BAY
Lake Winnipesaukee
Laconia, NH
2018 Actual July Treatment
& Sampling Map
July Treatment Areas (F & G - 22.05 acres)
Actual July Treatment Track (7/19/18)
5 Day Sampling Location
7 Day Sampling Location
10 Day Sampling Location
20 Day Sampling Location

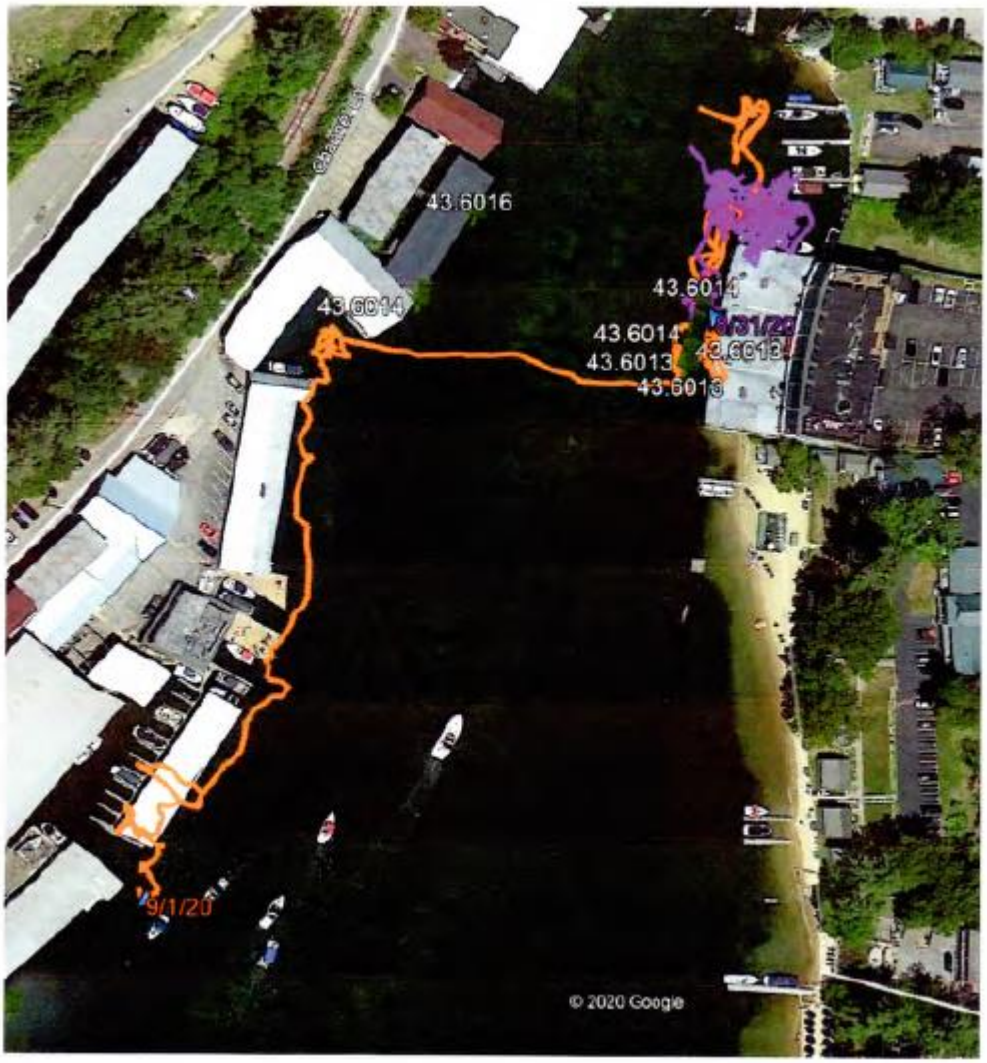

Area D- Procellacor
(Langley Cove)
6.02 acres
Herbicide Residue
Sampling Site D:
N 43° 35.070
W 71° 27.397
PAUGUS BAY
Lake Winnipesaukee
Laconia, NH
2018 Actual Fall Treatment
& Sampling Map
Fall Treatment Area (Area D- 6.02 acres)
Actual Fall Treatment Track (9/10/18)
3 Day Sampling Location
7 Day Sampling Location

2019 Actual


Launch Site &
Base of Operations
Herbicide Residue
Sampling Site:
N 43° 35.165"
W 71° 27.595"
Area C
5 acres
0
250
500
1,000
Feet
PAUGUS BAY
Lake Winnipesaukee
Laconia, NH
2019 Actual June (Area C)
Treatment & Sampling Map
FIGURE
SURVEY DATE:
MAP DATE:
2
6/28/19
10/27/19
Legend:
N
June Treament - Area C (5.0 acres)
Actual June Treatment Track (6/28/19)
3 Day Sampling Location
10 Day Sampling Location
SOLITUDE LAKE MANAGEMENT
PHONE: (508) 865-1600
SOLITUDELAKEMANAGEMENT.COM

