WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

November 21, 2024

Hop Brook Protection Association
PO Box 707
Sudbury, MA 01776
Sent via email: jeff@hopbrook.org

Re: Hop Brook Ponds (Stearns Millpond, Carding Millpond, and Grist Millpond), Sudbury, MA (DEP#301-1283) – 2024 Year End Report

Dear Hop Brook Protection Association Members:

It is our pleasure to present a year-end summary report to The Hop Brook Protection Association regarding the 2024 aquatic management program at the Hop Brook Ponds. The Hop Brook waterbodies include Stearns Millpond, Carding Millpond, and Grist Millpond, all located in Sudbury, MA.

Historically, Hop Brook Protection Association has battled invasive species water chestnut *(Trapa natans)* within all three waterbodies: Stearns Millpond, Carding Millpond, and Grist Millpond. The goal of the 2024 program was to manage the invasive water chestnut population while examining basic water quality through a proactive monitoring schedule. This would be accomplished by implementing an aquatic management program that focused around performing all applicable tasks, including planning, permitting, surveys, treatments, and reporting.

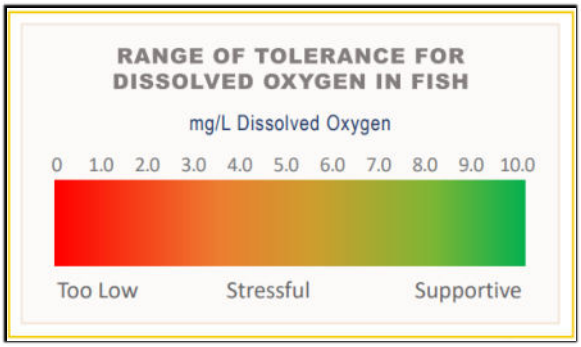

Figure 1: Dissolved oxygen table

During each visit to the ponds, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Additionally, dissolved oxygen (DO) and temperature readings were collected throughout the season using a calibrated YSI meter with optical sensor (Figure 2). Dissolved oxygen is the amount of oxygen in water that is available to aquatic organisms. DO is necessary to support fish spawning, growth, and activity. Tolerance varies by species, please see the figure provided for a general range of fish tolerance (Source: epa.gov). Dissolved oxygen can be affected by many outside factors, such as: temperature, time of day, and pollution. Dissolved oxygen levels are typically lowest early in the morning. Healthy water should generally have concentrations of about 6.5-8+ mg/L (Figure 1). Water clarity was also assessed using a Secchi disk, as applicable (Figure 2). A Secchi disk is a disk with alternating black and white quadrants. It is lowered into the water of a pond or lake until it can no longer be seen by the observer. This depth of disappearance, called the

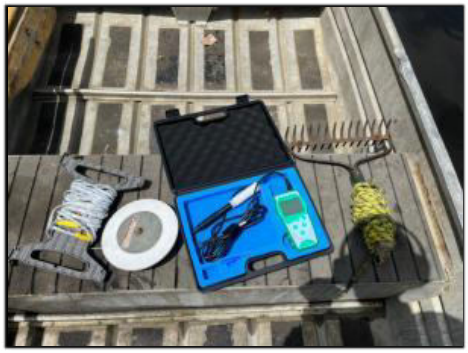
Figure 2: Equipment and meters utilized during each site visit

Secchi depth, is a measurement of the transparency of the water. All readings are included in the tables throughout this report.

All permitting, treatments, and survey tasks were completed without issue and at the proper times. The tables throughout the report provide the specific dates of each task. Below the table, each visit/task performed is described in additional detail.

Stearns Millpond

Stearns Millpond (Figure 3) is the northernmost waterbody of the three Hop Brook Ponds and is approximately 16.8 acres. This pond is primarily surrounded by woodlands with developed properties scattered on both the northern and southern shorelines. The inlet (which is Hop Brook) to Stearns Millpond is found along the southwestern point. Water flows from west to east within the waterbody, with the outlet noted at the northeastern point (adjacent to the public parking lot). This outlet is a constructed dam that flows back into Hop Brook. The Pond is fairly shallow, with an average depth of roughly 2.5-3 feet. Access to this waterbody is gained from the public parking lot off of Dutton Road.

Figure 3: Stearns Millpond - Sudbury, MA

Summary Of 2024 Management Activities

Date	Task/Description
June 5, 2024	A pre-management survey was performed to document baseline conditions of the pond, note the current vegetation species/densities present, and to guide future 2024 management; Water samples were collected
July 2, 2024	An interim survey was conducted to confirm treatment areas; The initial water chestnut treatment was completed
August 1, 2024	An interim survey was conducted to evaluate the effectiveness of the previous treatment; The follow-up water chestnut treatment was completed
September 16, 2024	A post-management survey was completed to evaluate the effectiveness of the previous treatment and the overall 2024 aquatic management program, and to guide recommendations for 2025; Water samples were collected

June 5, 2024 - Pre-Management Survey / Water Samples Collected

On June 5th, Aquatic Biologist, Grace Adams, and Environmental Scientist, Harley Westgate, made a visit to Stearns Millpond. The visit consisted of a survey and collecting water quality data.

Upon arrival at the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are

documented in the table below. (*) denotes an invasive species. Invasive species are non-native to the ecosystem and are likely to cause economic harm, environmental harm, or harm to human health.

Figure 4: Stearns Millpond during June 5th visit

Species Identified	
Common Name	**Latin Name**
Common Waterweed/Elodea	*Elodea canadensis*
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Curly-leaf Pondweed*	*Potamogeton crispus*
Coontail	*Ceratophyllum demersum*
Thin-leaf Pondweed	*Potamogeton pusillus*
Filamentous Algae	
Benthic Algae	
Burreed	*Sparganium*
Waterlilies	*Nymphaeaceae*
Common Reed*	*Phragmites australis*

Additional samples were collected from the contracted locations. The samples were properly preserved, and shipped on-ice via FedEx Overnight, or transported directly to the most appropriate lab. The lab will analyze the samples for the contracted/required parameters which are listed in the table to the right.

Water Quality Parameters
pH, Nitrate Nitrogen, Total Kjeldahl Nitrogen (TKN), Ammonia, Total Phosphorus, Dissolved Phosphorus, Algae ID and Enumeration, E. Coli Enumeration, Turbidity, True Color, Apparent Color, Alkalinity

During the survey, two invasive species were noted: sparse water chestnut at the north end of the pond and in scattered trace to sparse patches throughout the entirety of the pond. Curly-leaf pondweed (*Potamogeton crispus)* was also found throughout nearly the entirety of the pond. Water chestnut was growing moderately within the water column toward the southern end of the pond, while curly-leaf was mixed in with dense populations of elodea (*Elodea canadensis)* throughout. Coontail (*Myriophyllum demersum* – Figure 4) was also found in sparse to moderate densities across the entire pond, along with thin-leaf pondweed (*Potamogeton pusillus)*. No milfoil was found, though coontail could be mistaken for it. Filamentous algae was documented towards the south end of the pond, along with moderate densities of benthic algae.

Occasional patches of waterlilies (*Nymphaeaceae)* and burred (*Sparganium)* were documented at the southern end of the pond. Very shallow waters and dense vegetation prevented boat access, so the survey was performed by kayak. Dense elodea added to difficulties navigating, even in a kayak. Elodea decreased to sparse densities towards the southern end of the pond. Phragmites (*Phragmites australis)* were spotted

along one of the shorelines. Pollen was seen across the surface at windblown shorelines. Water samples, dissolved oxygen profile, and clarity measurements were taken.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (℃)	DO (mg/L)
Surface	25.7	9.43
1’	22.5	8.77
2’	21.1	7.85
Bottom	24.8	7.62

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	3'1" - to the bottom

July 2, 2024 – Survey / Initial Herbicide Treatment

On July 2nd, Senior Aquatic Biologist, Colin Gosselin, and Environmental Scientist, Jake McNary, made a visit to Stearns Millpond. This site visit included conducting a brief survey and performing the initial treatment.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Curly-leaf Pondweed*	*Potamogeton crispus*
Filamentous Algae	
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Common Waterweed/Elodea	*Elodea canadensis*
Coontail	*Ceratophyllum demersum*

Figure 5: Water chestnut in Stearns Millpond

Upon arrival a brief survey was conducted to confirm conditions and to guide the treatment process. Overall, water chestnut was greatly reduced from last year which was a fantastic sign. Stearns millpond showed great reduction, with scattered small patches or individual plants throughout (Figure 5).

A treatment was conducted for the control of water chestnut. The liquid herbicide, Clearcast (imazamox), was applied using the most appropriate boat, equipped with a calibrated pump, which is used to target the water chestnut plants via foliar application methodology. This method allows for even and precise coverage. Prior to the treatment, the shoreline was posted with neon signage noting the treatment,

affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

Prior to the visit, the weather was closely monitored to ensure a date without precipitation forecasted or high winds. Overall, the weather during and after the treatment was perfect with little wind and clear skies. Based on the survey, treatment was conducted using Imazamox herbicide. We also chose to incorporate selective hand-pulling when appropriate (where individual plants were observed). The treatment went well, and excellent coverage was achieved. Both an airboat and a jon boat were used. Both boats were thoroughly cleaned prior to being brought to the site. If used on multiple ponds, the boats were washed and inspected in between launches.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (℃)	DO (mg/L)
Surface	27.6	8.54
1’	26.0	7.87
2’	24.4	7.45
Bottom	24.1	7.13

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	2’6” (To the bottom)

August 1, 2024 - Survey / Follow-up Herbicide Treatment

On August 1st, Senior Aquatic Biologist, Colin Gosselin, and Environmental Scientist, Jake McNary, made a visit to Stearns Millpond. A survey to assess treatment areas was conducted and a follow-up herbicide treatment was applied.

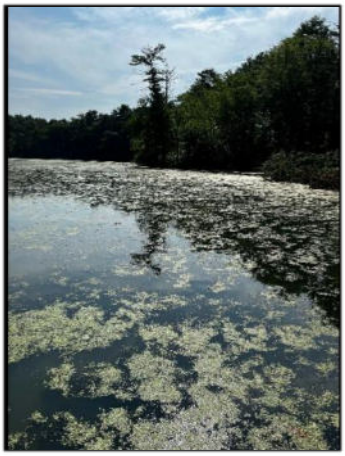

Figure 6: Stearns Millpond during Aug 1st visit

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Filamentous Algae	
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Common Waterweed/Elodea	*Elodea canadensis*
Coontail	*Ceratophyllum demersum*

At the time of this visit, Stearns Millpond had an algae bloom that discolored the water. Water chestnut in Stearns was scattered in smaller bunches throughout the waterbody, which was mixed throughout native pondweeds and algae (Figure 6). Based on the densities in Stearns Millpond, hand-pulling was also incorporated with the treatment. Navigation in Stearns was especially challenging due to dense vegetative mats, although this was manageable.

