WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

November 28, 2023

Ayer Conservation Commission
Ayer Town Hall – 1 Main Street
Ayer, MA 01432
Sent via email: concom@ayer.ma.us

## Re: Ayer Ponds (Sandy Pond, Flannagan Pond, and Pine Meadow Pond) – 2023 Year End Report – DEP File #100-0293

Dear Commission Members:

It is our pleasure to present a year end summary report regarding the 2023 Aquatic Management Programs at the Ayer Ponds (Flannagan Pond, Sandy Pond, and Pine Meadow Pond). The Town's objective of the aquatic management program is to manage invasive species and nuisance waterlilies within the three waterbodies. The purpose of the program is to restore and maintain habitat, public enjoyment, and recreation. These goals were met during the 2023 season through monitoring, reporting, communication, and treatments. Prior to the start of the program, a plan was developed for each individual Pond, based on its unique needs.

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 (pictured in 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 (Figure 1) 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 (reference Figure 1 above). Water clarity was also assessed using a Secchi disk, as applicable (Secchi disk pictured in 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 Secchi depth, is a measurement of the transparency of the water. All readings are included in the tables throughout this report.

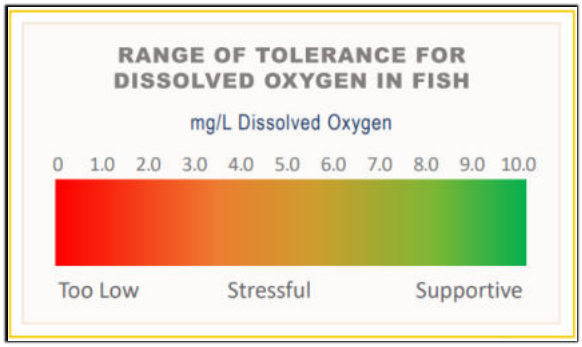


*Figure 1: Dissolved oxygen table*

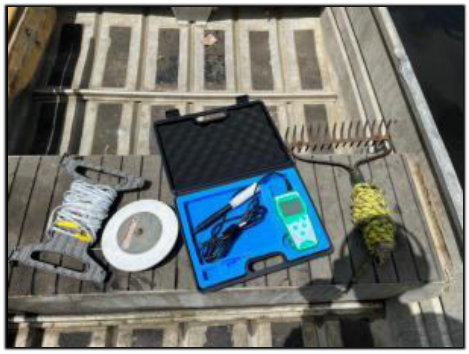

*Figure 2: Equipment and meters utilized during each site visit*

All permitting, treatment, and survey tasks were completed in accordance with the 2023 work plans and Orders of Conditions. The tables provided throughout this report list the specific dates of each task. Below the tables, each visit/task performed is described in additional detail.

## Sandy Pond

Sandy Pond (Figure 3) is the eastern most waterbody out of the three Ayer Ponds and is approximately 70 acres. The Pond is primarily surrounded by sparse woodlands and developed residential properties around the northern and southern shorelines. A small wetland area is located along the southeastern shoreline, which leads to Long Pond Brook. Sandy Pond Beach is found within the southwestern corner of the Pond, which is free to use for the residents of Ayer, and a small fee for non-residents. Sandy Pond Road (to the south), Snake Hill Road (to the west), and Wright Road (to the north and east) are the major roadways that border Sandy Pond. Access to the waterbody is granted through a pull-off on Snake Hill Road, or by navigating through the culvert that connects Sandy Pond and Flannagan Pond. Sandy Pond is a popular recreational waterbody for fishing, swimming, and boating.

*Figure 3: Sandy Pond - Ayer, MA*

Historically, Sandy Pond has battled several invasive species including fanwort (*Cabomba caroliniana),* variable milfoil (*Myriophyllum heterophyllum),* curly-leaf pondweed (*Potamogeton crispus),* and phragmites (*Phragmites australis),* in addition to nuisance densities of pondweeds (*Potamogeton sp.)*, specifically waterlilies (*Nymphaeaceae).* The goal of the 2023 program was to manage the invasive species and waterlily 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.

**Summary Of 2023 Sandy Pond Management Activities**

| Date | Task/Description |
|---|---|
| June 5, 2023 | A pre-management survey was performed to document baseline conditions of the Pond, note the current vegetation species/densities present, and to guide future 2023 management; The initial fanwort treatment was completed using Sonar (fluridone). |
| June 19, 2023 | An interim survey was completed to confirm treatment areas and assess the effectiveness of the previous treatment; Treatment was conducted with diquat as well as a Sonar booster treatment. |
| September 21, 2023 | A post-treatment inspection was completed to evaluate the effectiveness of the previous treatments and the overall 2023 Aquatic Management Program, in addition to helping guide recommendations for 2024; The final herbicide treatments were performed for the control of lilies and phragmites. |

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**June 5, 2023 - Pre-Management Survey / Initial Herbicide Treatment**

*Figure 4: Invasive vegetation documented during the survey*

On June 5th, Senior Environmental Scientist, James Lacasse, completed a site visit to Sandy Pond. The site visit consisted of conducting the pre-management survey, collecting basic water quality, and completing a treatment. Conditions during the visit were cloudy with occasional light rain.

During the survey, four invasive species (invasive growth documented in Figure 4) were again observed in Sandy Pond, including fanwort (pictured in Figure 5 below), variable milfoil, curly-leaf pondweed, and phragmites. The phragmites were noted along the northern shoreline in a small number of separated populations. Fanwort, variable milfoil, and curly-leaf pondweed were documented in both the northwestern cove and southeastern corner of the Pond (see Figure 4). This was consistent with past years. Variable milfoil was noted growing throughout the water column and occasionally surfacing. Fanwort was documented in the bottom third of the water column as it had recently begun growing (Figure 5). Curly-leaf pondweed was mixed within the fanwort and milfoil. Variable milfoil was the most prominent invasive species documented. Native species observed included waterlilies, watershield (*Brasenia schreberi)*, ribbon-leaf pondweed (*Potamogeton epihydrus)*, duckweed (*Lemnoideae)*, and clasping-leaf pondweed (*Potamogeton perfoliatus)*. These species were scattered throughout the littoral zone in trace to moderate densities. Pollen was observed on the surface of the Pond. There were a few types of algae noted, including filamentous algae, benthic algae, and epiphytic algae. Filamentous algae was documented in trace, scattered densities. Benthic algae was observed throughout roughly 30% of the littoral zone. Epiphytic algae was noted on portions of the vegetation, which indicates that the plant is dying or decaying.

*Figure 5: Fanwort observed at Sandy Pond*

The fanwort spots were treated with Sonar One, time released granular formulation, as planned. Sonar One allows for spot-treatment of fanwort, which is typically difficult with Sonar as it requires roughly 60+ days of contact exposure time at concentrations above 8+ parts per billion. The following planned diquat treatment would target the invasive milfoil and curly-leaf pondweed. At the same time as the next treatment, a "bump" Sonar treatment would be applied to the fanwort. Phragmites regrowth would be targeted during the later season treatment. The pH was documented at 7.0, which is within a standard range for freshwater and is considered neutral.

| Surface Temp (℃) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 19.8 | 7.5 | 13'10'' |

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**June 19, 2023 - Post-Treatment Survey / Follow-up Herbicide Treatment**

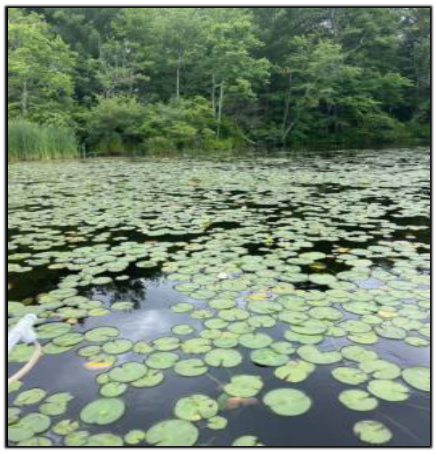


*Figure 6: Waterlilies noted during the site visit*

On June 19th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Sandy Pond. The visit consisted of performing a brief survey, collecting water quality data, and conducting a treatment. Conditions during the site visit were overcast and 73 degrees F, with calm wind.

Upon arrival, a brief survey was completed in order to confirm potential treatment areas and to assess the effectiveness of the previous treatment. Overall, plant growth was low. Variable milfoil, fanwort, and curly-leaf pondweed were visible at the time of the visit. Waterlilies and native pondweed species were also observed in the Pond (Figure 6). Curly-leaf pondweed was already dying off from the initial Sonar treatment, and the fanwort was beginning to show signs of being impacted.

*Figure 7: Water and Wetland conducting a treatment at Sandy Pond*

Granular Sonar (fluridone) formulation was applied using a calibrated blower/spreading equipment. This was applied to the target fanwort growth as diquat does not impact fanwort. Sonar works best early in the season, as immature plants are most susceptible to low concentrations of fluridone. Sonar works by maintaining concentration of fluridone within the management areas, so this treatment was considered a "booster" to help maintain the fluridone concentration generated by the initial treatment applied several weeks ago. The granular time-released formulation of Sonar was again selected as it is the only possible way to maintain concentrations in small areas/spot-treat. In addition to the Sonar, diquat herbicide was applied for the control of curly-leaf pondweed and variable watermilfoil (see treatment application in Figure 7). The liquid contact herbicide was applied using a treatment boat equipped with a calibrated sub-surface injection system. This application methodology allows for even coverage within the treatment areas. The treatment was completed without issue. We anticipated die-off of curly-leaf pondweed and variable milfoil within just a few days to a few weeks; whereas the fanwort die-off would be slower given how Sonar works. Phragmites regrowth was noted in patches around the shoreline, this was targeted later in the season to allow for translocation of the systemic herbicide down into the rhizomes of the phragmites plants. Nuisance waterlilies were targeted at the same time. Generally, the management areas in Sandy Pond are small and were consistent with previous years in terms of locations.