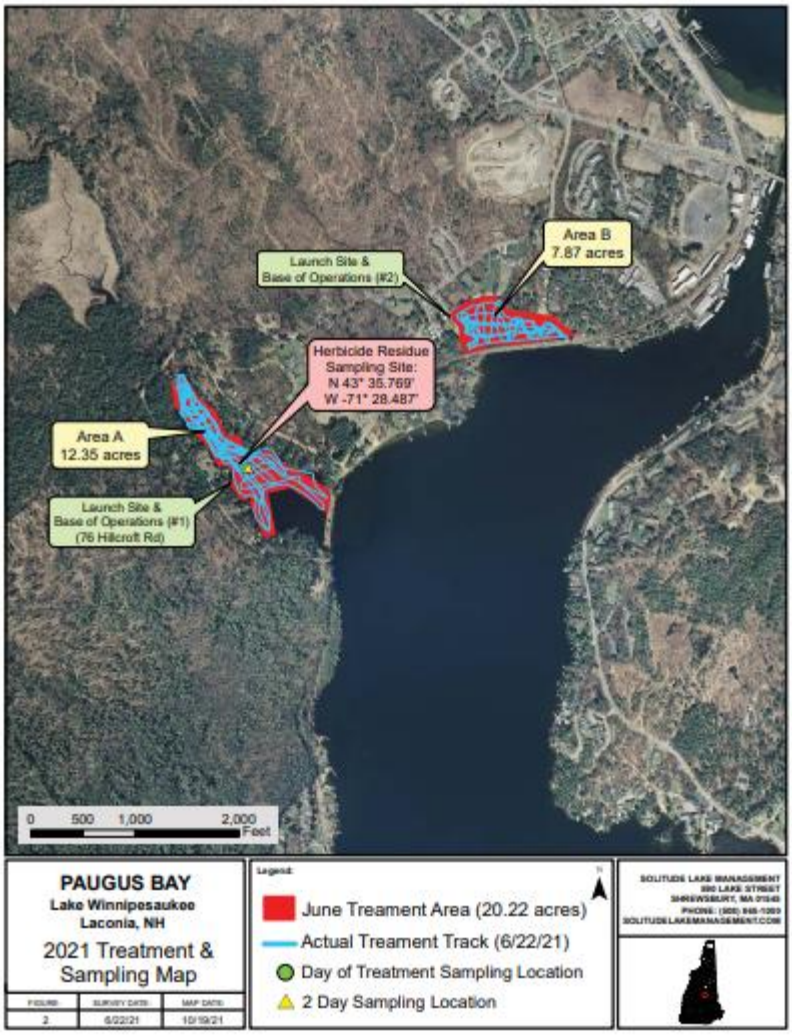

Launch Site &
Base of Operations
Herbicide Residue
Sampling Site A:
N 43° 35.759'
W 71° 28.182'
Area A
9 acres
Area B
8 acres
Herbicide Residue
Sampling Site B:
N 43° 35.466'
W 71° 28.263'
0
400
800
1,600
Foot
PAUGUS BAY
Lake Winnipesaukee
Laconia, NH
2019 Actual August
Treatment & Sampling Map
FIGURE:
SURVEY DATE:
MAP DATE:
2
8/22/19
10/2/19
Legend:
N
August Treament -
Areas A & B (A=9 ac, B= 8 ac)
Actual August Treatment Track (8/22/19)
3 Day Sampling Location
7 Day Sampling Location
SOLITUDE LAKE MANAGEMENT
380 LAKE STREET
SHREWSBURY, MA 01545
PHONE: (508) 865-1600
SOLITUDELAKEMANAGEMENT.COM