A follow-up treatment was conducted for the control of invasive water chestnut. Clearcast (imazamox), was paired with a non-ionic surfactant. The mixture was applied to live water chestnut via foliar application using low-volume calibrated spray equipment. This methodology allows for even coverage and distribution to the target water chestnut, while limiting any non-target impacts. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high winds. Prior to the treatment, the shoreline was posted with neon signage noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

Overall, we anticipated an extremely high level of success through this year's water chestnut treatment program. The weather for this event was perfect. The boat, when used in multiple water bodies, was cleaned in between launches.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (°C)	DO (mg/L)
Surface	28.4	7.54
1'	27.6	7.10
2'	27.2	6.43
Bottom	27.2	6.41

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	1'7"

September 16, 2024 - Post-Management Survey / Water Samples Collected

On September 16th, Environmental Scientist, Harley Westgate, made a visit to Stearns Millpond. The visit to Stearns Millpond included conducting a post-management survey and collecting basic water quality data in addition to collecting water samples.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Purple Loosestrife*	*Lythrum salicaria*
Water Chestnut*	*Trapa natans*

Figure 7: Stearns Millpond during the September 16th visit

Filamentous Algae	
Common Waterweed/Elodea	*Elodea canadensis*
Coontail	*Ceratophyllum demersum*
Curly-leaf Pondweed*	*Potamogeton crispus*
Waterlilies	*Nymphaeaceae*
Duckweed	*Lemna*
Watermeal	*Wolffia*
Common Reed*	*Phragmites australis*
Cattails	*Typha*

Dense watermeal (*Wolffia)* with interspersed duckweed (*Lemna)* covered more than half of the pond. Elodea, which is a native species, was dense throughout the water column in several shallower areas of the pond (conditions illustrated in Figure 7). Mixed within the elodea was coontail and scattered curly-leaf pondweed. Curly-leaf pondweed is a colder-water invasive species. The curly-leaf pondweed was found at slightly higher densities in the northern portion of the pond; however, was still very much scattered. Much of the vegetation was coated in epiphytic algae, which indicates the plants were dying/decaying. The water level was much lower than usual, with the northern portion of the pond containing only inches of water, making navigation difficult. Specific to water chestnut, excellent control was achieved this year, with only a small number of individual plants being documented during the survey, mostly within the northern portion of the pond.

Additional samples were collected from the contracted locations. The samples were properly preserved, and shipped on-ice via FedEx Overnight, or transported directly to the most appropriate lab. The lab will analyze the samples for the contracted/required parameters which are listed in the table to the right.

Water Quality Parameters
Phosphorus, Total & Free Reactive (Water), Microbial Bacteria (total coliforms & E. coli), Nitrogen, Total (Kjeldahl), Alkalinity, Turbidity, Apparent Color, True Color, Algae ID, Classification, Biomass, pH, Ammonia Nitrogen, Nitrate Nitrogen

Temperature & Dissolved Oxygen		
Depth	**Surface Temp (℃)**	**Surface DO (mg/L)**
Surface	22.0	9.0
1 Foot	21.9	8.84
2 Feet	21.6	8.48

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	2’1” – to the bottom

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Carding Millpond

Carding Millpond (Figure 8) is found between Grist Millpond and Stearns Millpond. This waterbody is south of Stearns Millpond, and northeast of Grist Millpond. Carding Millpond is approximately 42.8 acres, including two islands within the middle of the pond. The northern island is roughly 0.85 acres while the southern island (the larger island) is about 2.4 acres. Access to Carding Millpond was gained from a boat launch on the northern shoreline. The road to the boat launch is found off Dutton Road, which runs along the western shoreline. The pond is surrounded by sparse woodlands with a handful of developed properties/fields mixed noted on each shoreline. Two inlets are noted within the pond, one in each southern basin. The primary inlet is found within the southwestern basin. The outlet within the pond is along the northern shoreline, which flows into Hop Brook.

Figure 8: Carding Millpond - Sudbury, MA

Summary Of 2024 Management Activities

Date	Task/Description
June 5, 2024	A pre-management survey was performed to document baseline conditions of the pond, note the current vegetation species/densities present, and to guide future 2024 management; Water samples were collected
July 2, 2024	An interim survey was completed to confirm treatment areas; The initial water chestnut treatment was performed
August 1, 2024	An interim survey was conducted to evaluate the effectiveness of the previous treatment; The follow-up herbicide treatment was completed
September 16, 2024	A post-management survey was completed to evaluate the effectiveness of the previous treatment and the overall 2024 aquatic management Program and to guide recommendations for 2025; Water samples were collected

<u>June 5, 2024 - Pre-Treatment Survey / Water Samples Collected</u>

On June 5th, Aquatic Biologist, Grace Adams, and Environmental Scientist, Harley Westgate, made a visit to Carding Millpond. During this visit, a pre-treatment survey was conducted and water samples were collected.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Duckweed	*Lemna*

Figure 9: Carding Millpond during June 5th visit

Water Chestnut*	*Trapa natans*
Filamentous Algae	
Common Waterweed/Elodea	*Elodea canadensis*
Curly-Leaf Pondweed*	*Potamogeton crispus*
Common Waterweed	*Elodea canadensis*
Thin-Leaf Pondweed	*Potamogeton pusillus*
Coontail	*Ceratophyllum demersum*

Green patches along the shoreline composed of dense populations of watermeal and duckweed (illustrated in Figure 9), with water chestnut interspersed in a scattered fashion throughout the entirety of the pond. It was noted in small patches and even singular plants. Some filamentous algae was found floating along the shoreline (scattered within the native species – Figure 9). It should be noted that the shoreline also contained pollen floating which is not to be confused for microscopic algae. Sparse to moderate densities of elodea were documented predominantly along the southeastern shoreline; however, it was observed growing throughout the majority of the pond. Coontail was also mixed within the elodea. Curly-leaf pondweed was spotted in varying densities throughout the pond. It was predominantly scattered in trace densities with an area of moderate density along the southeastern shoreline.

The southern coves predominantly contained dense populations of elodea and watermeal. Thin-leaf pondweed appeared in the southwestern cove in low densities. The southwestern cove also contained trace densities of water chestnut. The other species previously noted decreased to sparse densities in this cove, with the exception of elodea which remained moderate. Algae was most dominant around the southwestern island and the western shoreline.

Additional samples were collected from the contracted locations. The samples were properly preserved, and shipped on-ice via FedEx Overnight, or transported directly to the most appropriate lab. The lab will analyze the samples for the contracted/required parameters which are listed in the table above above.

Water Quality Parameters
pH, Nitrate Nitrogen, Total Kjeldahl Nitrogen (TKN), Ammonia, Total Phosphorus, Dissolved Phosphorus, Algae ID and Enumeration, E. Coli Enumeration, Turbidity, True Color, Apparent Color, Alkalinity

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (°C)	DO (mg/L)
Surface	27.4	10.3
1’	27.2	9.23
2’	26.0	8.81
3’	25.3	8.36
4’	24.9	8.26
Bottom	24.3	7.96

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	4'8"

July 2, 2024 – Survey / Initial Herbicide Treatment

On July 2nd, Senior Aquatic Biologist, Colin Gosselin, and Environmental Scientist, Jake McNary, made a visit to Carding Millpond. This visit included a survey (Figure 10) to assess treatment areas, followed by an herbicide application.

Figure 10: Carding Millpond during July 2nd visit

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Curly-leaf Pondweed*	*Potamogeton crispus*
Filamentous Algae	
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Common Waterweed/Elodea	*Elodea canadensis*
Coontail	*Ceratophyllum demersum*

Based on the survey, treatment was conducted using Imazamox herbicide for the control of water chestnut. We also chose to incorporate selective hand-pulling when appropriate (where individual plants were observed). The treatment went well, and excellent coverage was achieved. Both an airboat and a jon boat were used. Both boats were thoroughly cleaned prior to being brought to the site. If used on multiple ponds, the boats were washed and inspected in between launches. Prior to the treatment, the shoreline was posted with neon signage noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

Prior to the visit, the weather was closely monitored to ensure a date without precipitation forecasted or high winds. Overall, the weather during and after the treatment was perfect with little wind and clear skies. Upon arrival, a survey was conducted to confirm conditions and to guide the treatment process. Overall, water chestnut was greatly reduced from last year which was a fantastic sign. Carding Millpond contained small patches and or singular plants without many large patches.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (℃)	DO (mg/L)
Surface	25.3	9.97
1’	25.0	9.59

2’	24.9	8.7
3’	24.5	8.06
4’	24.2	7.57
Bottom	24.2	7.43

Secchi Disk Clarity (Feet)	
Secchi Disk Depth (Feet)	3’2”

August 1, 2024 - Survey / Follow-up Herbicide Treatment

Figure 11: Carding Millpond during Aug 1st visit

On August 1st, Senior Aquatic Biologist, Colin Gosselin, and Environmental Scientist, Jake McNary, made a visit to Carding Millpond. The site visit consisted of conducting a survey, collecting basic water quality data, and performing a treatment.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Filamentous Algae	
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Common Waterweed/Elodea	*Elodea canadensis*
Coontail	*Ceratophyllum demersum*

Carding Millpond contained scattered patches of water chestnut plants in low densities throughout the entire water body; however, the densities of plants were greatly reduced compared to the conditions documented during/immediately prior to the last treatment (see improved conditions in Figure 11). There was also an algae bloom present at Carding, but this bloom appeared to be less dense than Grist Millpond. Overall, we anticipated an extremely high level of success through this year’s water chestnut treatment program. The weather for this event was perfect. The boat, when used in multiple water bodies, was cleaned in between launches.

As noted, a follow-up treatment was conducted for the control of invasive water chestnut. Clearcast (imazamox), was paired with a non-ionic surfactant. The mixture was applied to live water chestnut via foliar application using low-volume calibrated spray equipment. This methodology allows for even coverage and distribution to the target water chestnut, while limiting any non-target impacts. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high winds. The treatment went extremely well. Prior to the treatment, the shoreline was posted with neon signage noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (°C)	DO (mg/L)
Surface	27.8	9.67
1’	27.4	8.33
2’	27.0	8.12
3’	26.8	8.09
Bottom	26.2	7.12

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	2’3”

September 16, 2024 - Post-Management Survey / Water Samples Collected

On September 16th, Environmental Scientist, Harley Westgate, made a visit to Carding Millpond. The site visit consisted of collecting basic water quality data in addition to water samples and performing a post-treatment survey.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Water Chestnut*	*Trapa natans*
Curly-leaf Pondweed*	*Potamogeton crispus*
Common Waterweed/Elodea	*Elodea canadensis*
Watermeal	*Wolffia*
Filamentous Algae	
Coontail	*Ceratophyllum demersum*
Cattails	*Typha*

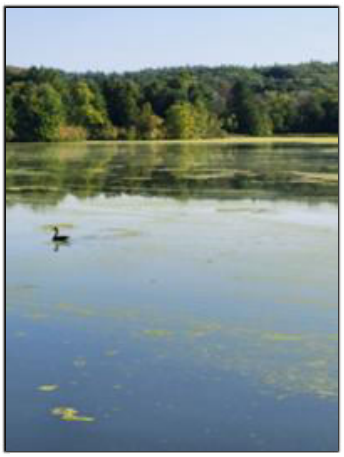

Figure 12: Carding Millpond during the September visit

Approximately half of the pond was covered in varying densities of watermeal and filamentous algae (Figure 12). Though the surface cover of vegetation in general was noticeably decreased due to the absence of water chestnut. While some water chestnut plants remained, either close to shorelines or as algae-coated masses in the water, the majority of the water chestnut was controlled through the treatment (estimated at >95%). The killed water chestnut has fallen from the water column. Curly-leaf pondweed, a colder-water invasive species, was found in the back portion of the pond, though the plants were late season growth and were immature. The water level was low and navigation around the island was restricted, so the throw-rake was used to access plant species within this area. At times, portions of the pond bottom were exposed as land, which became habitat for geese and other wildlife to utilize/traverse.

Additional samples were collected from the contracted locations. The lab will analyze the samples for the contracted/required parameters which are listed in the table to the right.

Water Quality Parameters
Phosphorus, Total & Free Reactive (Water), Microbial Bacteria (total coliforms & E. coli), Nitrogen, Total (Kjeldahl), Alkalinity, Turbidity, Apparent Color, True Color, Algae ID, Classification, Biomass, pH, Ammonia Nitrogen, Nitrate Nitrogen

Temperature & Dissolved Oxygen		
Depth	**Surface Temp (℃)**	**Surface DO (mg/L)**
Surface	21.8	10.03
1 Foot	21.6	10.01
2 Feet	21.6	9.12
3 Feet	21.2	8.6
4 Feet	20.6	8.03

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	3’4”

Grist Millpond

Figure 13: Grist Millpond - Sudbury, MA

Grist Millpond (pictured in Figure 13) is found north of Route 20 (Boston Post Road) and south of Wayside Inn Road. This waterbody is approximately 12.9 acres and is surrounded by woodlands and wetlands, with a small number of developed properties along the northern shoreline. The Wayside Inn Grist Mill is located downstream of the pond. Access to the Pond was gained from the northeastern point of the waterbody, adjacent to the outlet. Water flows from the west (inlet at the western point) to east within Grist Millpond. The outlet to the pond is a small culvert that is noted underneath a walking path. There are walking paths observed around portions of the perimeter of this waterbody. Grist Millpond is a well-known historical site in addition to a popular location for outdoor recreational activities such as hiking, fishing, walking dogs, and bird watching. There is public parking off Wayside Inn Road for both the Grist Millpond area as well as the Wayside Inn Grist Mill area.