Several days prior to the treatment, neon signs were posted around the shoreline noting the treatment, affiliated water-use restrictions, and Water & Wetland contact information. The treatment was performed late in the day so as not to interfere with recreation. We planned the phragmites/lily treatment for after the beach closes.

| Surface Temp (°C) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 22.8 | 8.84 | 5'1'' |

**September 21, 2023 - Post-Management Survey / Final Herbicide Treatments Completed**

On September 21st, Senior Environmental Scientist, James Lacasse, made a visit to Sandy Pond. The site visit consisted of performing a survey, collecting basic water quality data, and completing a treatment. Conditions during the visit were sunny and calm.

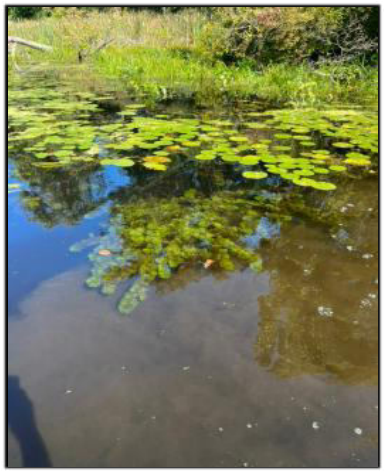


*Figure 8: Fanwort growth documented mixed within the waterlily population*

A post-management survey was conducted upon arrival to evaluate the effectiveness of the previous treatments and to help guide recommendations for the 2024 season. A healthy assemblage and balance of native species was documented during the survey. These species included cattails (*Typha sp.),* waterlilies, duckweed, Robbin's pondweed (*Potamogeton robbinsii),* bladderwort (*Utricularia sp.),* clasping-leaf pondweed, American bulrush (*Scirpus pungens),* tape grass (*Vallisneria americana),* ribbon-leaf pondweed, and watershield. A small portion of all vegetation was covered in epiphytic algae, which indicates the plants are dying/decaying. We were happy to report that we did not find any visual signs of a potentially harmful algal bloom, which was occurring last year around this time. Overall, due to the rain loading excess nutrients paired with a hot summer, high water temperatures, etc. algae blooms were increased this year in waterbodies throughout the Commonwealth.

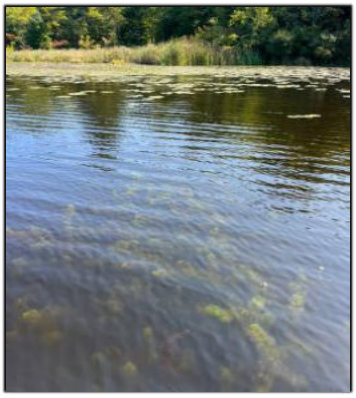


*Figure 9: Fanwort and variable milfoil documented during the site visit*

Two invasive species were found during the survey, variable milfoil, and fanwort (extremely small areas documented in Figures 8 and 9). Curly-leaf pondweed was not found during the survey. The invasive species were greatly reduced (>90%) through this year's management program. Both fanwort and variable milfoil were documented in two locations, the northwestern and southeastern corners. As shown in Figures 8 and 9, these species were found only in a few small patches (largely fanwort, as flow impacts Sonar treatment which is difficult to spot-treat with even in the driest years). Variable milfoil was even further scattered as we anticipated that any milfoil growth was late season regrowth which is common when treating with diquat (a contact herbicide). Overall, Sandy Pond looked great, and we were encouraged to see native species far outweighing the minimal remaining invasive species growth. Control of phragmites and lilies will not be fully realized until 2024, as a systemic herbicide was utilized, and we anticipated reduction in regrowth in Spring of 2024.

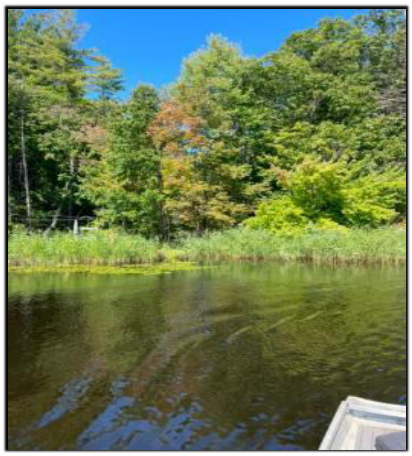


*Figure 10: An area of phragmites documented at Sandy Pond*

Two treatments were conducted during the site visit. The first treatment was a treatment conducted for the control of invasive phragmites (pictured in Figure 10). There were a handful of areas that contained phragmites, specifically along the northern shoreline, and a few smaller stands along the eastern and southern shorelines. The liquid herbicide was applied using foliar application methodology. Phragmites in low densities and/or phragmites plants in close proximity to non-target native species were individually hand-wiped to minimize/negate any non-target impacts. These methods allow for even and precise coverage. The phragmites were accessed via boat, as most applicable. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high winds.

The second treatment was conducted for the control of nuisance level waterlilies. The waterlily treatment focused on scattered waterlily patches that were encroaching towards the middle of the Pond, around docks/boats/beach area, and trimming back larger densities. The liquid herbicide was applied using a small jon boat, equipped with a calibrated pump, which is used to target the nuisance lilies via foliar application methodology. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high winds. Waterlilies are a native species, so the goal of the program is to scale back nuisance level lilies, but not eliminate all waterlily growth. Lilies provide valuable habitat and cover; however, dense lilies covering large areas have the ability to limit oxygen transfer and biodiversity.

Days prior to the treatments, the shoreline was posted with neon pink signs noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

| Surface Temp (℃) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 22.1 | 7.91 | 8’3’’ |

## Flannagan Pond

Flannagan Pond (Figure 11) is found in the middle of Sandy Pond and Pine Meadow Pond and is approximately 87 acres. Flannagan Pond is surrounded by sparse woodlands and wetlands, with residential properties along the northern, western, and southern shorelines. The Pond is fairly shallow, as the entirety of the waterbody is considered a littoral zone. Access to the Pond was granted from the Ayer Water Department building located on the southern shoreline, off Central Avenue. The inlets at Flannagan Pond are found on the eastern shoreline (from Sandy Pond) and within the

*Figure 11: Flannagan Pond - Ayer, MA*

northwestern cove (from Pine Meadow Pond). The outlet is located in the southwestern cove which feeds Balchs Pond. Flannagan Pond is a popular recreational waterbody for activities such as fishing and boating.

Historically, Flannagan Pond has battled several invasive species including fanwort, variable milfoil, water chestnut (*Trapa natans),* and curly-leaf pondweed, in addition to nuisance densities of pondweeds, specifically waterlilies. The goal of the 2023 program was to manage the invasive species and waterlily 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.

**Summary Of 2023 Management Activities**

| Date | Task/Description |
|---|---|
| June 5, 2023 | A pre-management survey was performed to document baseline conditions of the Pond, note the current vegetation species/densities present, and to guide future 2023 management; The initial Sonar treatment was completed within the designated management areas. |
| June 19, 2023 | An interim survey was completed to confirm treatment areas and assess the effectiveness of the previous treatment; Diquat was applied for the control of variable milfoil and curly-leaf pondweed; A Sonar "booster" treatment was applied. |
| September 21, 2023 | A post-treatment inspection was completed to evaluate the effectiveness of the previous treatment and the overall 2023 Aquatic Management Program, in addition to helping guide recommendations for 2024; Treatment of waterlilies was conducted. |

**<u>June 5, 2023 - Pre-Management Survey / Initial Treatment</u>**

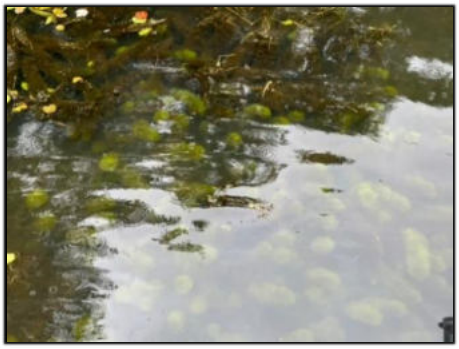


*Figure 12: Fanwort noted during the survey*

On June 5th, Senior Environmental Scientist, James Lacasse, completed a site visit to Flannagan Pond. The site visit consisted of conducting the pre-management survey, collecting basic water quality, and completing a treatment. Conditions during the visit were cloudy with occasional light rain.

Four invasive species were documented within Flannagan Pond during the 2023 pre-treatment survey. These species included fanwort (Figure 12), variable milfoil (Figure 13), curly-leaf pondweed, and water chestnut (Figure 14). Curly-leaf pondweed was the most prominent invasive noted as it was found throughout the Pond in sparse to moderate densities. Fanwort was primarily found scattered along the southern shoreline, southwestern cove, northwestern cove with isolated densities along the northern cove. Fanwort was not found within the eastern basin; this was extremely encouraging. Variable milfoil

*Figure 13: Variable milfoil surfacing, occasionally flowering at Flannagan Pond*

was noted in the northwestern cove and within the eastern basin. Only a handful of water chestnut plants were identified within the eastern basin (scattered, isolated populations illustrated in Figure 14). To our knowledge, this is the first-time water chestnut has been documented in Flannagan Pond. While outside of the scope of our contract, we hand-pulled this species when encountered. Native species documented during the survey included bladderwort, ribbon-leaf pondweed, watershield, waterlilies, Robbins Pondweed, and thin-leaf pondweed (*Potamogeton pusillus)*. Filamentous algae and epiphytic algae were also noted in varying densities. The densest filamentous algae was along the northern shoreline in the western basin.