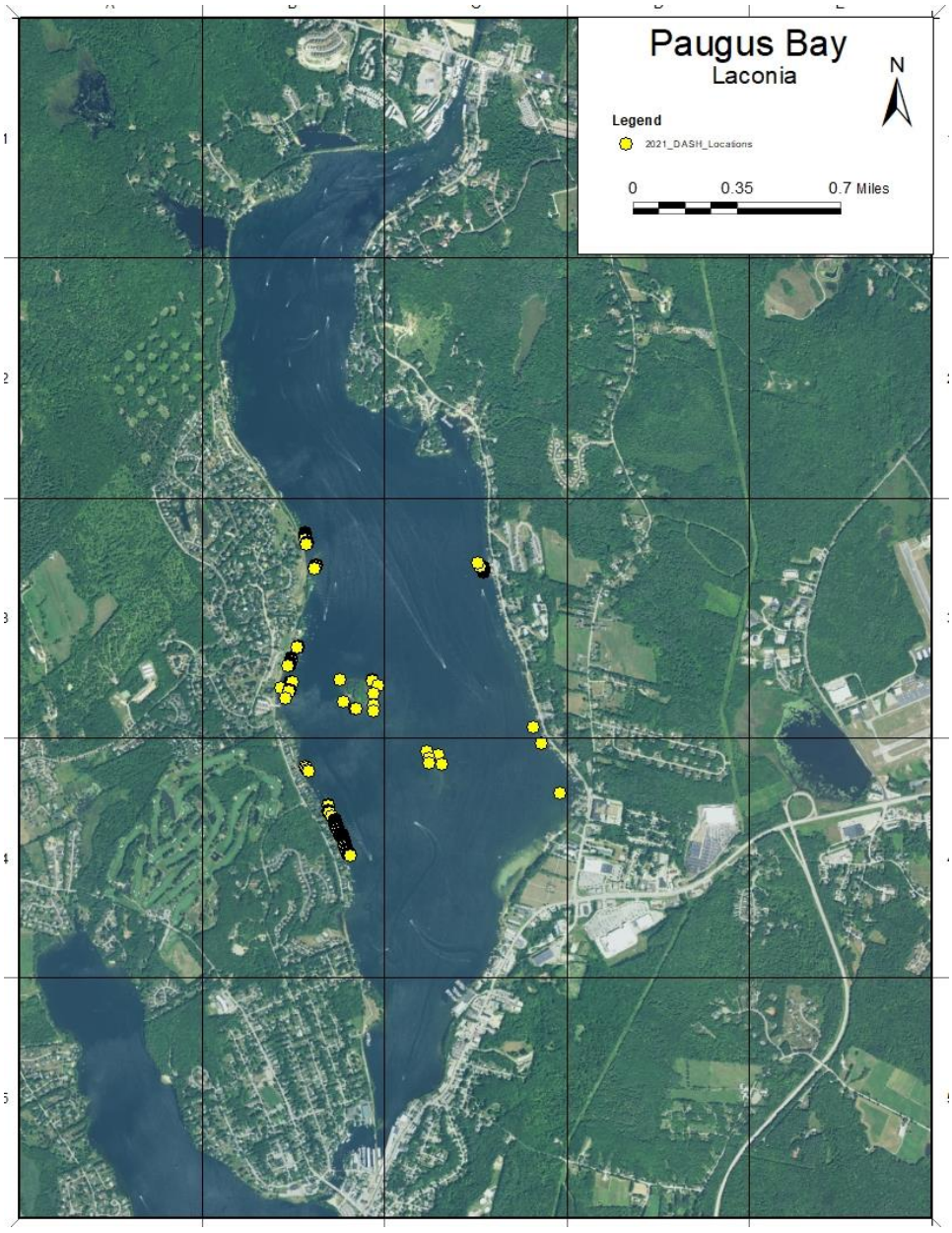
2020 Actual (dive maps from AB Aquatic)