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Summary Of 2024 Management Activities

Date	Task/Description
June 5, 2024	A pre-management survey was performed to document baseline conditions of the pond, note the current vegetation species/densities present, and to guide future 2024 management; Water samples were collected
July 2, 2024	An interim survey was conducted to confirm potential treatment areas; The initial water chestnut treatment was conducted
August 1, 2024	An interim survey was conducted to evaluate the effectiveness of the previous treatment; Follow-up water chestnut treatment completed
September 16, 2024	A post-management survey was completed to evaluate the effectiveness of the previous treatment and the overall 2024 aquatic management program, and to guide recommendations for 2025; Water samples were collected

<u>June 5, 2024 - Pre-Treatment Survey / Water Samples Collected</u>

On June 5th, Aquatic Biologist, Grace Adams, and Environmental Scientist, Harley Westgate, made a visit to Grist Millpond. During this visit, a pre-treatment survey was conducted, and water samples were collected. Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Watermeal	*Wolffia*
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Thin-leaf Pondweed	*Potamogeton pusillus*
Curly-Leaf Pondweed*	*Potamogeton crispus*
Common Waterweed	*Elodea canadensis*

Duckweed and watermeal were growing around the edges of the pond, most prominently along the northeastern shoreline. Water chestnut was growing both on surface and throughout water column across the entirety of the pond but grew less dense moving southwest (Figure 14). Densities varied throughout, with much of the water chestnut being in the water column during the survey. Overall, it appeared reduced from previous years and was found in small patches or even as single plants.

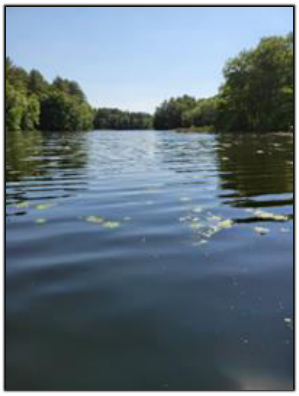

Figure 14: Grist Millpond during June 5th visit

Curly-leaf pondweed was growing interspersed with thin-leaf pondweed across the entire pond. At the north end, curly-leaf pondweed contained epiphytic algae which indicates the plants are dying/decaying/unhealthy. Towards the southwestern portion of the pond, thin-leaf pondweed became denser. Both thin-leaf and curly-leaf pondweed contained epiphytic algae at the southern end. Elodea could be seen growing in shallow portions of the pond. Overall, thin-leaf

pondweed and elodea were the most prominent natives. Boat maneuverability was limited due to shallow water and vegetation density.

Additional samples were collected from the contracted locations. The samples were properly preserved, and shipped on-ice via FedEx Overnight, or transported directly to the most appropriate lab. The lab will analyze the samples for the contracted/required parameters which are listed in the table to the right.

Water Quality Parameters
pH, Nitrate Nitrogen, Total Kjeldahl Nitrogen (TKN), Ammonia, Total Phosphorus, Dissolved Phosphorus, Algae ID and Enumeration, E. Coli Enumeration, Turbidity, True Color, Apparent Color, Alkalinity

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (°C)	DO (mg/L)
Surface	27.9	9.02
1’	27.9	8.96
2’	25.8	8.92
3’	25.2	8.46
Bottom	24.8	8.21

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	3'5"

July 2, 2024 – Survey / Initial Herbicide Treatment Conducted

Figure 15: Grist Millpond during July 2nd visit

On July 2nd, Senior Aquatic Biologist, Colin Gosselin, and Environmental Scientist, Jake McNary, made a visit to Grist Millpond. The site visit consisted of collecting basic water quality data, completing a survey, and conducting the initial treatment.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	**Latin Name**
Curly-leaf Pondweed*	*Potamogeton crispus*
Filamentous Algae	
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Common Waterweed/Elodea	*Elodea canadensis*

Coontail	*Ceratophyllum demersum*

Prior to the visit, the weather was closely monitored to ensure a date without precipitation forecasted or high winds. Overall, the weather during and after the treatment was perfect with little wind and clear skies. Upon arrival a brief survey was conducted to confirm conditions and to guide the treatment process. Overall, water chestnut was greatly reduced from last year which was a fantastic sign. Grist Millpond contained scattered plants throughout with the majority being near the inlet and a few large patches near the outlet (documented in Figure 15). Topped out elodea was found throughout the pond mixed with duckweed and algae.

Based on the survey, treatment was conducted using Imazamox herbicide for the control of water chestnut. The liquid herbicide, Clearcast (imazamox), was applied using the most appropriate boat, equipped with a calibrated pump, which is used to target the water chestnut plants via foliar application methodology. This method allows for even and precise coverage. We also chose to incorporate selective hand-pulling when appropriate (where individual plants were observed). The treatment went well, and excellent coverage was achieved. Both an airboat and a jon boat were used. Both boats were thoroughly cleaned prior to being brought to the site. If used on multiple ponds, the boats were washed and inspected in between launches. Prior to the treatment, the shoreline was posted with neon signage noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (℃)	DO (mg/L)
Surface	23.4	8.91
1’	23.4	8.27
2’	23.1	8.12
3’	22.8	7.57
Bottom	22.4	7.43

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	2’3”

August 1, 2024 - Survey / Follow-up Herbicide Treatment

On August 1st, Senior Aquatic Biologist, Colin Gosselin, and Environmental Scientist, Jake McNary, made a visit to Grist Millpond. During this site visit, a survey to assess treatment areas and a follow-up herbicide treatment was applied.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Filamentous Algae	
Duckweed	*Lemna*
Water Chestnut*	*Trapa natans*
Common Waterweed/Elodea	*Elodea canadensis*
Coontail	*Ceratophyllum demersum*

Grist Millpond contained sparse densities of water chestnut (densities illustrated in Figure 16), though the majority of the plants noted were found near the outlet and the boat launch. Only a handful of plants were located near the inlet. Dense mats of filamentous algae were observed in the middle of the pond, and the water was bright green due to what visually appeared to be a dense microscopic algae bloom (conditions pictured in Figure 16). Water clarity was extremely low.

Figure 16: Grist Millpond during Aug 1st visit

A follow-up treatment was conducted for the control of invasive water chestnut. Clearcast (imazamox), was paired with a non-ionic surfactant. The mixture was applied to live water chestnut via foliar application using low-volume calibrated spray equipment. This methodology allows for even coverage and distribution to the target water chestnut, while limiting any non-target impacts. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high winds. Prior to the treatment, the shoreline was posted with neon signage noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

We anticipated an extremely high level of success through this year's water chestnut treatment program. The weather for this event was perfect. The boat, when used in multiple water bodies, was cleaned in between launches.

Temperature & Dissolved Oxygen		
Depth (Feet)	Temp (°C)	DO (mg/L)
Surface	27.8	9.0
1'	27.6	8.25
2'	26.5	7.12
3'	26.5	7.10
Bottom	26.4	6.43

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	8"

WATER & WETLAND
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September 16, 2024 - Post-Management Survey / Water Samples Collected

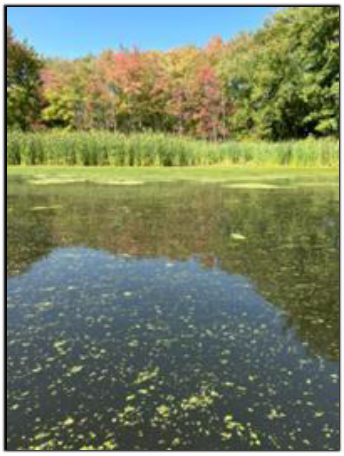

Figure 17: Grist Mill Pond during the September visit

On September 16th, Environmental Scientist, Harley Westgate, made a visit to Grist Millpond. The visit to Grist Millpond included conducting a post-management survey, collecting basic water quality data on-site, and collecting samples which were preserved and shipped to the lab for analysis.

Upon arrival to the site, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Plants documented during the survey are documented in the table below. (*) denotes an invasive species.

Species Identified	
Common Name	Latin Name
Watermeal	*Wolffia*
Duckweed	*Lemna*
Cattails	*Typha*
Common Waterweed/Elodea	*Elodea canadensis*
Filamentous Algae	
Water Chestnut*	*Trapa natans*
Coontail	*Ceratophyllum demersum*

Watermeal with some duckweed interspersed was documented covering approximately 60% of the pond's surface in varying densities (Figure 17). Within the shoreline and other shallow areas, watermeal tended to have almost complete coverage of the surface, whereas the center of the pond contained sparser coverage. Excellent control of water chestnut was achieved this year, as only a small number of plants were observed during the survey. When found, water chestnut was within the watermeal. Water chestnut seeds were also spotted floating on the surface of the pond. Elodea was the most dominant submerged aquatic species. It was surfacing at times and was predominantly found covered in dense algae. Filamentous algae was documented as "caught" within the areas of dense elodea, often developing surface mats. Aside from the minimal water chestnut, no other invasive species were documented during the survey. Overall, excellent control of invasive water chestnut was achieved this year.

Additional samples were collected from the contracted locations. The samples were properly preserved, and shipped on-ice via FedEx Overnight, or transported directly to the most appropriate lab. The lab will analyze the samples for the contracted/required parameters which are listed in the table to the right.

Water Quality Parameters
Phosphorus, Total & Free Reactive (Water), Microbial Bacteria (total coliforms & E. coli), Nitrogen, Total (Kjeldahl), Alkalinity, Turbidity, Apparent Color, True Color, Algae ID, Classification, Biomass, pH, Ammonia Nitrogen, Nitrate Nitrogen

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Temperature & Dissolved Oxygen		
Depth	**Surface Temp (℃)**	**Surface DO (mg/L)**
Surface	23.5	8.87
1 Foot	23.2	8.4
2 Feet	23.2	8.32
3 Feet	22.8	7.9
4 Feet	22.0	7.73

Secchi Disk Clarity	
Secchi Disk Depth (Feet)	3'11"

Water Quality

As required by the special orders (within the order of conditions), during the June 5th and September 16th survey events, water samples were collected to analyze specific water quality within Grist Millpond, Stearns Millpond, and Carding Millpond. Samples were collected from the middle of the ponds, preserved, and immediately taken/shipped to a State certified laboratory, where they were analyzed for the specific contracted parameters. The samples were analyzed for turbidity, true color, apparent color, total alkalinity, pH, ammonia nitrogen, nitrate nitrogen, total kjeldahl nitrogen, total phosphorus, soluble phosphorus, and E. coli. All samples collected were "surface grabs." Dissolved oxygen and temperature were measured using a calibrated meter during each site visit.

Water quality in ponds and lakes is constantly changing and is altered by many environmental factors. The samples collected during the two site visits provide a baseline and the results depict a "snap-shot" of the results specific to the sampling date. The results from the two sampling events, as well as a description of each parameter are included in the tables below.