*Figure 14: Water chestnut documented*

During this visit, fanwort was spot-treated with Sonar (fluridone), similar to Sandy Pond which is described in more detail above. The surface dissolved oxygen collected during the survey was 7.9 mg/l, which is sufficient to support fish and wildlife. The pH was documented at 6.6, which is within a standard range for freshwater, and is considered fairly neutral. The Secchi disk clarity reading was to the bottom throughout the Pond; however, Flannagan Pond is quite shallow as mentioned. The upcoming diquat treatment would target curly-leaf pondweed and variable milfoil. During this treatment, Sonar would again be applied to boost the concentration of fluridone for fanwort control (within the contracted areas).

| Surface Temp (°C) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 19.9 | 7.9 | To the bottom |

**June 19, 2023 - Post-Treatment Survey / Follow-up Herbicide Treatment**

*Figure 15: Overlooking dense pondweeds at Flannagan Pond*

On June 19th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Flannagan Pond. The visit consisted of performing a brief survey, collecting basic water quality data, and completing a treatment. Conditions during the visit were mostly cloudy with a slight breeze.

Upon arrival, a survey was conducted to evaluate the effectiveness of the previous treatment. Conditions were similar to those of the pre-management survey although the initial Sonar treatment was starting to show signs of fanwort control. The pH was measured at 7.5 which is within a standard range for freshwaters and is considered fairly neutral. Waterlilies were beginning to take over large areas of Flannagan Pond (pictured in Figure 15) and would be treated later in the season. Other species noted during the survey included curly-leaf pondweed, variable milfoil, ribbon-leaf pondweed, and coontail.

Granular Sonar (fluridone) formulation was applied using a calibrated blower/spreading equipment. This was applied to the target fanwort growth as diquat does not impact fanwort. The application methodology allows for even coverage within the treatment areas. Sonar works best early in the season, as immature plants are most susceptible to low concentrations of fluridone. In addition to the Sonar, diquat herbicide was applied for the control of curly-leaf pondweed and variable watermilfoil. The liquid contact herbicide was applied using a treatment boat equipped with a calibrated sub-surface injection system (illustrated in Figure 16). The treatment was completed without issue. We anticipated die-off of curly-leaf pondweed and variable milfoil within just a few days to a few weeks; whereas the fanwort die-off would be slower given how Sonar works. This treatment would only have minimal effects on nuisance waterlilies, only within the Sonar treatment areas. Treatment specific to waterlilies occured later in the season (September). Several days prior to the treatment, neon signs were posted around the shoreline noting the treatment, affiliated water-use restrictions, and Water & Wetland contact information.

*Figure 16: Water and Wetland conducting a treatment*

| Surface Temp (°C) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 22.5 | 7.71 | 3'2'' |

**September 21, 2023 - Post-Management Survey / Final Herbicide Treatment**

*Figure 17: Variable milfoil documented during the survey*

On September 21st, Senior Environmental Scientist, James Lacasse, made a visit to Flannagan Pond. The visit consisted of performing the post-treatment survey, collecting basic water quality data, and completing the final treatment. Conditions during the visit were sunny with a slight breeze.

Upon arrival to Flannagan Pond, a post-management survey was conducted. The purpose of this survey was to assess the efficacy of the 2023 management program and to guide 2024 management. A large number of native species have returned to Flannagan Pond, which was great to see. Bladderwort and waterlilies were the most dominant native species. Bladderwort, although native, can reach nuisance densities especially in shallow waterbodies like Flannagan Pond. The weather during the 2023 growing season was also conducive to allowing bladderwort to thrive. Bladderwort was documented throughout the entirety of Flannagan Pond. It was growing on the bottom, throughout the water column, and surfacing (occasionally forming a mat on the surface). Waterlilies were densest in the eastern and western basins.

Two invasive species were noted during the survey, fanwort (see Figure 18), and variable milfoil (Figure 17). Curly-leaf pondweed was not documented during the survey. Variable milfoil was very much scattered in low densities when found (See small patch in Figure 17). Fanwort was only targeted in select areas based on the 2022 post-management survey. In these treatment areas, fanwort growth was greatly

reduced (>90%). Unfortunately, fanwort was again spreading to additional areas which should be addressed in 2024, if budget allows. In these areas it was documented in varying densities, ranging from just trace to moderate. It did not reach dense densities in any location, as the Sonar within the treatment areas likely still had some impacts outside the management areas. Other species noted during the survey included cattails, Robbin's Pondweed, ribbon-leaf pondweed, tapegrass, watershield, and duckweed.

*Figure 18: Fanwort flowering*

Several days prior to the treatment, neon signs were posted around the pond, noting the treatment, affiliated water-use restrictions, and Water & Wetland contact info. Treatment was rescheduled on one occasion due to weather, which resulted in two rounds of posting.

*Figure 19: Dense waterlilies and pondweeds within Flannagan Pond*

A treatment was conducted for the control of nuisance level waterlilies. The liquid herbicide was applied using the most appropriate boat, equipped with a calibrated pump, which is used to target the nuisance lilies via foliar application methodology. This method allows for even and precise coverage. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high winds. Waterlilies are a native species, so the goal of the program was to scale back nuisance level lilies, but not eliminate all waterlily growth. Lilies provide valuable habitat and cover; however, dense lilies covering large areas have the ability to limit oxygen transfer and biodiversity. Although, given the density and cover of lilies in Flannagan Pond, it is worth considering an initial and a follow-up treatment in Flannagan Pond in 2024. These treatments would be spaced approximately two-four weeks apart from one another. Several days prior to the treatment, neon signs were posted around the pond, noting the treatment, affiliated water-use restrictions, and Water & Wetland contact info. Treatment was rescheduled on one occasion due to weather, which resulted in two rounds of posting.

| Surface Temp (℃) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 23.3 | 7.44 | To the bottom |

## Pine Meadow Pond

Pine Meadow Pond (pictured in Figure 20) is found north of Flannagan Pond, as this waterbody is also called "Upper Flannagan Pond". Pine Meadow Pond is approximately 34 acres and is fairly shallow throughout the entirety of the Pond as the whole Pond would be considered a littoral zone. The Pond is primarily surrounded by woodlands and wetlands, with a few residential properties along the southern and southwestern shorelines. Groton-Harvard Road borders the western shoreline (through the woods) and Oak Ridge Drive is found along the southern shoreline. Ayer Conservation hiking trails are located through the woods along the western shoreline (off Groton-Harvard Road). The Pond receives flow from

Rock Meadow Pond as the flow within the Pond moves from north to south. The outlet is found along the southern shoreline, with flows into Flannagan Pond. Access to Pine Meadow Pond was granted off Oak Ridge Drive.

*Figure 20: Pine Meadow Pond - Ayer, MA*

Historically, Pine Meadow Pond has battled several invasive species including fanwort, variable milfoil, water chestnut (*Trapa natans),* and curly-leaf pondweed, in addition to nuisance densities of pondweeds, specifically waterlilies. The goal of the 2023 program was to manage the invasive species and waterlily 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.

**Summary Of 2023 Management Activities**

| Date | Task/Description |
|---|---|
| June 5, 2023 | A pre-management survey was performed to document baseline conditions of the Pond, note the current vegetation species/densities present, and to guide future 2023 management |
| June 19, 2023 | An interim survey was completed to confirm treatment; Diquat treatment was conducted targeting invasive curly-leaf pondweed and variable milfoil. |
| September 21, 2023 | A post-treatment inspection was completed to evaluate the effectiveness of the previous treatment and the overall 2023 Aquatic Management Program, in addition to helping guide recommendations for 2024; The final herbicide treatment was performed targeting nuisance waterlilies and watershield. |

**<u>June 5, 2023 - Pre-Management Survey</u>**

*Figure 21: Curly-leaf pondweed documented during the survey*

On June 5th, Senior Environmental Scientist, James Lacasse, completed a site visit to Pine Meadow Pond. The site visit consisted of conducting the pre-management survey and collecting basic water quality. Conditions during the visit were cloudy with occasional light rain.

The pre-management survey was consistent with the 2021 and 2022 pre-treatment surveys. Two invasive species were documented throughout the survey, which included curly-leaf pondweed and variable milfoil. Curly-leaf pondweed was the more dominant invasive noted as it was observed throughout the majority of the Pond ranging from sparse to dense densities (Figure 21). The densest curly-leaf pondweed and variable milfoil was documented in the northern half of the Pond. Native species (See Figure 23 below) observed included waterlilies, watershield, bladderwort, duckweed, and thin-leaf pondweed. Various forms of algae were noted as there were moderate to dense densities of filamentous algae and macro-algae, with small amounts of epiphytic algae. Filamentous algae

*Figure 22: Filamentous algae seen growing throughout the water column and surfacing*

was noted on the bottom, in the water column, and surfacing (reference Figure 22). Macro-algae was noted throughout much of the Pond along the bottom, occasionally growing through the water column. Epiphytic algae was noted on roughly 5-10% of the vegetation, specifically variable milfoil. Pollen was noted on the surface especially against windblown shorelines. A handful of floating islands were observed throughout the dense populations of waterlilies and watershield. Native cattails (cattails visible in the background of Figure 23 below) surrounded the eastern, northern, and portions of the western shoreline. Curly-leaf pondweed was found in the middle to western half of the Pond, with scattered variable milfoil mixed in. Milfoil was found mixed within the open areas of waterlilies. Fanwort was not found in Pine Meadow Pond, which is consistent with previous years. The waterlily population was notably reduced from last year's treatment – which helps promote open water habitat. The surface dissolved oxygen collected during the survey was 7.66 mg/l, which is sufficient to support fish and wildlife. The pH was documented at 6.6, which is within a standard range for freshwater, and is considered fairly neutral. The planned diquat treatment would target the areas of variable milfoil and curly-leaf pondweed. Diquat is highly effective at providing seasonal control of both species.