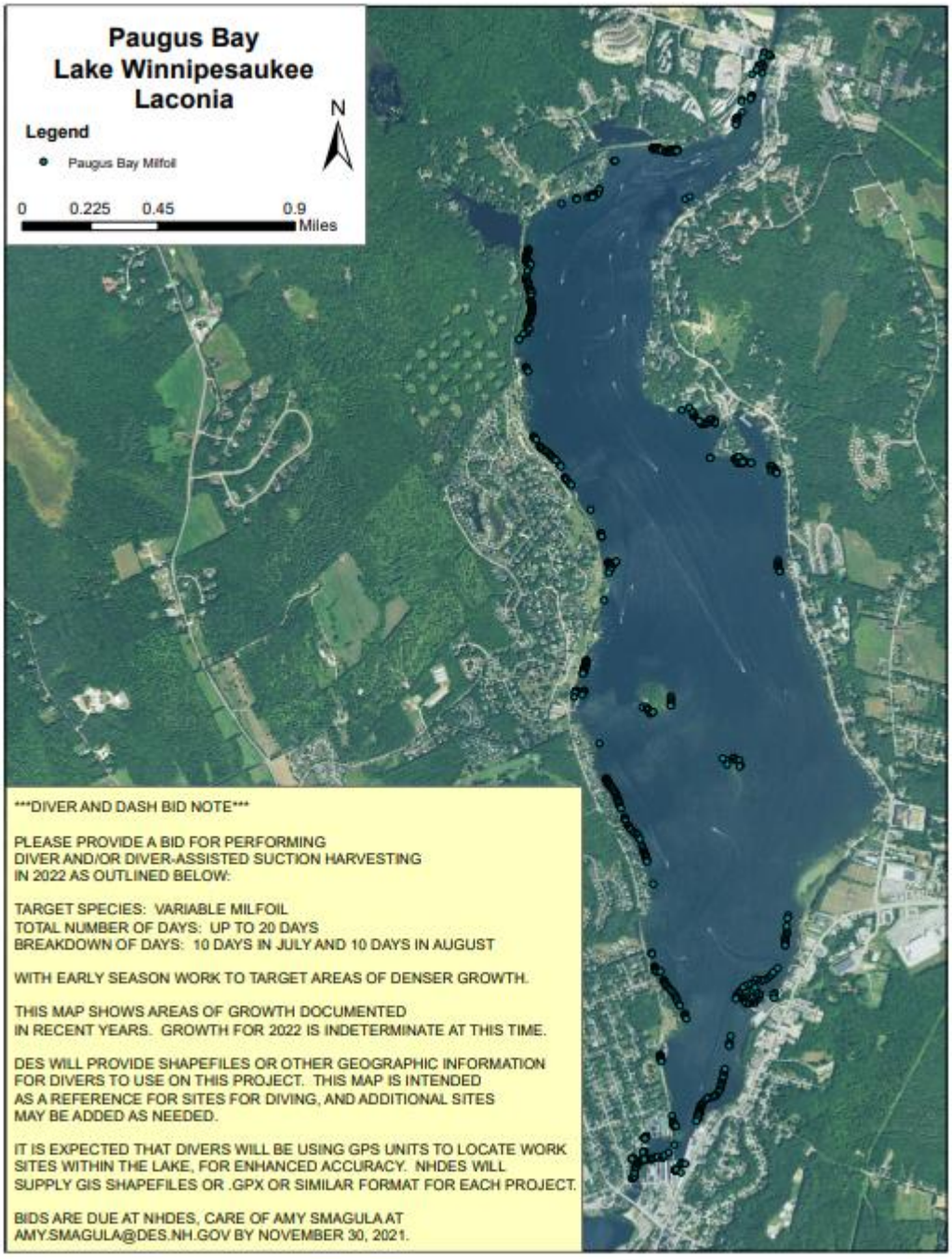

Chattle Cove
43.5999
43.5984
Pickerel Cove
Plummer Island
9/2/20

2021 Actual


Area B
7.87 acres
Launch Site &
Base of Operations (#2)
Herbicide Residue
Sampling Site:
N 43° 35.769'
W -71° 28.487'
Area A
12.35 acres
Launch Site &
Base of Operations (#1)
(76 Hillcroft Rd)
0 500 1,000 2,000
Feet
PAUGUS BAY
Lake Winnipesaukee
Laconia, NH
2021 Treatment &
Sampling Map
FIGURE
SURVEY DATE
MAP DATE
2
6/22/21
10/19/21
Legend:
June Treament Area (20.22 acres)
Actual Treament Track (6/22/21)
Day of Treatment Sampling Location
2 Day Sampling Location
SOLITUDE LAKE MANAGEMENT
PHONE: (508) 948-1099
SOLITUDELAKEMANAGEMENT.COM