Water Quality Parameter	Results					
	06/05/2024			09/17/2024		
	Grist Millpond	Stearns Millpond	Carding Millpond	Grist Millpond	Stearns Millpond	Carding Millpond
Turbidity (NTU)	7	5.5	6	4.2	4.6	5.3
True Color (A.P.C.U)	26	25	18	33	45	37
Apparent Color (A.P.C.U)	70	95	78	81	72	73
Total Alkalinity (mg $CaCO_3$/L)	63.6	45.3	66.4	80.8	77.3	88
pH (SU)	7.4	7.2	7.1	7.4	7.3	7.2
Ammonia Nitrogen (µg/L)	15.2	13.4	10.4	98.1	31.5	27.7
Nitrogen, Nitrate (mg/L)	1.35	0.8	0.6	2.41	0.31	0.2
Total Kjeldahl Nitrogen (mg/L)	2.55	1.18	1.41	1.32	0.58	1.04

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Total Phosphorus (µg/L)	167.1	91.4	75.5	99.8	73.9	45.9
Soluble Phosphorus (µg/L)	10.9	10.1	5.7	34.7	35.5	10.3
E. Coli (CFU/100ml)	7.5	11.9	11	155.3	55.6	15.8

Water Quality Parameter Table

Turbidity: Turbidity is either planktonic organisms or suspended solid particulates (algae, clay, silt, dead organic matter) in the water column that interfere with the penetration of light. The more suspended material throughout the water column, the higher the turbidity.
<10 NTU drinking water standards; 10-50 NTU is considered moderate; >50 NTU potentially impactful to aquatic life. All turbidity readings within the three ponds during both samplings were in a desirable range.

True Color: The color of the water sample after filtering all suspended material. This measurement represents the color of the filtered water due to dissolved components.

Apparent Color: the color of the entire water sample, which consists of color caused by both dissolved and suspended particles/components. This value can be highly variable based on weather conditions. Typically, values may increase in the case of storm events and may decrease in the event of drought.
0-25 is clear, 25-40 is light tea-color, 40-80 is tea color, >80 is dark tea color. During both samplings, all ponds showed a tea color, with Stearns appearing as a dark tea color during the June sampling and Grist Millpond barely crossing the threshold of a dark tea color during the September sampling.

Total Alkalinity: Measure of the buffering capacity of water, primarily consisting of carbonate, bicarbonate, and hydroxide in typical freshwater. Waters with lower levels are more susceptible to pH shifts.
>20 mg/L is considered healthy; ~50 mg/L illustrates the water is resistant to change. All samplings were near or slightly above 50 mg/L, illustrating that the ponds are less susceptible to pH shifts.

pH: the measure of how acidic or basic the water is.
<6 notably acidic; 6-9 standard for freshwaters (7 is neutral); >9 notably basic. pH during all samplings was within a standard range for freshwaters and near neutral in all samplings.

Nitrogen, Ammonia: Ammonia and organic nitrogen can enter water through sewage effluent and runoff from land where manure has been applied or stored. Ammonia in water is non-toxic to humans, but it is toxic to aquatic life. Unlike other forms of nitrogen, which can indirectly harm aquatic ecosystems by increasing nutrient levels and promoting algae growth in the process known as eutrophication, ammonia has direct toxic effects on aquatic ecosystems. High levels of ammonia in lakes and streams can promote the growth of algae, which in turn can choke out the growth of other aquatic plants. Bacteria can also convert ammonia in water to nitrate in a process known as nitrification. Nitrification is a beneficial process if it takes place in the soil — plants can use the produced nitrates as food. However, nitrification tends to lower the dissolved oxygen levels in water, making it harder for fish and other aquatic life to breathe.
Ammonia nitrogen was well below 500 µg/L threshold for all samplings.

Nitrogen, Nitrate: Nitrate nitrogen is important to the growth of algae. Nitrate is the oxidized nitrogen and is often readily free for algae uptake.
<1 mg/L typical for freshwater; 1-10 mg/L is potentially harmful; >10 mg/L possibly toxic. Generally, <0.30 mg/L is ideal, and a maximum of 10 mg/L is the EPA standard for drinking water. Nitrate results fell within the standard range that is typical of freshwater

Total Kjeldahl Nitrogen (TKN): Total Kjeldahl Nitrogen (TKN) is the organic and ammonia forms of nitrogen. Nitrogen is essential for living organisms to live in a pond. *Generally, concentrations below 1.0 mg/L are considered desirable. All readings were slightly above the desired range, with the exception of Stearns Millpond in September.*
Total Phosphorus: Total phosphorous is a nutrient that is essential for plants and algae to grow. Typically, a value of 30 parts per billion, or 30 µg/L, is sufficient enough to stimulate excessive plant and algae growth. This sample measures all forms of phosphorus in the water column. *<12 µg/L is considered nutrient deficient or oligotrophic; 12-24 µg/L is considered a moderate amount of nutrients, or mesotrophic; 25-96 µg/L is nutrient rich, or eutrophic; >96 µg/L is considered excessive nutrients, or hypereutrophic.* *Grist Millpond would be considered excessive nutrients, or hypereutrophic; while Stearns Millpond and Carding Millpond are considered eutrophic, or nutrient rich*
Soluble Phosphorus: Soluble phosphorous is the measure of filterable soluble and inorganic phosphorus. This form of phosphorus is directly taken up by plant cells. *Soluble phosphorus was below the concerning threshold in all three ponds.*
E. Coli: E. Coli is a potentially harmful fecal coliform bacteria that can be harmful to humans and pose a health threat. *>235 colonies/100 ml is potentially harmful. All results were well below this threshold.*

Algae Sampling

During the June 5th and September 17th sampling events, an algae sample from each Pond was collected, and transported to the lab, where they were identified for algae species and enumeration. This parameter is not required within the Order of Conditions, but we feel it has value. We did not charge an extra cost to test for this. The samples were properly preserved and shipped to SePro Labs in North Carolina where they were analyzed for algae ID and enumeration. We have attached the results to this report and have summarized below.

Blue-green algae / cyanobacteria occur in aquatic ecosystems and have the ability to produce toxins. These toxins can pose a risk to human and animal health. The Massachusetts Department of Public Health (MA DPH) recommends an advisory when cell counts exceed 70,000 per ml of water. Dense blooms and scum can contain millions of cells/ml and toxin levels in the parts per million. They can form near embankments and in areas suitable for swimming and other forms of recreation. Neither sampling event resulted in concerning cyanobacteria levels. It's important to note that prior to the sampling, during the summer months, visual signs of an algae bloom were documented. The September sample found low algae cell counts, including low blue-green counts; however, the chlorophyll a reading (from the same bottle) showed an extremely high level of algae production. These parameters are worth keeping an eye on.

Summary/2025 Recommendations

The 2024 season at Hop Brook Ponds went extremely well, despite the irregular weather pattern presented to the northeast. The management program has proven effective at maintaining and creating open-water habitat. The focus of the program was to maintain native vegetation at beneficial densities and cover while managing invasive water chestnut. This was successfully accomplished through monitoring, water quality and sample collection, and treatments. We are pleased to report that hand-pulling was also an applicable strategy this year, in conjunction with the imazamox treatments. The timing

of all management tasks allowed us to assess efficacy and adjust, as necessary, prior to water chestnut plants setting seed. Overall, excellent control of water chestnut was achieved in all three waterbodies. All notifications, communication, surveys, and water quality sampling were conducted in strict accordance with the Order of Conditions requirements. We also sampled some additional parameters (at no additional cost), out of being great stewards of water.

Looking forward to 2025, we must consider that water chestnut seeds are viable for 12+ years. Despite the great control achieved over the past few years, we anticipate regrowth in 2025 at densities and cover that warrant continued applications of Clearcast (imazamox). The approach taken in 2024 worked extremely well, as surveys and treatments were conducted early enough that several weeks remained following the 2nd treatment and the time when water chestnut seeds typically drop. We plan to take this approach again in 2025. We also plan to incorporate hand-pulling during the second treatment event for singular plants or plants in small groups. We will continue to keep both Hop Brook Protection Association and Sudbury Conservation Commission up to date throughout the season, as we did during the past several seasons. This will allow us to make the adjustments defined above, as necessary.

Aside from the water chestnut, some thought should continue to be put towards management of other nuisance and/or invasive species. Especially for Grist Millpond and Carding Millpond, many areas where water chestnut was controlled were again replaced by dense watermeal and duckweed covering the surface. Although watermeal and duckweed are both native species, their dense cover also has the ability to limit oxygen exchange and biodiversity. Additionally, these ponds specifically have additional dense species including coontail and/or elodea. Similar to previous years, curly-leaf pondweed (invasive) was again documented in all three waterbodies. In an effort to create open-water habitat in the ponds, some consideration should continue to be given to treatment with Sonar (fluridone), particularly at Carding Millpond and Grist Millpond. Sonar is an aquatic herbicide that was initially registered with the Environmental Protection Agency (EPA) in 1986 and has been used throughout Massachusetts and the United States for decades. The herbicide inhibits the photosynthesis process by stopping plants from making a protective pigment that keeps chlorophyll from breaking down in the sunlight. Fluridone moves quickly throughout a waterbody and is therefore usually applied as a whole lake/basin treatment, as would be recommended for Grist Millpond and Carding Millpond. Sonar is also one of the few herbicides approved for use in drinking water, which speaks volumes to the safety of the product. This approach requires maintenance of approximately 10-20 parts per billion of fluridone for a period of 45-60+ days, so an initial treatment and at least follow-up application would be recommended. We recommend this approach in an effort to create more open-water habitat in the ponds, specifically Grist Millpond and Carding Millpond.

We bring up Sonar as a recommendation, but not necessarily an immediate recommendation. In many cases, water chestnut becomes the first priority as is the case with Hop Brook Ponds. Once the water chestnut has been controlled to a level where minimal management is needed, such as a small amount of hand-pulling, the project could shift towards management of other species. When that time comes, Sonar is the preferred option for Hop Brook Ponds as it provides rate specific selectivity. Meaning we can control some species while growth regulating others. This approach allows for a more balanced eco-system of native plants at healthy densities.

Phosphorus levels remain elevated within the ponds. Water quality should continue to be monitored as it has been in the past. Consideration should be given to a watershed assessment to identify potential sources of phosphorus. Sediment sampling for phosphorus fractions may also be beneficial to determine the extent of internal recycling of phosphorus verses external loading. This past season was an anomaly regarding the weather, which presented the northeast with a soft winter, consistently above average temperatures, and lack of rain - which resulted in lower water levels and higher than average water temperatures. This combination of events leads to an increase of nutrient cycling within ponds/lakes, which can increase the concentration of nutrients within the water column.

We hope that this year-end report has provided Hop Brook Protection Association and Sudbury Conservation Commission with valuable information regarding the details of the work performed at Hop Brook Ponds during the 2024 season. We hope that you continue to be impressed by the level of communication, follow through, and expertise provided by Water & Wetland. We look forward to working closely with you to further improve the health of the Hop Brook Ponds for many years to come.