*Figure 23: Dense native pondweeds, specifically waterlilies and watershield, surfacing at Pine Meadow Pond*

| Surface Temp (°C) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 17.5 | 7.66 | To the bottom |

**June 19, 2023 – Survey / Initial Herbicide Treatment Conducted**

*Figure 24: Filamentous algae noted during the site visit*

On June 19th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Pine Meadow Pond. The visit consisted of performing a brief survey, collecting basic water quality data, and completing a treatment. Conditions during the visit were mostly sunny and calm.

Upon arrival, a brief survey was conducted in order to confirm potential treatment areas. Filamentous algae was noted on the surface during this visit (illustrated against a wind-blown shoreline in Figure 24). Variable milfoil was mature at the time of the treatment. Curly-leaf pondweed was still present at the time of treatment. Waterlilies had begun to take over the middle and perimeter of the Pond (pictured in Figure 25 below), which would be targeted later in the season. Other species noted during the survey included cattails, benthic algae, and watershield.

As planned, a treatment with diquat was conducted for the control of target nuisance/invasive plant growth including curly-leaf pondweed and variable milfoil. The liquid contact herbicide was applied using a treatment boat equipped with a calibrated sub-surface injection system. This application methodology allows for even coverage within the treatment areas. The treatment was completed without issue. We anticipated plant die-off within just a few days to a few weeks. Days prior to the treatment, the shoreline was posted with neon pink signs noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill the permit obligation for shoreline posting.

*Figure 25: Waterlilies and watershield growing to nuisance densities*

| Surface Temp (℃) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 22.2 | 7.06 | 4'5'' |

**September 21, 2023 - Post-Treatment Survey / Final Herbicide Treatment**

*Figure 26: Water and Wetland treating the waterlilies*

On September 21st, Senior Environmental Scientist, James Lacasse, made a visit to Pine Meadow Pond. The visit consisted of performing a brief survey, collecting water quality data, and completing a treatment. Conditions during the visit were mostly sunny and calm.

Overall, Pine Meadow Pond looked great as the 2023 treatment program has been a success. Waterlilies were noted encroaching towards the middle of the Pond (see Figure 26). Besides waterlilies and watershield, minimal vegetation was noted. When noted, the vegetation was either black/brown or covered in epiphytic algae (which indicates that the plant is decaying/dying). Variable milfoil was found in trace densities, scattered within the northern third of the Pond. All variable milfoil populations appeared dead/discolored (illustrated in Figure 28 below). The previous years of treatment targeting waterlilies have worked great as more and more open water habitat has been created each year (illustrated in Figure 27). Overall, >90% control of the target invasive species (variable milfoil and curly-leaf pondweed) was achieved during the 2023 program.

*Figure 27: Open water habitat and much improved conditions created from years of waterlily treatments*

A treatment was conducted for the control of nuisance level waterlilies, specifically focusing on patches of waterlilies within the middle of the Pond and trimming the patches along the shorelines and northern point. The liquid herbicide was applied using a small jon boat, equipped with a calibrated pump, which is used to target the nuisance lilies via foliar application methodology. This method allows for even and precise coverage. Weather was also closely monitored prior to treatment to ensure a treatment date without rain or high

*Figure 28: Dead variable milfoil covered in epiphytic algae*

winds. Waterlilies are a native species, so the goal of the program was to scale back nuisance level lilies, but not eliminate all waterlily growth. Lilies provide valuable habitat and cover; however, dense lilies covering large areas have the ability to limit oxygen transfer and biodiversity. Days prior to the treatment, the shoreline was posted with neon pink signs noting the treatment, affiliated water use restrictions, and Water & Wetland contact information. The signs fulfill permit obligations for shoreline posting.

| Surface Temp (°C) | Surface Dissolved Oxygen (mg/l) | Secchi Disk Clarity (ft) |
|---|---|---|
| 22.7 | 7.89 | 5'6'' |

**Summary / 2024 Recommendations**

Flannagan Pond

Flannagan Pond continues to be the most challenging of the three Ayer Ponds. The rationale is that we are battling three invasive species. Diquat has provided excellent control of variable milfoil and curly-leaf pondweed each year. A Sonar treatment program was conducted in 2021 for the control of fanwort. This provided great control in 2021 with some regrowth in 2022. During the Spring 2023 survey, fanwort was still reduced from both the 2021 extensive Sonar treatment and the 2022 Sonar spot-treatments. Later in the 2023 season, fanwort regrowth was expanding outside of the 2023 contracted treatment areas (which were based on the 2022 surveys as Sonar must be applied early in the season). Waterlilies are also extensive throughout Flannagan Pond, although a systemic herbicide is being used on this species thus providing some level of carry-over control.

Looking forward to 2024, we recommend that Flannagan Pond be prioritized as ultimately another whole-pond Sonar treatment would highly benefit the Pond. This would target all target species in Flannagan Pond, so diquat would not be needed if this approach is taken. Sonar would provide some reduction to waterlilies; however much higher rates of fluridone would be needed to fully control lilies. Given this, we recommend the rate appropriate for control of the other species, paired with a follow-up foliar waterlily treatment.

If this approach does not fit within budgets, a similar approach to that of 2023 should be taken consisting of an initial Sonar treatment paired with the pre-management survey (May or early June). Several weeks later, diquat should be applied for the control of variable milfoil and curly-leaf pondweed (mid-June). This treatment could again be paired with a Sonar "booster" treatment. Finally, waterlily treatment should occur during the post-treatment survey in September. As noted within the report, lilies are so dense in Flannagan Pond that an initial lily treatment and a follow-up should be considered. The follow-up treatment allows for access to additional areas and can target any areas not controlled through the initial application due to boat splashing, etc. It is important to note that if whole-Pond Sonar is not the approach taken in 2024, we recommend expanding the Sonar treatment areas at a minimum.

This year, we found water chestnut in Flannagan Pond, albeit just a few plants. Luckily, this species was caught early, and we removed all plants prior to them setting seed. We will remain diligent about monitoring for water chestnut not only in Flannagan Pond, but in all three ponds. When encountered, we plan to hand-pull this species and to properly discard off-site.

Pine Meadow Pond

*Figure 29: Overlooking Pine Meadow Pond*

Conditions in Pine Meadow Pond in 2023 were consistent with previous years. Luckily, fanwort has not been introduced into Pine Meadow Pond. If it does find its way into the Pond, ideally it will be caught early through the regular surveys being conducted. Water & Wetland staff is diligent about cleaning and inspecting our boats in between each pond we visit to help limit the spread of invasives. The Town may want to consider signage at any access points to the ponds, noting the importance of cleaning and inspecting boats. Water chestnut was also found in Flannagan Pond this year and is present in other Ayer Ponds. We aim to keep this species out of Pine Meadow Pond through diligent monitoring, although signage would also help limit introduction of new invasive species (specifically fanwort and water chestnut).

Aside from keeping new invasive species out of Pine Meadow Pond, continued management of the two invasive species, curly-leaf pondweed and variable milfoil, is necessary. Diquat herbicide has been extremely effective at providing season long control of both target invasive species in Pine Meadow Pond. Unfortunately, diquat is a contact herbicide which only provides season long control of these invasive species. For this reason, diquat application should be repeated annually, based on the pre-treatment survey. The benefits to diquat are that it is fast acting, which makes it great for spot treatment. It is also much less costly verses other herbicides such as Sonar. We also considered other herbicide options, such as Procellacor, which is a newer herbicide that is widely considered the ultimate milfoil control tool. One of the benefits to Procellacor is that it is highly selective to milfoil. In the case of Pine Meadow Pond, a second target invasive species is curly-leaf pondweed, which will not be controlled through Procellacor treatment. Based on this we recommend continuing with diquat during the 2024 season for the control of the two target invasive species.

Similar to Flannagan Pond, excessive waterlily cover and density has taken over much of Pine Meadow Pond, especially in the northern portion. Since Water & Wetland took over management, there has been a drastic increase in open-water habitat, but waterlily treatment is still necessary in upcoming years. Continuing to pair this treatment with the post-management survey in September will help reduce costs.

Sandy Pond

Sandy Pond has historically battled three invasive species: fanwort, variable milfoil, and curly-leaf pondweed. Luckily, Sandy Pond is deep, and these invasive species have stayed confined to only a few small areas. This allows for spot-management of curly-leaf pondweed and variable milfoil with diquat, and management of fanwort with Sonar One. This program should ideally continue in 2024. We recommend continuing with the initial Sonar treatment during the pre-management survey, with treatment areas to be based on 2023 maps. Additionally, the Sonar booster application can be applied with the mid-June diquat application. As noted within the Flannagan Pond recommendations, we recommend Flannagan be

a priority in 2024. Waterlily and Phragmites treatment can likely be foregone in Sandy Pond in 2024, this would allow additional budget to be put towards Flannagan Pond. Given that the fanwort and milfoil stay confined to two small areas, treatment of milfoil and fanwort could also be foregone in Sandy Pond in 2024, if absolutely crucial.