Paugus Bay
Laconia
N
Legend
2021_DASH_Locations
0
0.35
0.7 Miles

2022 Proposed



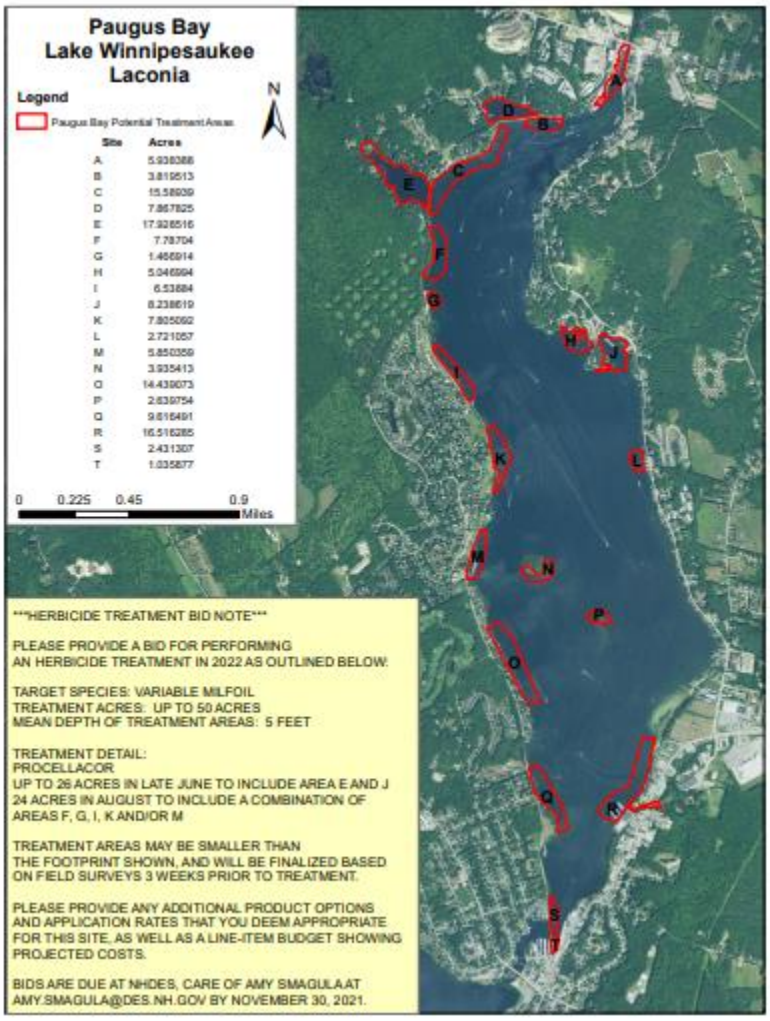
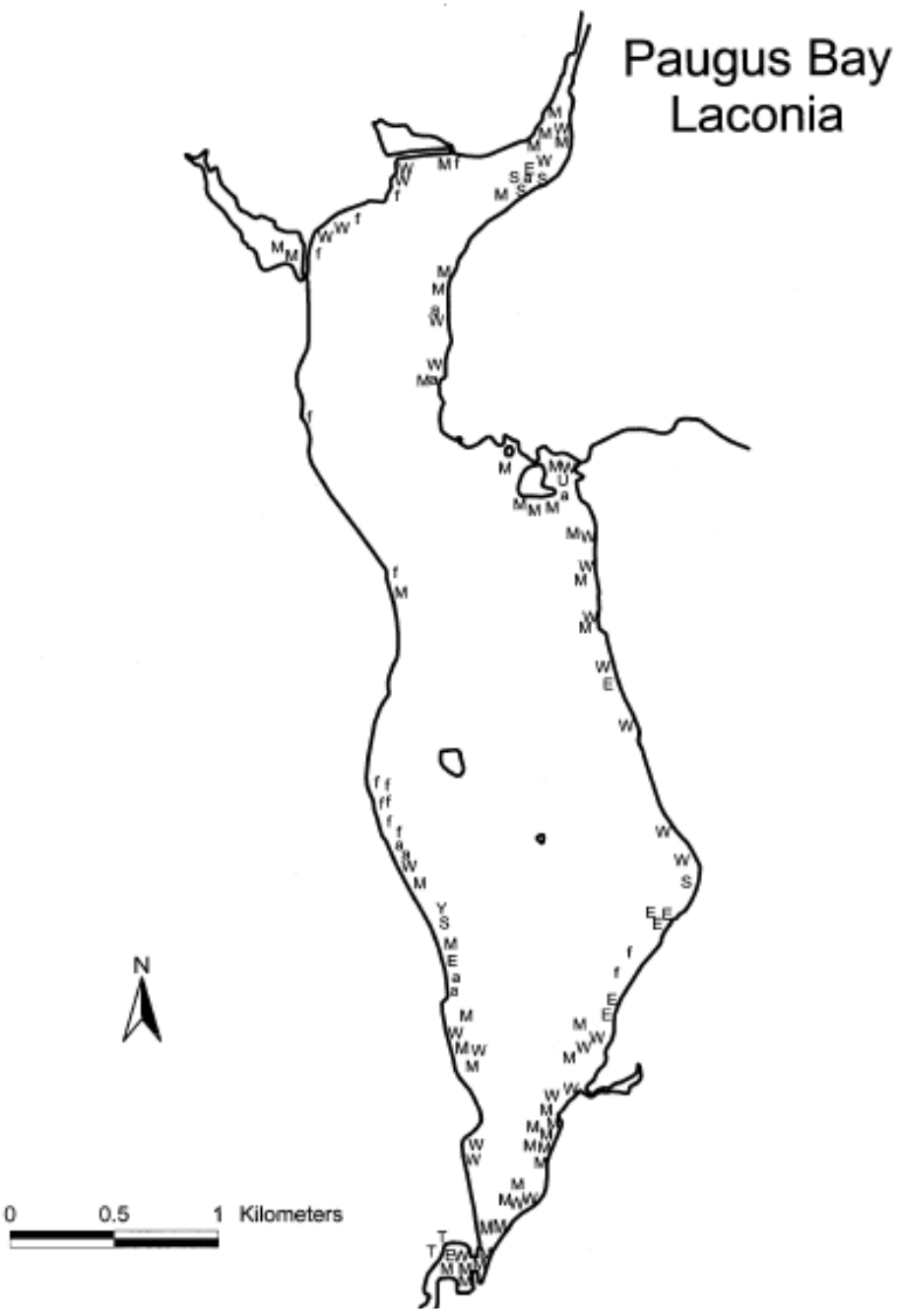