Sincerely,

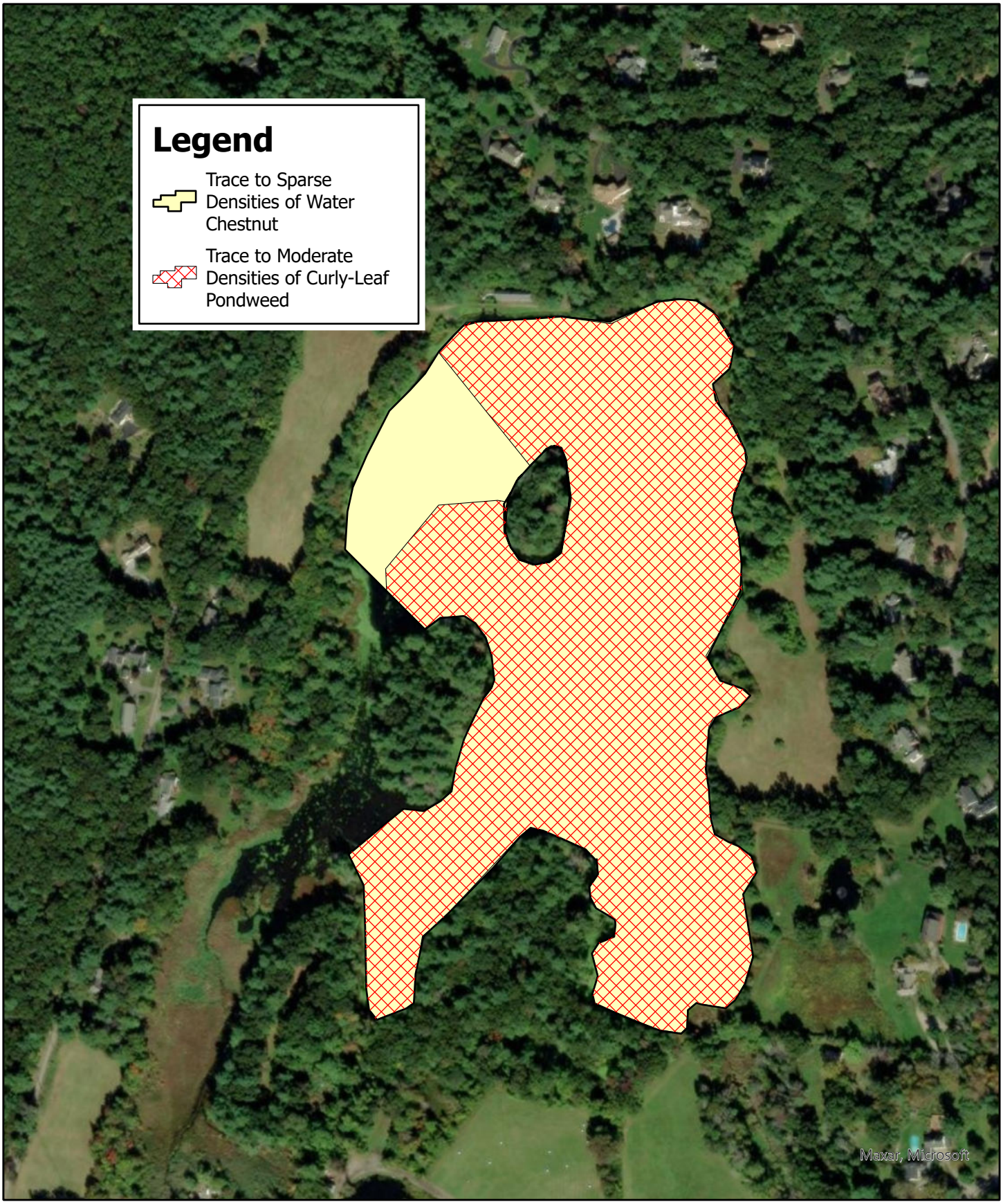
James Lacasse
Branch Manager
Senior Environmental Scientist
c: 774-276-6098
o: 888-4WETLAN(D)
james@waterandwetland.com
www.waterandwetland.com

Attachments Include

- **Pre-Treatment Invasive Species Maps**
- ***Post-Treatment Invasive/Nuisance Species Maps**
- **Lab WQ Results**

***It is important to note that a dot on the map (specifically for water chestnut) typically signifies a single plant or a very small number of plants. Many of which appeared dead/dying.**

CC: Sudbury Conservation Commission



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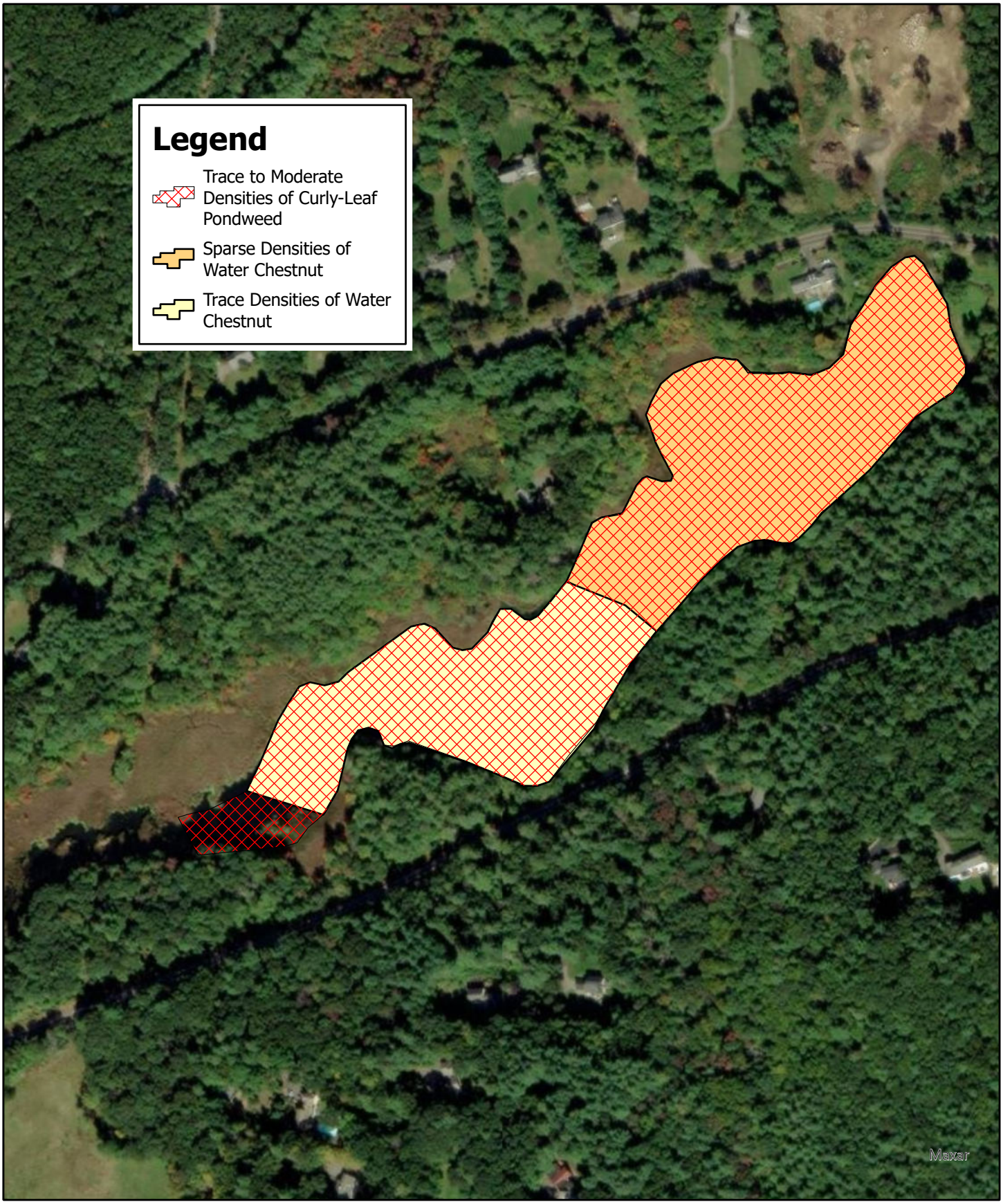
Carding Millpond
Invasive Species Distribution
Sudbury, MA