Sandy Pond was closed late in the 2022 season due to a cyanobacteria bloom. Our surveys during the 2023 season did not show visual signs of cyanobacteria at any time. The 2023 season was extremely wet, so many ponds experienced nutrient loading and more persistent blooms than usual. We were happy that the Ayer Ponds did not have issues with cyanobacteria. Despite this, we still recommend having a plan in place for cyanobacteria management. The plan below is similar to our plan provided in the 2022 year-end summary report.

<u>All Ponds</u>

Cyanobacteria have the ability to reproduce rapidly, as was the case with Sandy Pond in the late Summer of 2022. Weather patterns can drastically impact cyanobacteria, the 2022 season was extremely hot and dry, which may have helped exacerbate the issue in Sandy Pond. 2023 brought wet conditions and luckily, no signs of cyanobacteria were documented in any of the three ponds. It remains extremely important to have plans in place to manage potentially harmful algae blooms, and to further understand the causes. By understanding the causes of frequent blooms, programs designed to target source nutrients can be implemented.

Phosphorus is the limiting nutrient typically fueling potentially harmful algae blooms. At a minimum in 2024, baseline nutrient analysis should be collected. This will help to make phosphorus mitigation decisions in the future. More extensive sampling could also be completed as budget allows, this would include multiple locations, depths, and rounds of sampling. Exploration of alum use can be explored, but we'd recommend bringing in a consultant such as ESS Group/TRC Environmental, who specializes in dosing aluminum treatments. Alum is commonly used in ponds, lakes and drinking water reservoirs to remove phosphorus through precipitation, forming a heavier than water particulate known as floc. This floc settles to the bottom of the waterbody to create a barrier that slows sediment phosphorus release. Alum dosing can vary greatly. A low dose treatment can be used to strip phosphorus from the water column but may need to be repeated annually or more. Higher doses may be needed to inactivate sediment phosphorus reserves. Higher doses also typically require buffering with sodium aluminate. In either case, dosing is the key to success, and a specialist such as ESS Group can assist with intense sediment sampling and dosing. Given the need for this extensive testing. We recommend keeping alum in mind for the long-term future of Sandy Pond but are not recommending its' use for 2024.

Even prior to having this data, some proactive measures could be taken to address phosphorus. One possible low-cost addition to the 2024 program would be the possible use of EutroSORB filters at the inlets. These filters are low in cost and provide filtration/reduction in free reactive phosphorus as water passes through the filters. This approach of course assumes that the phosphorus within the Pond and entering the Pond is elevated. It makes most sense to conduct water quality testing during the 2024 season to further hone in on appropriate approaches to phosphorus mitigation, if applicable.

As is always the case, we recommend using best management practices. These practices include not using fertilizers on lawns/turf or using non-phosphorous fertilizers when not fertilizing is not an option.

Encouraging beneficial buffers will also help limit nutrient input into the Pond. This can be as simple as not mowing directly up to the shoreline.

Ultimately, based on the above dialogue and analysis, the immediate recommendation for the Ayer Ponds is collection of a baseline water quality sample which includes several basic parameters as well as a suite of nutrients. This may help us "predict" blooms. Aside from this, we are always available to either collect on-call samples for algae ID and enumeration, or if budget allows, set a regular program to monitor algae species and counts. By using this data, we can determine the need for an algaecide treatment prior to conditions shutting down the waterbody. The best approach to actual management in 2024 is on-call algaecide applications with copper-sulfate if needed based on either visual monitoring, or sampling. Copper sulfate is frequently used in drinking water reservoirs, so it is extremely safe. By applying copper sulfate at the early stages of a bloom, we can control it prior to it reaching a level which would warrant a pond shut down. Copper sulfate applications are limited to ½ of the waterbody at a time per the product label. We have provided copper sulfate application costs for all three ponds within our cost table. It is recommended to budget a small amount towards copper sulfate application if applications are necessary during the 2024 season.

Conclusion

Much was accomplished in 2023 as we have continued to control invasive species and nuisance waterlilies within the Ayer Ponds. As described above, there's still work to be done. For 2024, we recommend the work described above, paired with the same approach to pre-treatment and post-treatment surveys. Flannagan Pond would benefit from more extensive attention, so we are happy to work with the Town to shift tasks accordingly to fit budgets.

We hope that this year-end report has provided the Commission with valuable information regarding the details of the work performed at Ayer Ponds during the 2023 season. All work performed was consistent with the Orders of Conditions, and the scope of services provided to the Commission. We look forward to working closely with Ayer Conservation Commission to continue to improve the health of the Ayer Ponds for many years to come.

Sincerely,

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

WATER & WETLAND

LAKE, POND & WETLAND MANAGEMENT

**Attachments Include**

- **Notarized Control Statement**
- **Pre-Treatment Invasive Species Maps**
- **Post-Treatment Maps Invasive Species Maps**
- **Post-Treatment Native Plant Assemblage Maps**

***Please note that the invasive species maps note locations where plants were found (by species). As noted within the above dialogue, the invasive species documented during the post-treatment surveys consisted of small areas, many of which were extremely unhealthy and covered in epiphytic algae.**

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

November 30,2023

Ayer Conservation Commission
c/o Office of the Board of Selectmen
Town Hall, One Main Street
Ayer, MA 01432

Dear Ms. Hampson and Commission Members:

I, Joe Onorato, certify that 90% minimum control of fanwort, milfoil, and curly-leaf pondweed within the areas designated for management, was achieved during the 2023 season. Based on surveys, it appears that significant control (>95%) of phragmites has been achieved in recent years. We anticipate this level of phragmites control through the 2023 treatments; however, this will be confirmed during the Spring 2024 survey which will assess the level of regrowth.

Sincerely,

Joe Onorato – Water & Wetland — Date 11/30/2023

I, ELVIS LULO (NOTARY) as a notary public certify that I witnessed the signature of the aforementioned signatory above and I verified the individual's identity on this date:

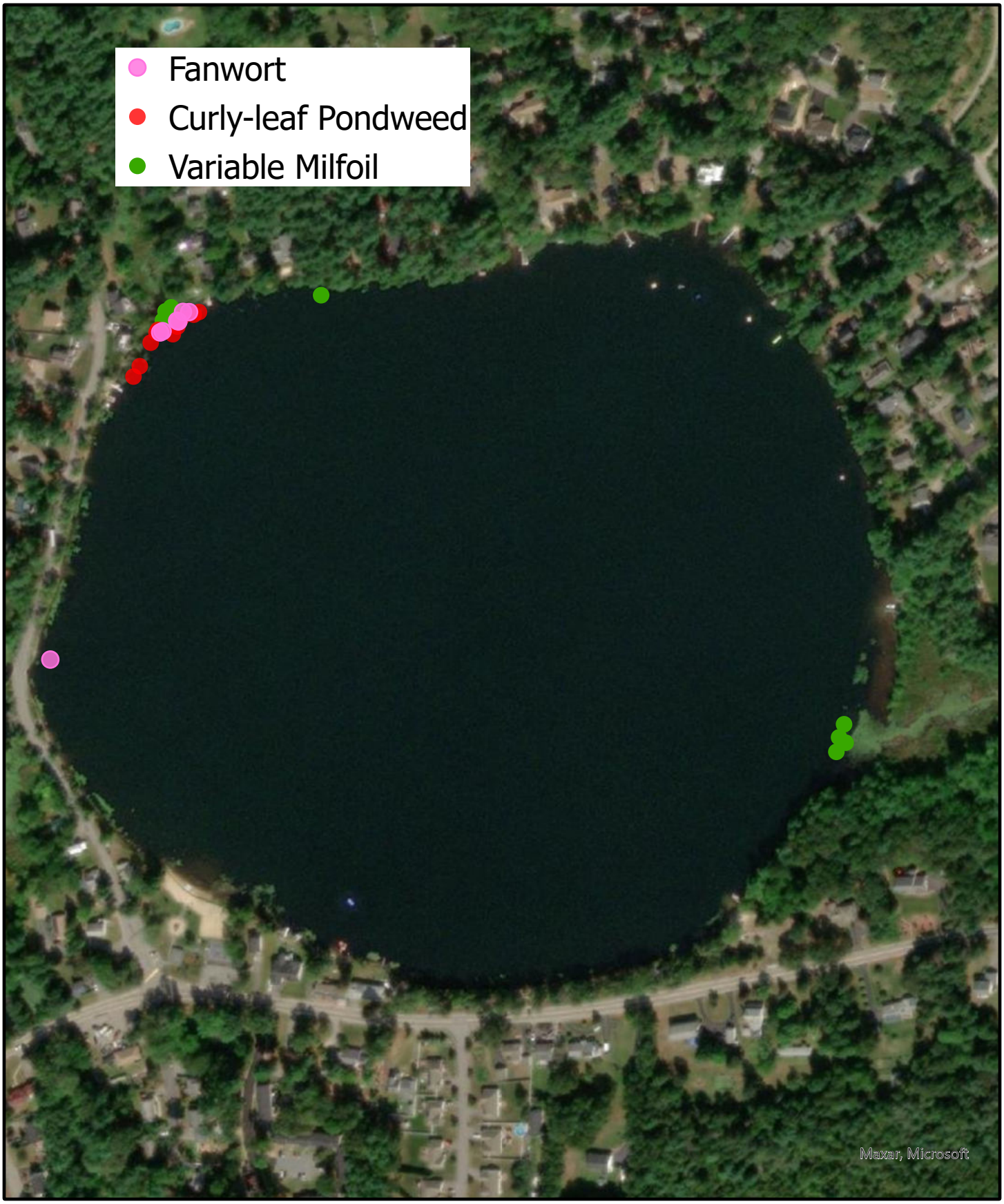
NOVEMBER 30, 20 23.