Paugus Bay
Lake Winnipesaukee
Laconia
Legend
Paugus Bay Potential Treatment Areas
N
Site Acres
A 5.938388
B 3.819513
C 15.58939
D 7.867825
E 17.926516
F 7.78704
G 1.466914
H 5.046994
I 6.53684
J 8.238619
K 7.805092
L 2.721057
M 5.850359
N 3.935413
O 14.439073
P 2.639754
Q 9.616491
R 16.516285
S 2.431307
T 1.035877
0 0.225 0.45 0.9
Miles
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
HERBICIDE TREATMENT BID NOTE
PLEASE PROVIDE A BID FOR PERFORMING
AN HERBICIDE TREATMENT IN 2022 AS OUTLINED BELOW:
TARGET SPECIES: VARIABLE MILFOIL
TREATMENT ACRES: UP TO 50 ACRES
MEAN DEPTH OF TREATMENT AREAS: 5 FEET
TREATMENT DETAIL:
PROCELLACOR
UP TO 26 ACRES IN LATE JUNE TO INCLUDE AREA E AND J
24 ACRES IN AUGUST TO INCLUDE A COMBINATION OF
AREAS F, G, I, K AND/OR M
TREATMENT AREAS MAY BE SMALLER THAN
THE FOOTPRINT SHOWN, AND WILL BE FINALIZED BASED
ON FIELD SURVEYS 3 WEEKS PRIOR TO TREATMENT.
PLEASE PROVIDE ANY ADDITIONAL PRODUCT OPTIONS
AND APPLICATION RATES THAT YOU DEEM APPROPRIATE
FOR THIS SITE, AS WELL AS A LINE-ITEM BUDGET SHOWING
PROJECTED COSTS.
BIDS ARE DUE AT NHDES, CARE OF AMY SMAGULA AT
AMY.SMAGULA@DES.NH.GOV BY NOVEMBER 30, 2021.

Figure 3: Map of Native Aquatic Macrophytes



Key to Macrophyte Map

AQUATIC PLANT SURVEY

LAKE: PAUGUS BAY TOWN: LACONIA DATE: 09/07/2000

Key	PLANT NAME		ABUNDANCE
	GENERIC	COMMON	
T	Typha	Cattail	Sparse
f		Filamentous algae	Scattered
E	Eriocaulon septangulare	Pipewort	Scattered
M	Myriophyllum heterophyllum	Water milfoil	Common
W	Potamogeton	Pondweed	Scattered
S	Sparganium americanum	Bur reed	Sparse
a	Potamogeton amplifolius	Bass weed	Scattered
U	Utricularia	Bladderwort	Sparse
J	Najas	Bushy pondweed	Sparse
e	Elodea nuttallii	Waterweed	Sparse
Y	Nuphar	Yellow water lily	Sparse