Survey Date
6/05/2024
Map Date
6/20/2024

N

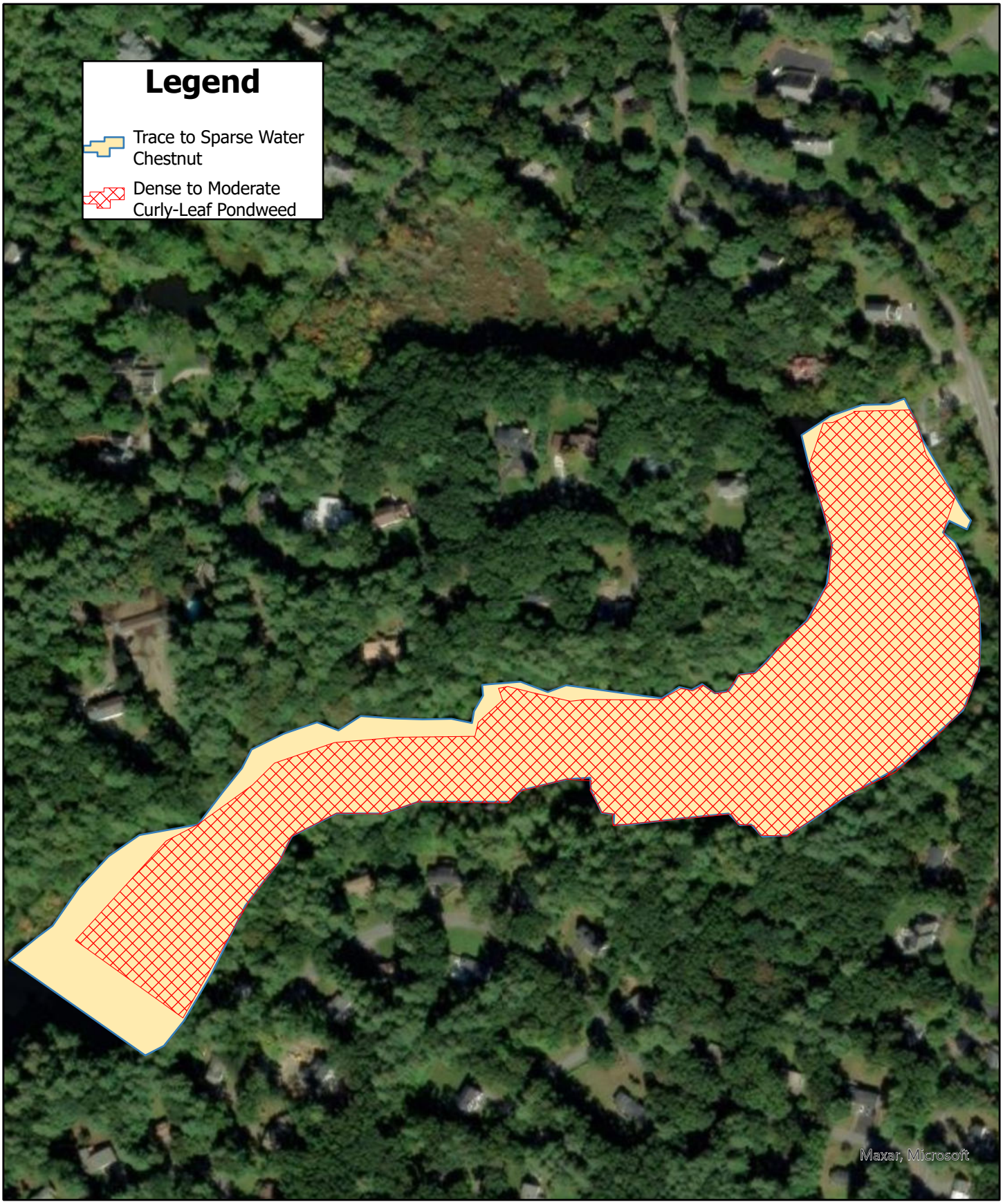


WATER & WETLAND
LAKE POND & WETLAND MANAGEMENT

Grist Mill Pond
Invasive Species Distribution
Sudbury, MA

Survey Date
6/05/2024
Map Date
6/20/2024

N

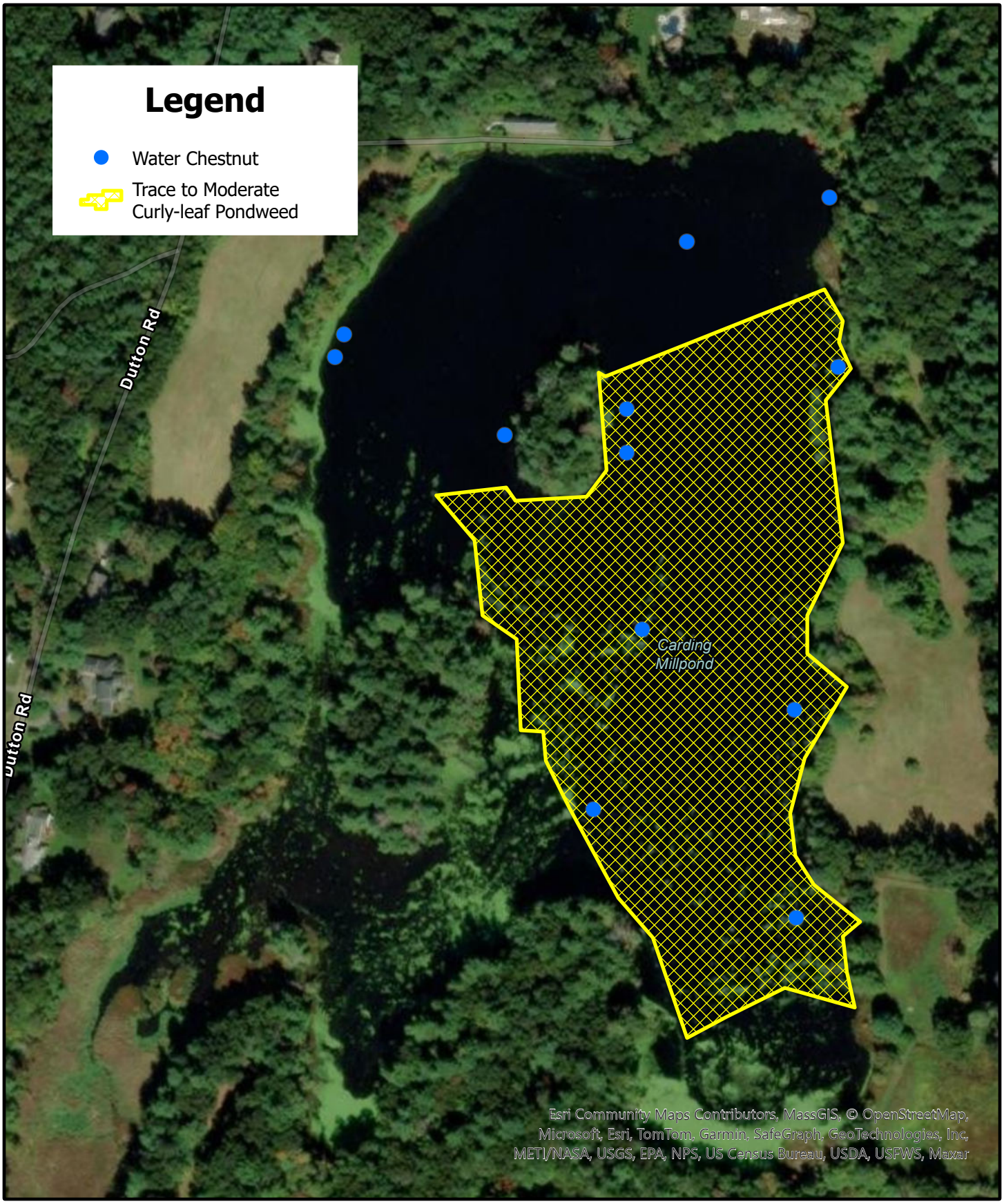


WATER & WETLAND
LAKE POND & WETLAND MANAGEMENT

Stearns Mill Pond
Invasive Species Distribution
Sudbury, MA

Survey Date
6/5/2024
Map Date
6/15/2024

N



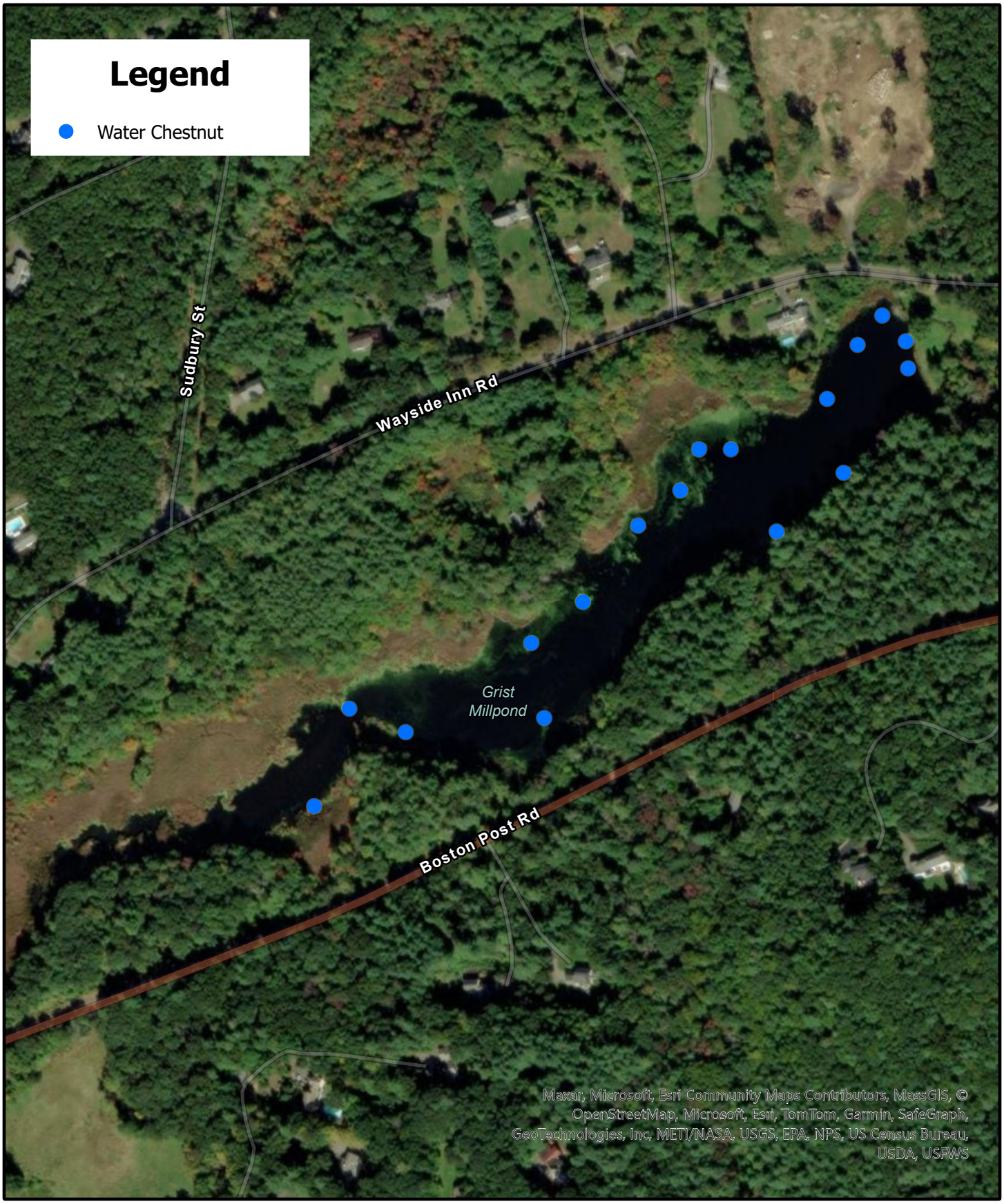
WATER & WETLAND
LAKE POND & WETLAND MANAGEMENT

Carding Mill Pond
Invasive Aquatic Vegetation
Sudbury, MA

Survey Date

Map Date
9/23/2024

N



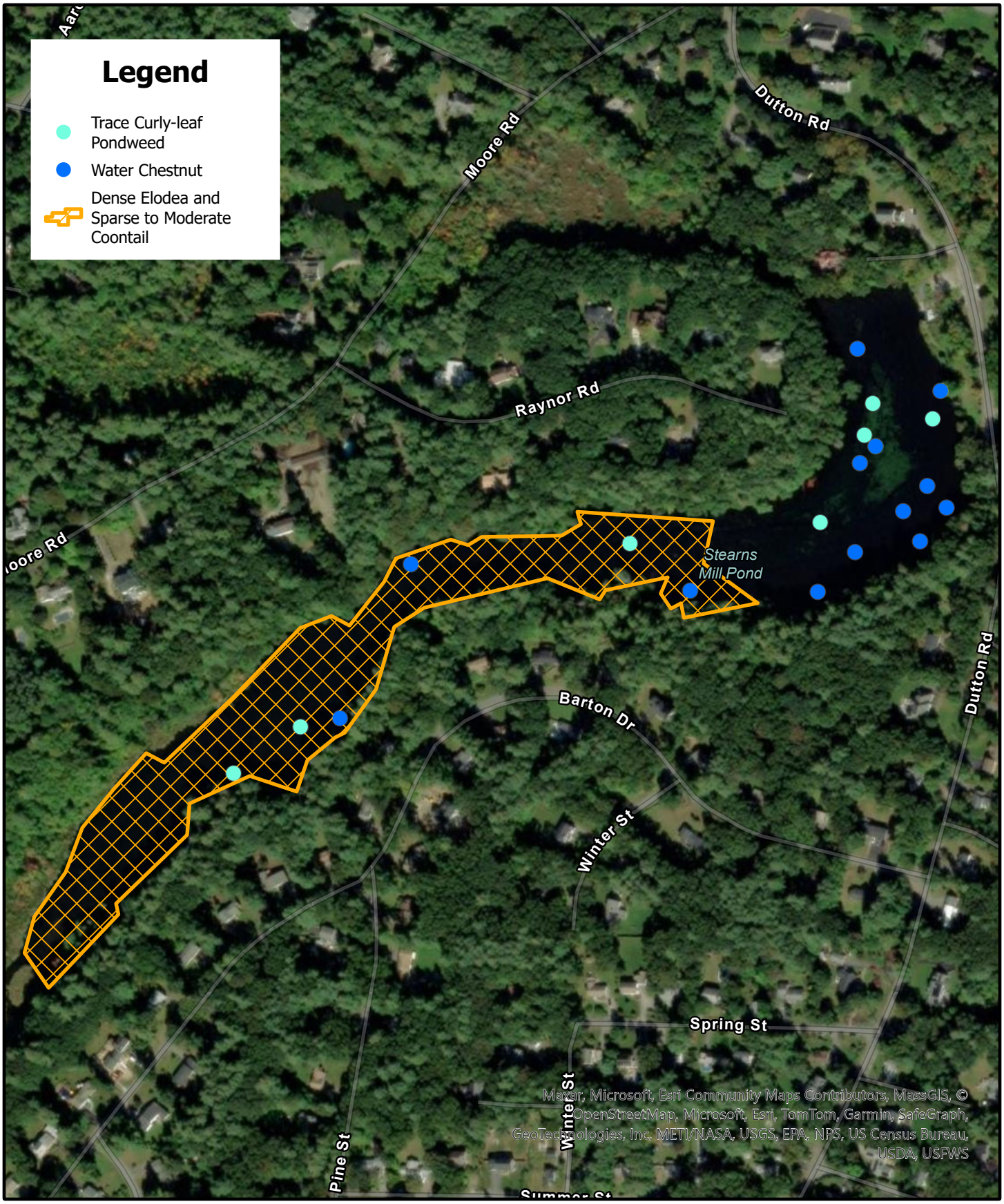
WATER & WETLAND
LAKE POND & WETLAND MANAGEMENT

Grist Mill Pond
Invasive Aquatic Vegetation
Sudbury, MA

Survey Date

Map Date
9/23/2024

N



WATER & WETLAND
LAKE POND & WETLAND MANAGEMENT

Stearns Mill Pond

Nuisance/Invasive Aquatic Vegetation

Sudbury, MA

Survey Date

Map Date

9/23/2024

N

SePRO Lab
Water Diagnostics for Lakes & Ponds
SeSCRIPT*
16013 Watson Seed Farm Road, Whitakers, NC 27891

LABORATORY REPORT

Chain of Custody: eCOC13312

Customer Contact Information

Company Name: Water and Wetland	Contact Person: Joe Onorato
Address: 134 Ferry St., South Grafton, MA 01560	E-mail Address: joe@waterandwetland.com
	Phone: 888-493-8526