My commission expires on: 08/18/2028

Elvis Lulo
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
08/18/2028

AFFIX NOTARY SEAL

ELVIS LULO
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires 08/18/2028



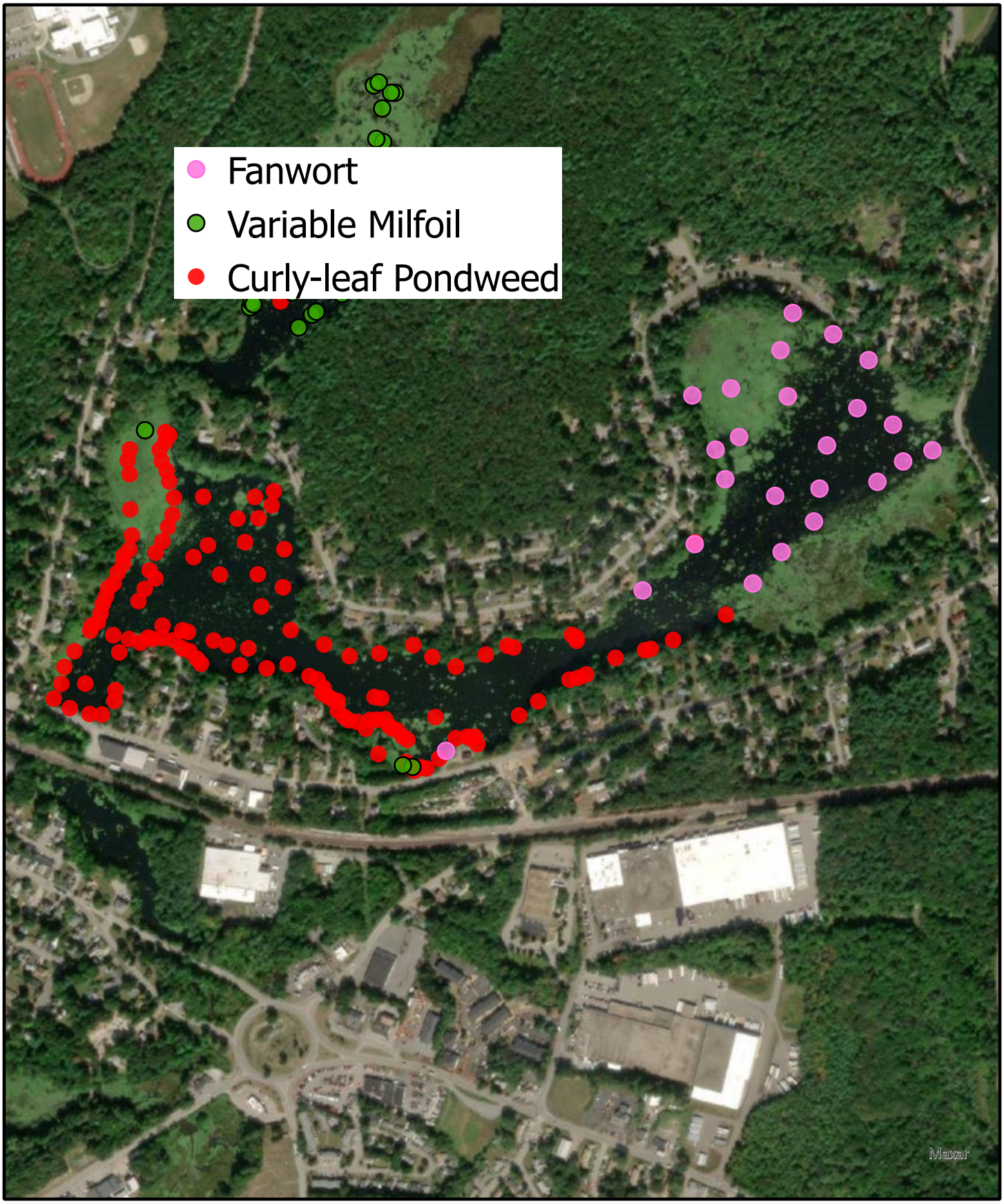

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Sandy Pond***
Invasive Species Map
**Ayer, MA**

Survey Date
*6/1/2022*

Map Date
*6/6/2022*

N



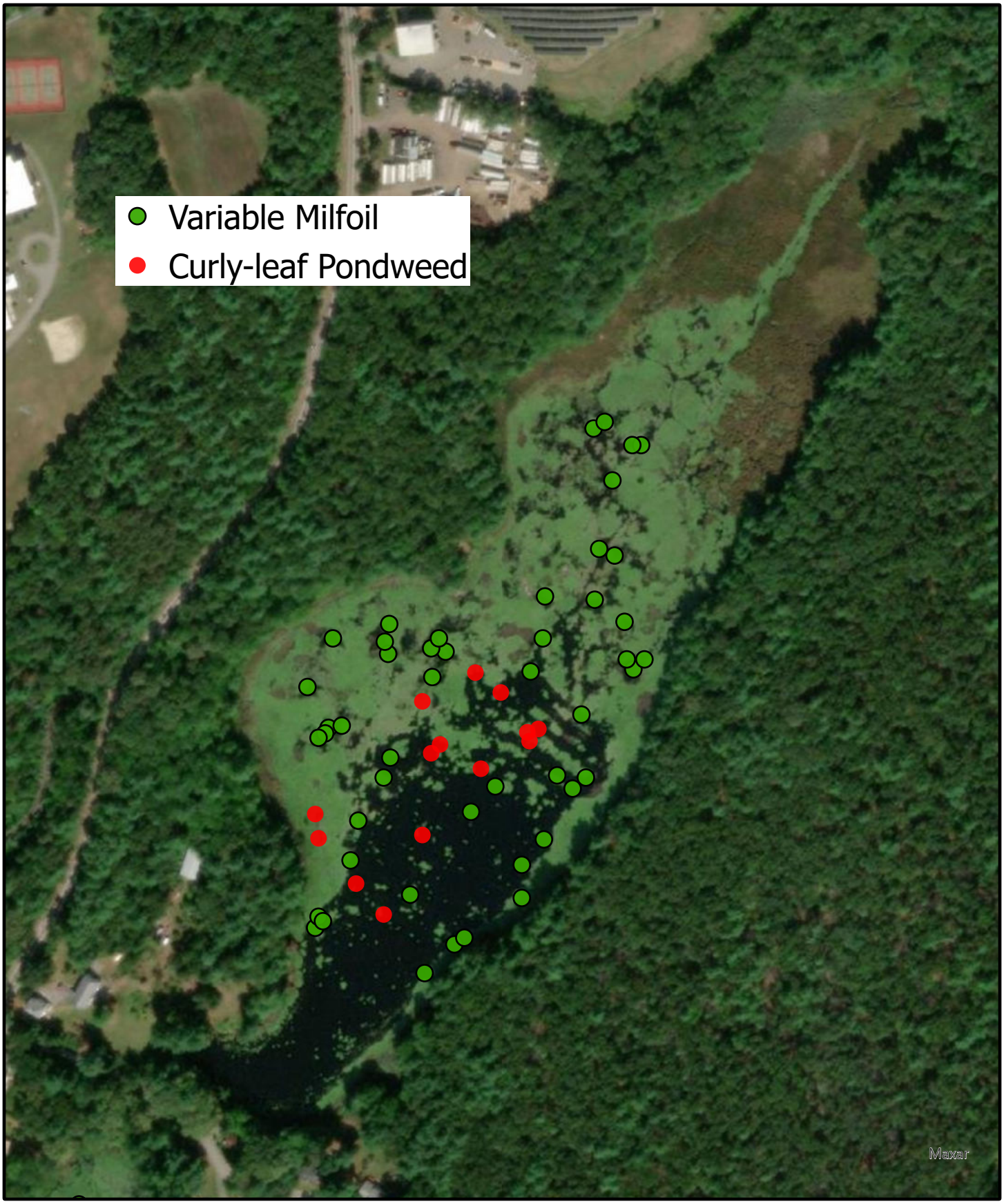

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Flannagan Pond***
Invasive Species Map
**Ayer, MA**