OVERALL ABUNDANCE: Scat/Common

Figure 4: Bathymetric Map

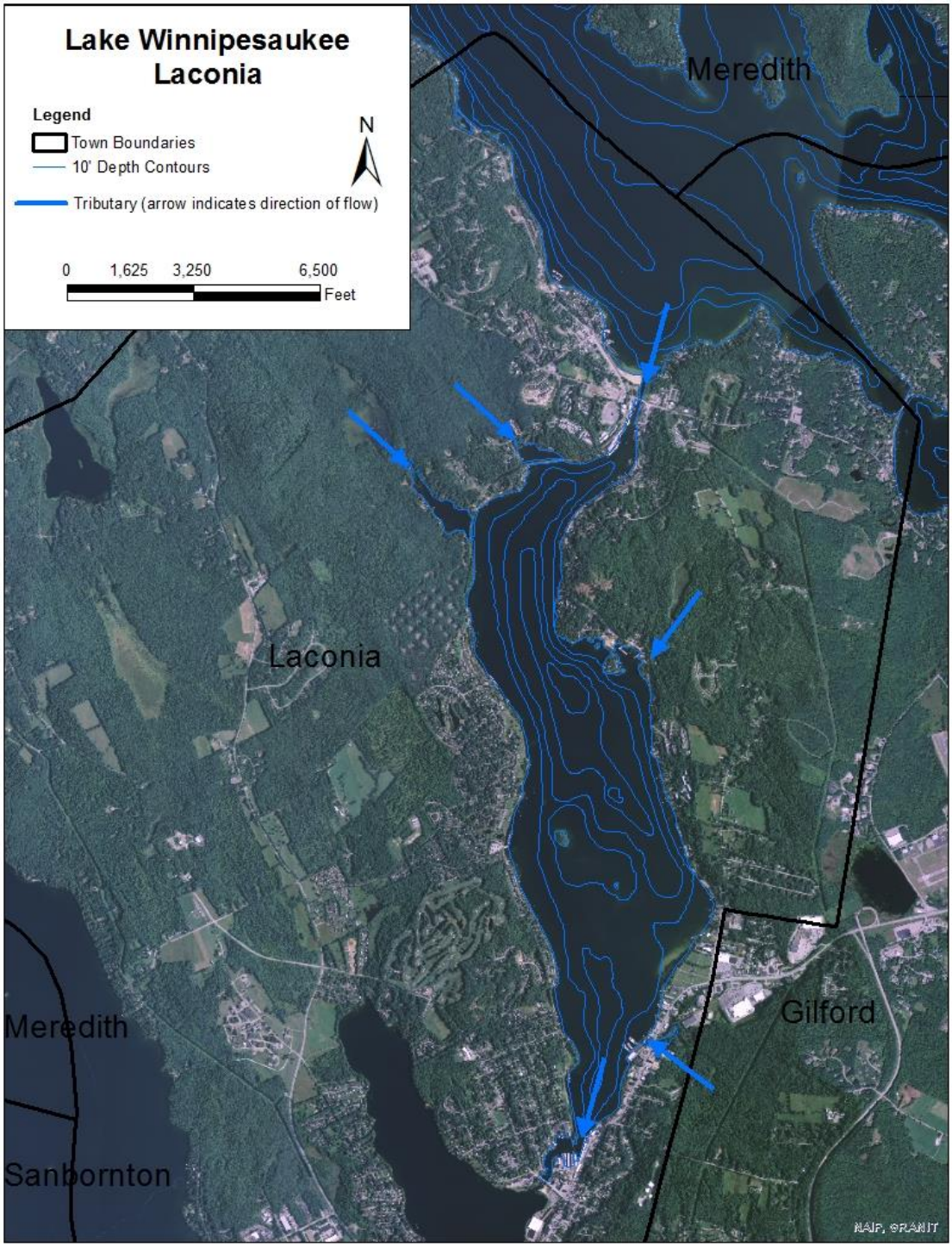


Figure 5: Critical Habitats or Conservation Areas

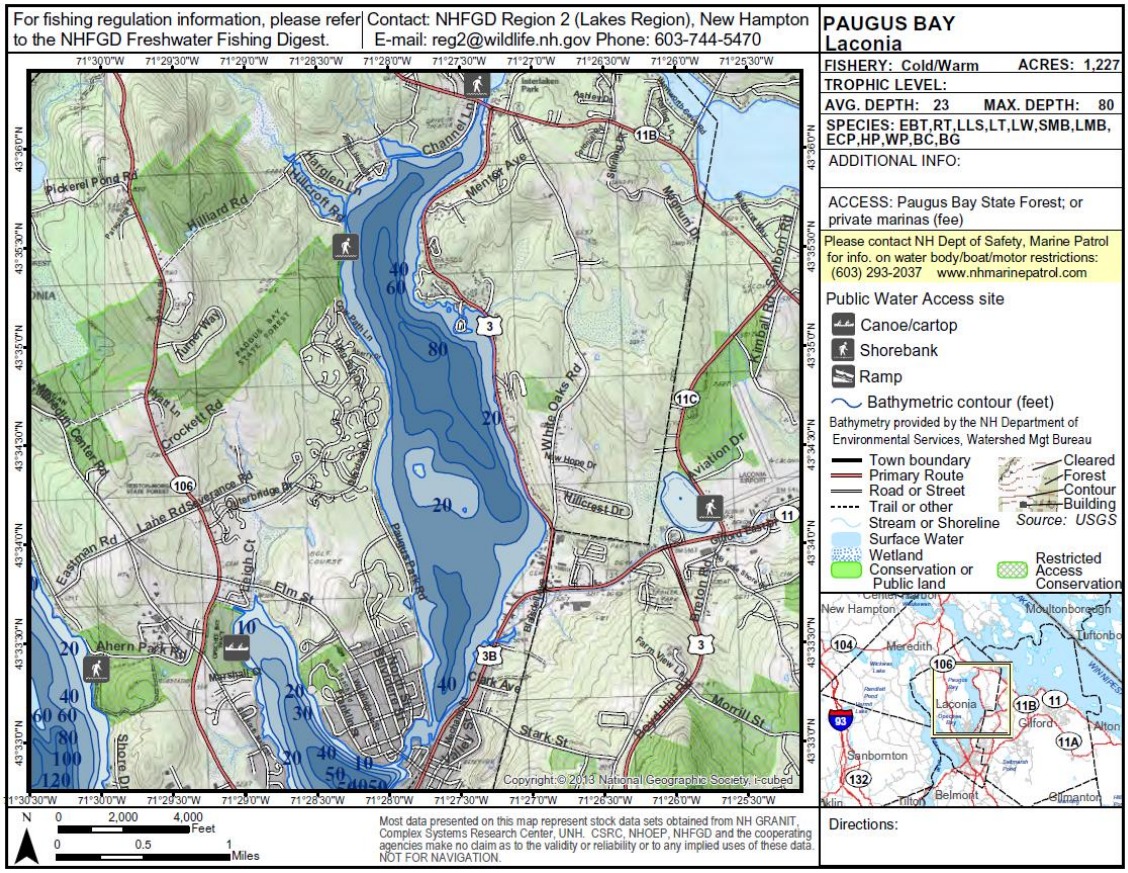
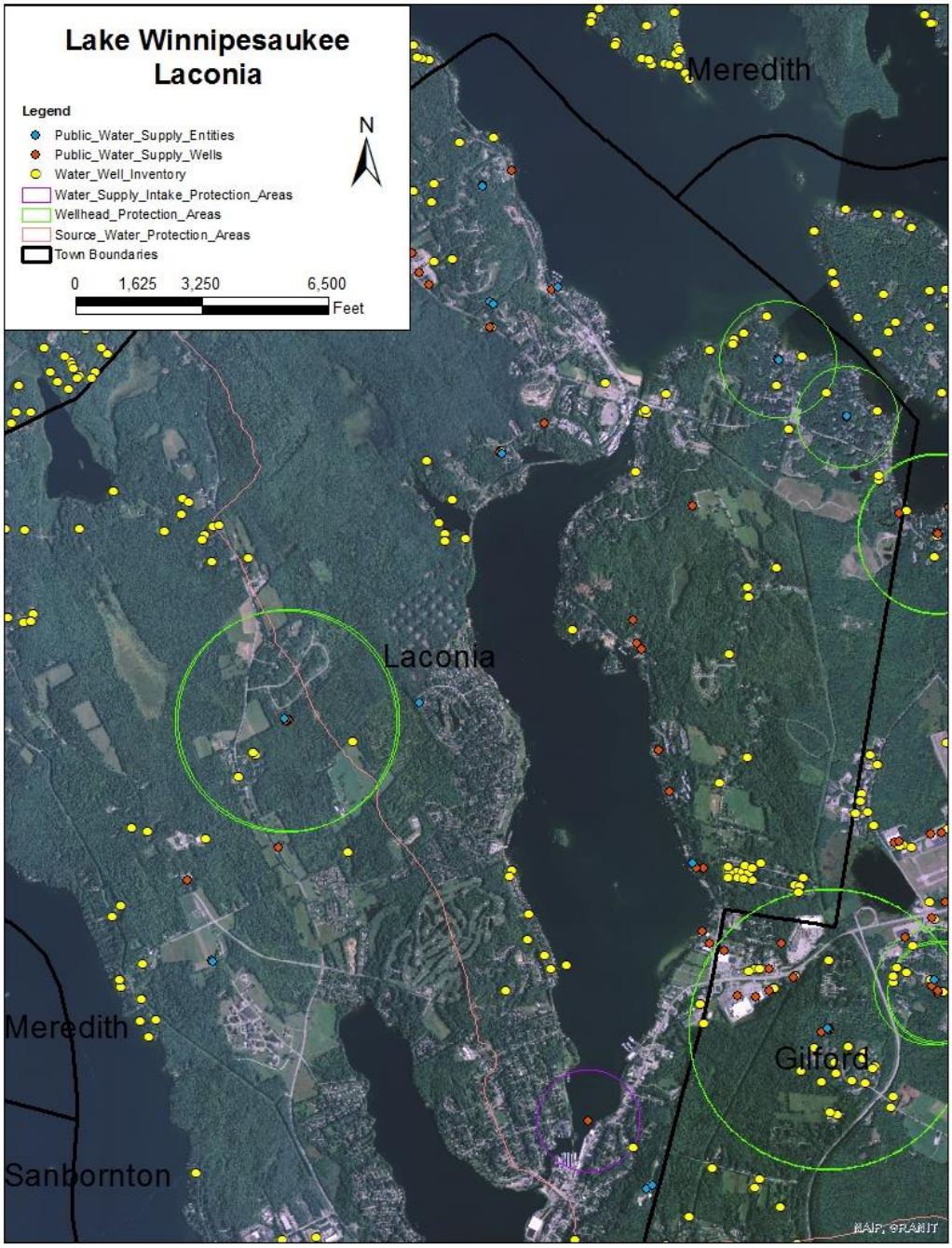


Figure 6: Public Use/Access Sites

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 <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 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, ProcellaCOR or 2,4-D (Navigate formulation) are the herbicides that are recommended for control of variable milfoil. Based on laboratory and field trials, these are the most effective herbicides 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.

In 2018, a new aquatic formulation of an herbicide was labeled and licensed for use. ProcellaCOR is a reduced-risk liquid formulation herbicide that is a systemic. Based on New Hampshire field data, it works well on variable milfoil, it is taken up very quickly following treatment (hours) and it degrades quickly in the water column, with typical non-detect readings within 24-48 hours post treatment.

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.

Biological Control

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

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