Waterbody Information

Waterbody:	Hop Brook Ponds - MA
Waterbody size:	
Depth Average:	

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM53004-1	Carding Millpond	Turbidity (NTU)	EPA 180.1	6	06/05/2024
		Free Reactive Phosphorus (µg/L)	EPA 365.3	5.7	
		Total Phosphorus (µg/L)	EPA 365.3	75.5	
		Alkalinity (mg/L as CaCO3)	EPA 310.2	66.4	
		Total Nitrate (mg/L) and Nitrite (mg/L)	Campbell et al 2004	0.65	
		Nitrite (mg/L)	Campbell et al 2004	0.05	
		Nitrate (mg/L)	calculated	0.6	
		Total Kjeldahl Nitrogen (mg/L)	EPA 351.2	1.41	
		E. coli (CFU/100mL)	EPA 9223B	11.0	
		Total Coliforms (CFU/100mL)	EPA 9223B	>2419.6	
		Total Nitrogen (mg/L)	calculated	2.06	
		Ammonia (µg/L)	SESC 12	10.4	
		True Color (CU)	EPA 2120C	18	
		Apparent Color (CU)	EPA 2120B	78	
CTM53005-1	Grist Millpond	Turbidity (NTU)	EPA 180.1	7	06/05/2024
		Free Reactive Phosphorus (µg/L)	EPA 365.3	10.9	
		Total Phosphorus (µg/L)	EPA 365.3	167.1	
		Alkalinity (mg/L as CaCO3)	EPA 310.2	63.6	
		Total Nitrate (mg/L) and Nitrite (mg/L)	Campbell et al 2004	1.42	
		Nitrite (mg/L)	Campbell et al 2004	0.07	
		Nitrate (mg/L)	calculated	1.35	
		Total Kjeldahl Nitrogen (mg/L)	EPA 351.2	2.55	
		E. coli (CFU/100mL)	EPA 9223B	7.5	
		Total Coliforms (CFU/100mL)	EPA 9223B	>2419.6	
		Total Nitrogen (mg/L)	calculated	3.97	
		Ammonia (µg/L)	SESC 12	15.2	
		True Color (CU)	EPA 2120C	26	
		Apparent Color (CU)	EPA 2120B	70	
CTM53006-1	Stearns Millpond	Turbidity (NTU)	EPA 180.1	5.5	06/05/2024
		Free Reactive Phosphorus (µg/L)	EPA 365.3	10.1	

Total Phosphorus (µg/L)	EPA 365.3	91.4
Alkalinity (mg/L as CaCO3)	EPA 310.2	45.3
Total Nitrate (mg/L) and Nitrite (mg/L)	Campbell et al 2004	0.84
Nitrite (mg/L)	Campbell et al 2004	0.04
Nitrate (mg/L)	calculated	0.8
Total Kjeldahl Nitrogen (mg/L)	EPA 351.2	1.18
E. coli (CFU/100mL)	EPA 9223B	11.9
Total Coliforms (CFU/100mL)	EPA 9223B	>2419.6
Total Nitrogen (mg/L)	calculated	2.02
Ammonia (µg/L)	SESC 12	13.4
True Color (CU)	EPA 2120C	25
Apparent Color (CU)	EPA 2120B	95

ANALYSIS STATEMENTS:
SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.
PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.
QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.
COMMENTS: No significant observations were made unless noted in the report.
MEASUREMENT UNCERTAINTY: Uncertainty of measurement has been determined and is available upon request.

Laboratory Information
Date / Time Received: 06/06/24 11:00 AM
Date Results Sent: Wednesday, June 12, 2024

Disclaimer: The results listed within this Laboratory Report relate only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a dry weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the exclusive use of SRTC Laboratory and its client. This report shall not be reproduced, except in full, without written permission from SRTC Laboratory. The Chain of Custody is included and is an essential component of this report.

This entire report was reviewed and approved for release.

Reviewed By: Laboratory Supervisor

SePRO Lab
Water Diagnostics for Lakes & Ponds

Water Quality Analysis Explanation

These water quality parameters are essential to document the condition of a water body and design custom treatment prescriptions to achieve the desired management objective.

pH: Measure of how acidic or basic the water is (pH 7 is considered neutral).

Hardness: Measure of the concentration of divalent cations, primarily consisting of calcium and magnesium in typical freshwaters.
0-60 mg/L as CaCO3 soft; 61-120 mg/L as CaCO3 moderately hard; 121-180 mg/L as CaCO3 hard; > 181 mg/L as CaCO3 very hard

Alkalinity: Measure of the buffering capacity of water, primarily consisting of carbonate, bicarbonate, and hydroxide in typical freshwaters. Waters with lower levels are more susceptible to pH shifts.
< 50 mg/L as CaCO3 low buffered; 51-100 mg/L as CaCO3 moderately buffered; 101-200 mg/L as CaCO3 buffered; > 200 mg/L as CaCO3 high buffered

Conductivity: Measure of the waters ability to transfer an electrical current, increases with more dissolved ions.
< 50 µS/cm relatively low concentration may not provide sufficient dissolved ions for ecosystem health; 50-1500 µS/cm typical freshwaters; > 1500 µS/cm may be stressful to some freshwater organisms, though not uncommon in many areas

Phosphorus: Essential nutrient often correlating to growth of algae in freshwaters.

Total Phosphorus (TP): is the measure of all phosphorus in a sample as measured by persulfate strong digestion and includes: inorganic, oxidizable organic and polyphosphates. This includes what is readily available, potential to become available and stable forms. *<12 µg/L oligotrophic; 12-24 µg/L mesotrophic; 25-96 µg/L eutrophic; > 96 µg/L hypereutrophic*

Free Reactive Phosphorus (FRP): is the measure of inorganic dissolved reactive phosphorus (PO4-3, HPO4-2, etc). This form is readily available in the water column for algae growth.

Nitrogen: Essential nutrient that can enhance growth of algae.

Total N is all nitrogen in the sample (organic N+ and Ammonia) determined by the sum of the measurements for Total Kjeldahl Nitrogen (TKN) and ionic forms.

Nitrites and Nitrates are the sum of total oxidized nitrogen, often readily free for algae uptake.
< 1 mg/L typical freshwater; 1-10 mg/L potentially harmful; >10 mg/L possible toxicity, above many regulated guidelines

Chlorophyll a: primary light-harvesting pigment found in algae and a measure of the algal productivity and water quality in a system.
0-2.6µg/L oligotrophic; 2.7-20 µg/L mesotrophic; 21-56 µg/L eutrophic; > 56 µg/L hypereutrophic

Turbidity: Measurement of water clarity. Suspended particulates (algae, clay, silt, dead organic matter) are the common constituents impacting turbidity.
< 10 NTU drinking water standards and typical trout waters; 10-50 NTU moderate; > 50 NTU potential impact to aquatic life.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Water Diagnostics for Lakes & Ponds

SeSCRIPT Analysis Report: Hop Brook Ponds

Company: Water and Wetland
Address: 134 Ferry St. South Grafton, MA. 01560
Contact Person: Joe Onorato
Phone: (888)-493-8526
Email: joe ; info@waterandwetland.com

Project Name: Hop Brook Ponds
Surface Area: 20 acres
Average depth: 4 feet
Date Algae Sample Received: 6/6/2024
SeSCRIPT Analysis Performed: Algae ID

Algae ID Results

Hop Brook Ponds

Identification	Classification	Description	Density/Biomass (cells/mL)
Carding Millpond			
Tetraselmis sp.	Chlorophyta-Green algae	Single-celled, flagellated, planktonic	4,200
Planktosphaeria sp.	Chlorophyta-Green algae	Colonial, planktonic	2,100

Other algae observed at densities less than 40 cells/mL: *Chlamydomonas, Desmodesmus, Oocystis, Pandorina* (Chlorophyta); *Planktolyngbya* (Cyanophyta); *Gymnodinium* (Dinophyta)

Much particulate matter observed

Identification	Classification	Description	Density/Biomass (cells/mL)
Stearns Millpond			
Navicula sp.	Bacillariophyta-Diatoms	Single-celled, planktonic	220

Other algae observed at densities less than 40 cells/mL: *Cyclotella, Ulnaria* (Bacillariophyta); *Desmodesmus, Tetraselmis, Oocystis* (Chlorophyta); *Trachelomonas* (Euglenophyta)

Much particulate matter observed

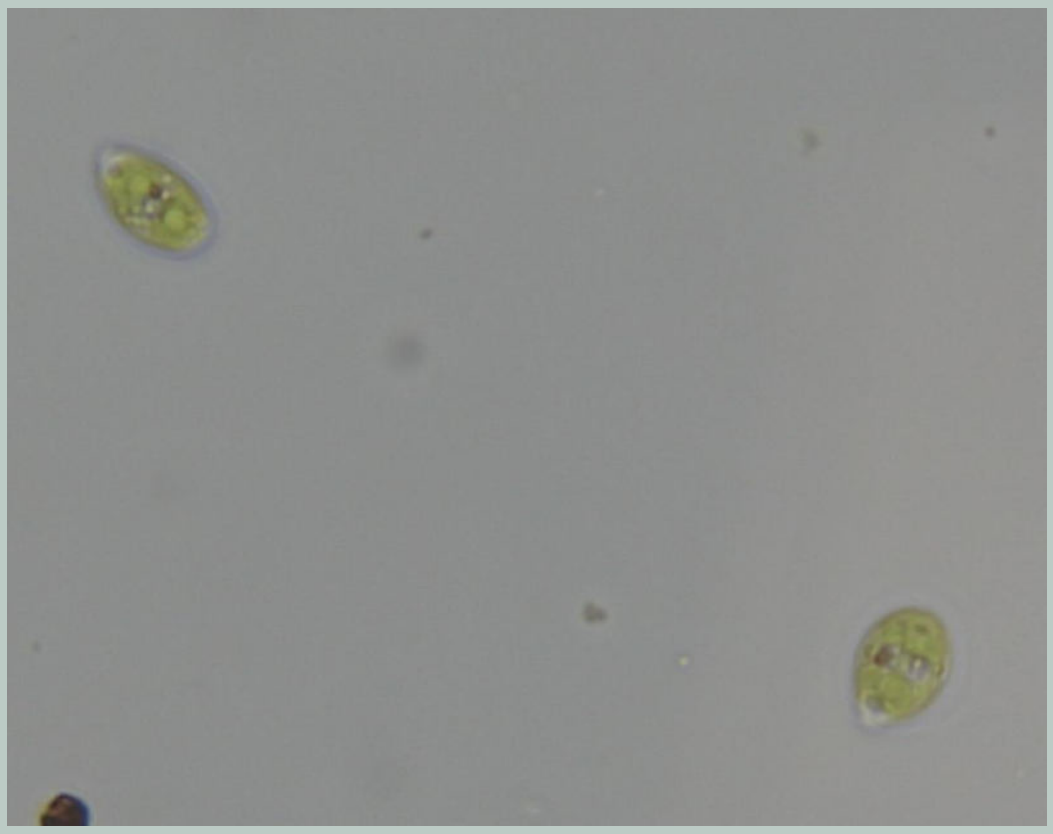
Algae ID Results

Hop Brook Ponds

Identification	Classification	Description	Density/Biomass (cells/mL)
Grist Millpond			
Desmodesmus sp.	Chlorophyta-Green algae	Colonial, planktonic	3,200
Nitzschia sp.	Bacillariophyta-Diatoms	Single-celled, planktonic	1,400

Other algae observed at densities less than 40 cells/mL: *Aulacoseira, Cyclotella* (Bacillariophyta); *Planktosphaeria* (Chlorophyta)

Much particulate matter observed

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Company: Water and Wetland
Address: 134 Ferry St. South Grafton, MA. 01560
Contact Person: Joe Onorato
Phone: (888)-493-8526
Email: joe ; info@waterandwetland.com