Survey Date
*6/1/2022*

Map Date
*6/6/2022*

N



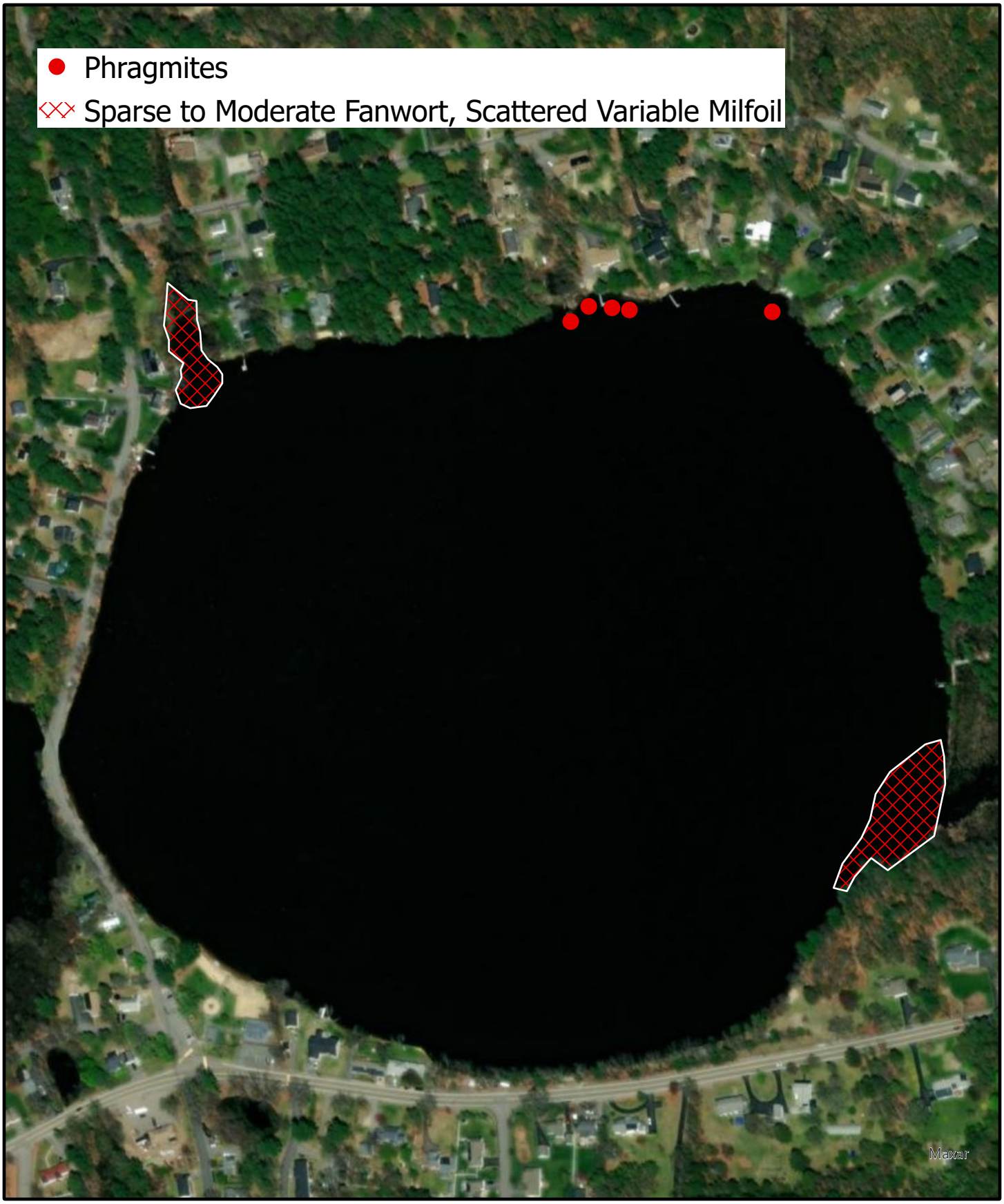

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Pine Meadow Pond***
Invasive Species Map
**Ayer, MA**

Survey Date
*6/1/2022*

Map Date
*6/6/2022*

N



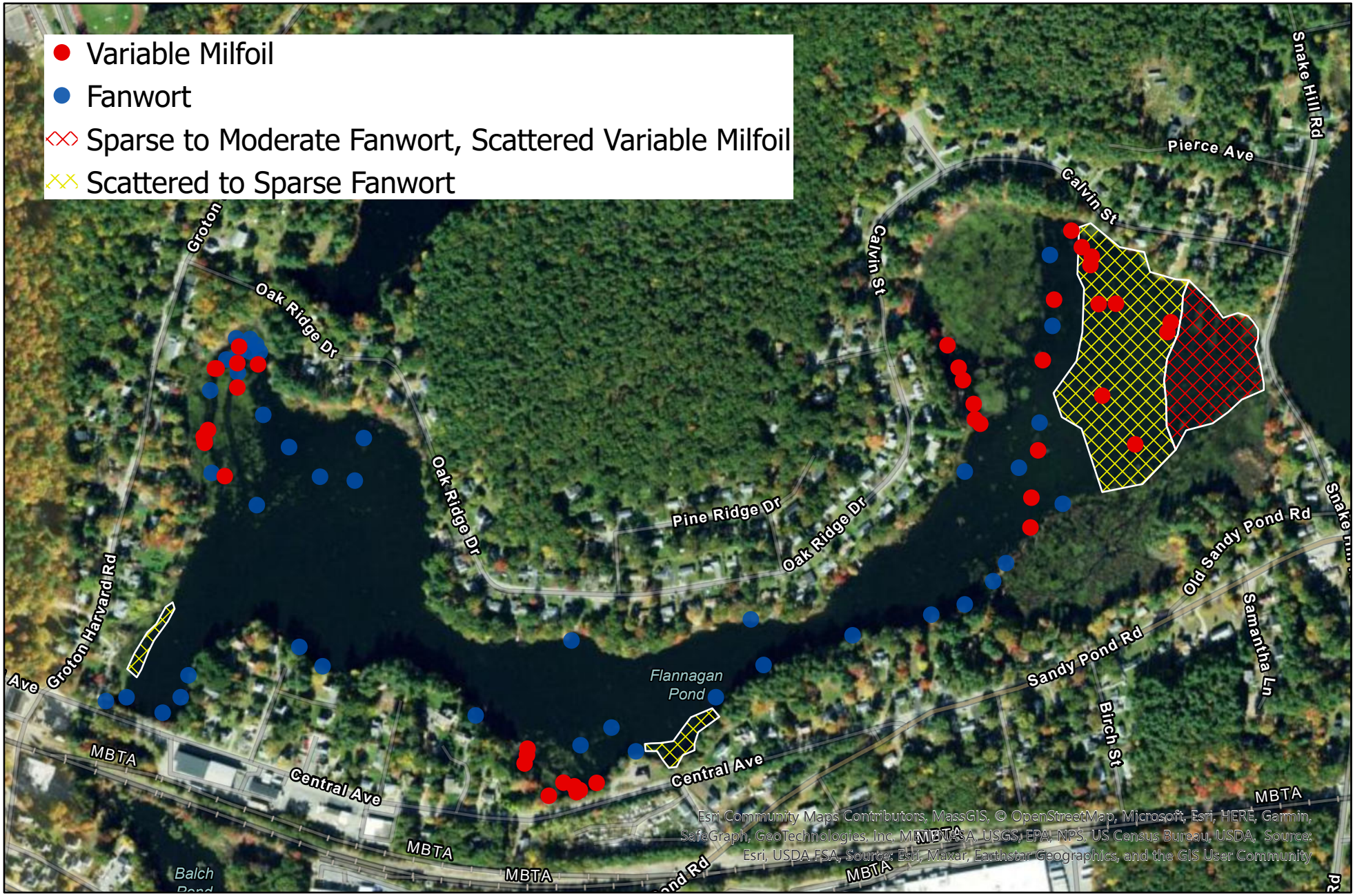

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Sandy Pond***
Invasive Species Distribution
**Ayer, MA**

Survey Date
*9/21/2023*

Map Date
*10/9/2023*

N



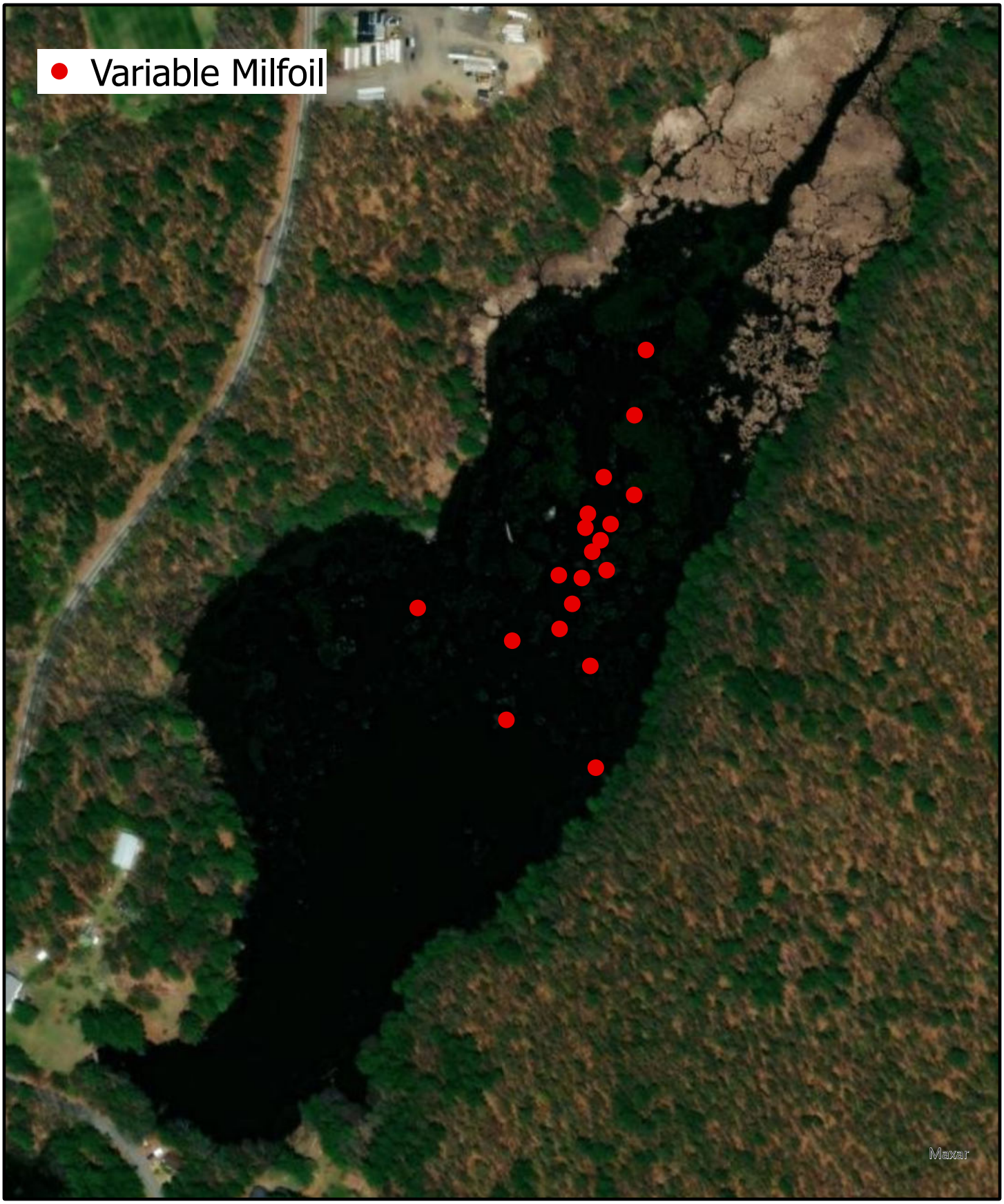

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Flannagan Pond***
Invasive Species Distribution
**Ayer, MA**

Survey Date
*9/21/2023*

Map Date
*10/9/2023*

N



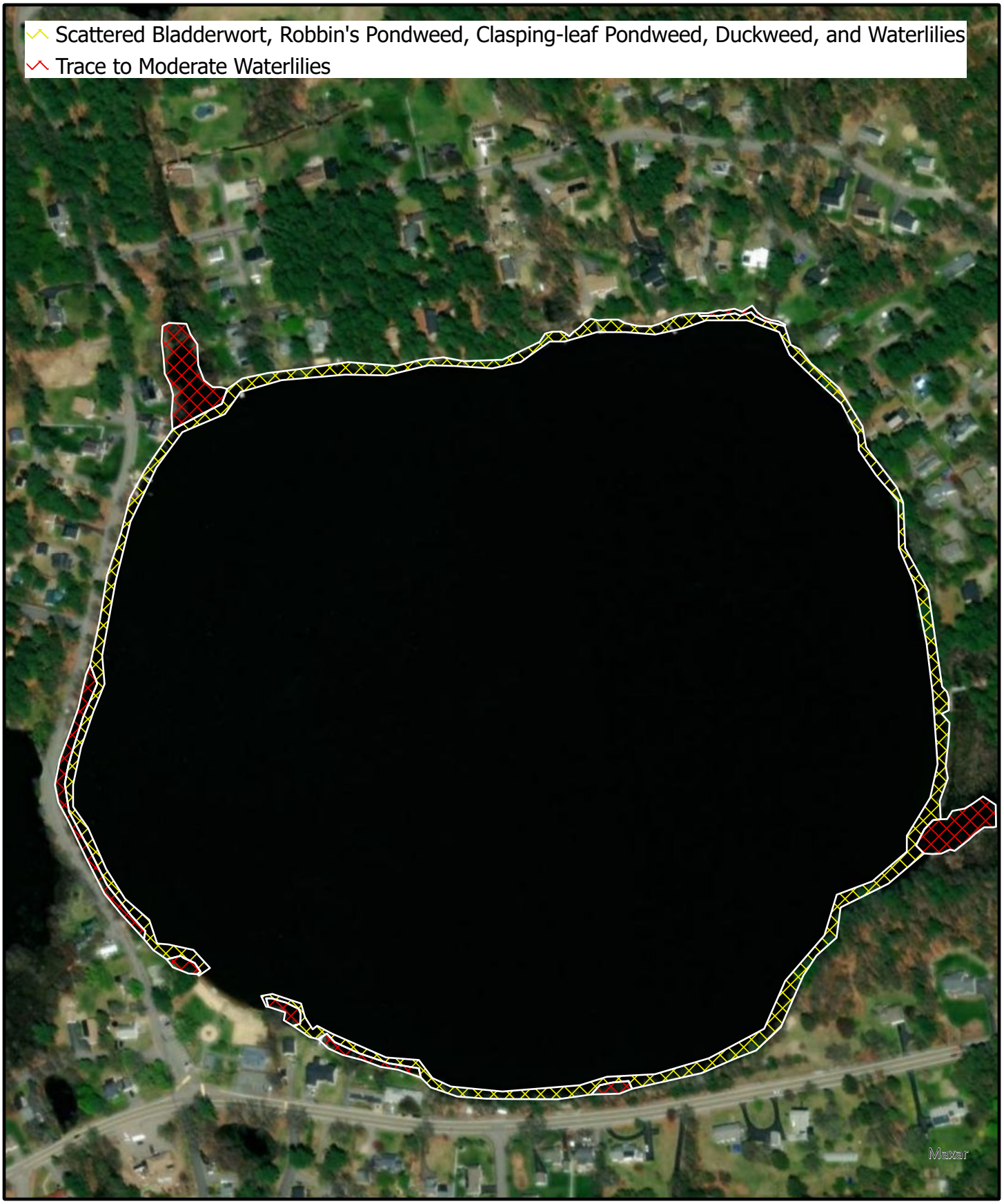

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Pine Meadow Pond***
Invasive Species Distribution
**Ayer, MA**

Survey Date
*9/21/2023*

Map Date
*10/9/2023*

N




WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Sandy Pond***
Native Species Distribution
**Ayer, MA**

Survey Date
*9/21/2023*

Map Date
*10/9/2023*

N

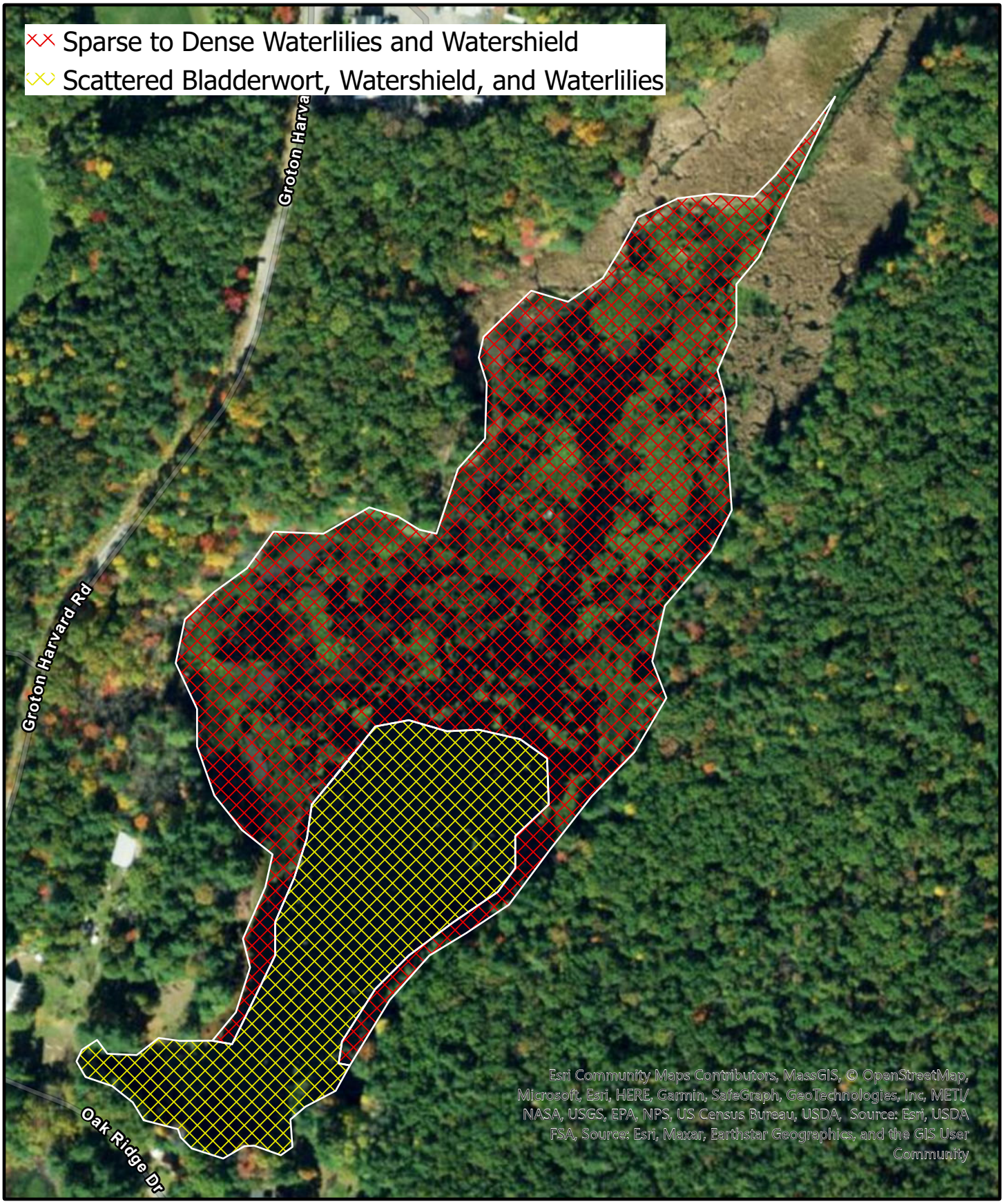

WATER & WETLAND
LAKE, POND & WETLAND MANAGEMENT

***Flannagan Pond***
Native Species Distribution
**Ayer, MA**

Survey Date
*9/21/2023*

Map Date
*10/9/2023*

N

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***Pine Meadow Pond***
Native Species Distribution
**Ayer, MA**

Survey Date
*9/21/2023*

Map Date
*10/9/2023*

N