Project Name: Hop Brooks Ponds
Surface Area: 20 acres
Average depth: 4 feet
Date Algae Sample Received: 9/18/2024
SeSCRIPT Analysis Performed: Algae ID and Water Quality Baseline Plus

Algae ID Results

Hop Brooks Ponds

Identification	Classification	Description	Density/Biomass (cells/mL)
Carding Millpond			
Cyclotella sp.	Bacillariophyta-Diatoms	Single-celled, planktonic	< 40
Trachelomonas sp.	Euglenophyta-Euglenoids	Single-celled, flagellated, planktonic	< 40
Desmodesmus sp.	Chlorophyta-Green algae	Colonial, planktonic	< 40

Identification	Classification	Description	Density/Biomass (cells/mL)
Grist Millpond			
Cyclotella sp.	Bacillariophyta-Diatoms	Single-celled, planktonic	1,300
Desmodesmus sp.	Chlorophyta-Green algae	Colonial, planktonic	890

Other algae observed at densities less than 40 cells/mL: *Aulacoseira, Gomphonema* (Bacillariophyta); *Pediastrum* (Chlorophyta); *Trachelomonas* (Euglenophyta)

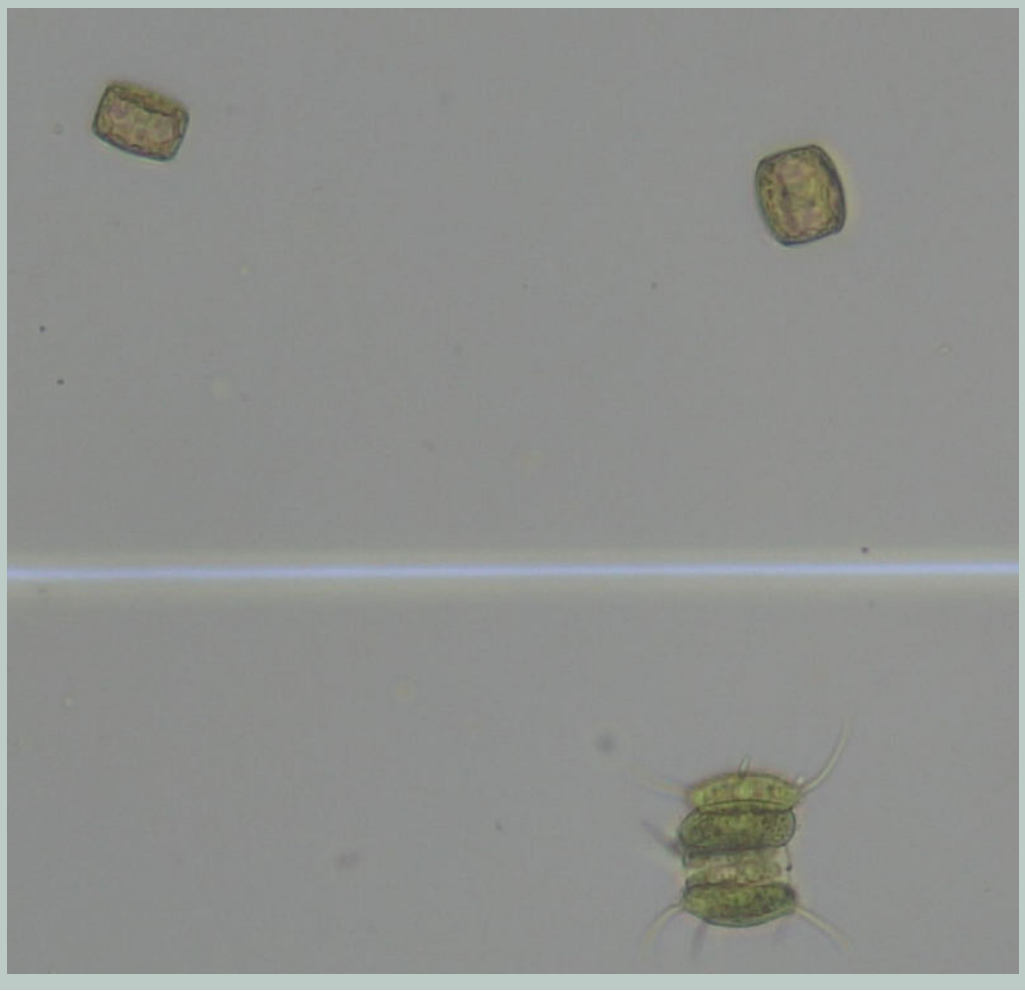
Some bacteria and particulate matter observed

Algae ID Results

Hop Brooks Pond

Identification	Classification	Description	Density/Biomass (cells/mL)
Stearns Millpond			
Cyclotella sp.	Bacillariophyta-Diatoms	Single-celled, planktonic	< 40
Trachelomonas sp.	Euglenophyta-Euglenoids	Single-celled, flagellated, planktonic	< 40
Oocystis sp.	Chlorophyta-Green algae	Colonial, planktonic	< 40

Some particulate matter observed



Water Quality Results

Carding Millpond

Analysis	Measurements	Description
pH (SU)	7.2	Near neutral
Conductivity (µS/cm)	734.7	Typical for freshwaters
Alkalinity (mg/L as $CaCO_3$)	88.0	Moderately buffered
Hardness (mg/L as $CaCO_3$)	82.0	Moderately hard
Turbidity (NTU)	5.3	Low

Nutrient Results

Carding Millpond

Analysis	Measurements	Description
Total Phosphorus (µg/L)	45.9	High amount: Eutrophic
Free Reactive Phosphorus (µg/L)	10.3	Moderate
Total Kjeldahl Nitrogen (mg/L)	1.04	Moderate
Nitrates & Nitrites (mg/L)	0.22	Moderate
Total Nitrogen (mg/L)	1.26	Moderate
Chlorophyll a (µg/L)	62.2	Very high
E. coli (CFU/100mL)	15.8	Low
Total Coliforms (CFU/100mL)	> 2419.6	Very high
Ammonia (µg/L)	27.7	Low

Water Quality Results

Grist Millpond

Analysis	Measurements	Description
pH (SU)	7.4	Near neutral
Conductivity (µS/cm)	738.4	Typical for freshwaters
Alkalinity (mg/L as $CaCO_3$)	80.8	Moderately buffered
Hardness (mg/L as $CaCO_3$)	87.8	Moderately hard
Turbidity (NTU)	4.2	Low

Nutrient Results

Grist Millpond

Analysis	Measurements	Description
Total Phosphorus (µg/L)	99.8	Very high amount: Hypereutrophic
Free Reactive Phosphorus (µg/L)	34.7	High
Total Kjeldahl Nitrogen (mg/L)	1.32	Moderate
Nitrates & Nitrites (mg/L)	2.68	Very high
Total Nitrogen (mg/L)	4.0	Moderate
Chlorophyll a (µg/L)	37.7	High
E. coli (CFU/100mL)	155.3	Moderate
Total Coliforms (CFU/100mL)	> 2419.6	Very high
Ammonia (µg/L)	33.0	Low

Water Quality Results

Stearns Millpond

Analysis	Measurements	Description
pH (SU)	7.3	Near neutral
Conductivity (µS/cm)	627.2	Typical for freshwaters
Alkalinity (mg/L as $CaCO_3$)	77.3	Moderately buffered
Hardness (mg/L as $CaCO_3$)	74.5	Moderately hard
Turbidity (NTU)	4.6	Low

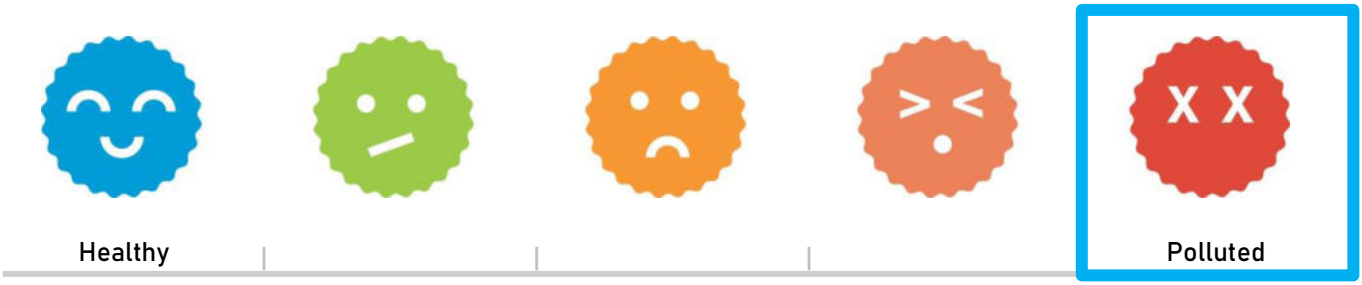
Nutrient Results

Stearns Millpond

Analysis	Measurements	Description
Total Phosphorus (µg/L)	73.9	High amount: Eutrophic
Free Reactive Phosphorus (µg/L)	35.5	High
Total Kjeldahl Nitrogen (mg/L)	0.58	Low
Nitrates & Nitrites (mg/L)	0.31	Moderate
Total Nitrogen (mg/L)	0.89	Low
Chlorophyll a (µg/L)	< 10	Low
E. coli (CFU/100mL)	55.6	Low
Total Coliforms (CFU/100mL)	> 2419.6	Very high
Ammonia (µg/L)	31.5	Low

SePRO Lab
Water Diagnostics for Lakes & Ponds

SeSCRIPT Discussion



The algae and water sample collected from Hop Brooks Ponds was received on 9/18/2024. Based on results from the water quality and algae analyses, proposed treatment recommendations for control of the problematic algae and nutrient management in Hop Brooks Ponds were determined (see below).

For the purpose of this report, the health rating reflects water quality concentrations detected at the time of collection and should only be used as a guide for treatment purposes. Follow product label instructions. Check with the appropriate local and state agencies for product restrictions and permit regulations prior to use.

SeSCRIPT Diagnostic Guidance — Hop Brooks Ponds

To restore *Hop Brooks Ponds* to a more balanced natural state, it is recommended to manage the nuisance algae and the nutrient pollution (or prevent pollution levels to rise to unhealthy levels.

STEP 1: ALGAE MANAGEMENT

In order to control the targeted algae at this site, apply:

Cutrine Plus at a rate range of 0.3-0.6 gallons/acre-foot (0.1-0.2 mg Cu/L).

Contact your SePRO Aquatic Specialist for further guidance on final application rate selection, technique and frequency based on project objectives, site conditions, algae location and density at treatment time.

STEP 2: PHOSPHORUS MANAGEMENT

Analysis of the water quality parameters in this pond revealed this system is hypereutrophic (nutrient polluted water). Based on these site-specific water parameters, consider implementing one of the following EutroSORB phosphorus removal solutions to restore water quality in your water body.

a. Recovery Solution: Improve or prevent further nutrient pollution by applying EutroSORB WC on an annual basis. The recommended starting dose is 10 PDUs per acre. Integrate with SePRO algaecide applications as needed to control algae and achieve desired water quality objectives.
b. Reset Solution: Reset the ecological clock and restore water quality in your pond by implementing a Reset application strategy customized by water body. EutroSORB G permanently binds phosphorus pollution both in the water and at a source, the sediments.

Always read and follow product labels and applicable permits. Contact your SePRO Technical Specialist for assistance on developing a custom prescription based on site conditions and water quality management objectives

Jon Gosselin, Technical Specialist
Phone: 603-494-5966
Email: jong@sepro.com

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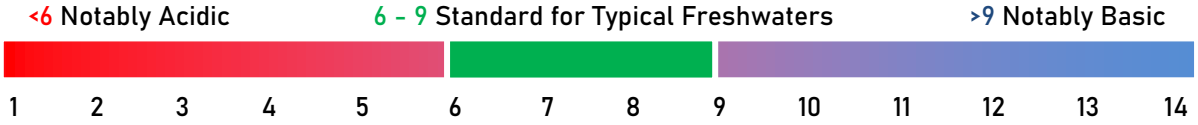

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