December 21, 2023

The City of Lynn
3 City Hall Square
Lynn, MA 01901
Attn: Lisa Nerich – Associate Commissioner, Department of Public Works
Sent via email: lnerich@lynnma.gov

Re: Lynn Ponds (Sluice Pond, Flax Pond, Floating Bridge Pond, and Goldfish Pond), Lynn, MA – 2023 Year End Report

Dear Ms. Nerich,

It is our pleasure to present a year end summary report to The City of Lynn regarding the 2023 aquatic management program at The Lynn Ponds (Sluice Pond, Flax Pond, Floating Bridge Pond, and Goldfish Pond). Below you will find table summaries of the work performed, followed by more detailed summaries of each visit. Lastly, you will find 2024 recommendations as applicable.

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 1). 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, but the figure shown provides 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 (refer to Figure 2). Water clarity was also assessed using a Secchi disk. A Secchi disk is a disk with alternating black and white quadrants (pictured in Figure 1). 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 measure of the transparency of the water. All readings are included in the tables throughout this report.

Figure 1: Equipment and meters utilized during each site visit as applicable

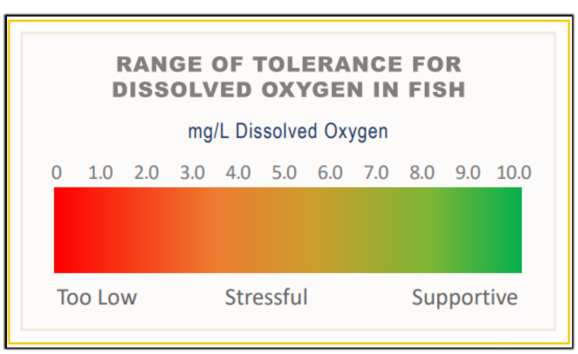

Figure 2: Dissolved oxygen table

SLUICE POND

Figure 3: Sluice Pond - Lynn, MA

Sluice Pond (pictured in Figure 3 to the right) is approximately 43 surface acres and is located in Lynn, MA. This waterbody is primarily bordered by developed properties around the perimeter of the Pond. There is a public boat launch found within the western cove, off Lynnfield Street (Route 129). This is the launch that Water and Wetland would utilize during each site visit. Lynnapeasaukee Four Winds Pub and Grill is noted within the eastern cove, which is a restaurant on the waterbody that includes docks for boating. Sluice Pond is fairly deep as the average depth is roughly 12 feet, with a maximum depth of 69 feet. Fishing is a popular recreation activity at Sluice Pond as it is stocked by MA Fish and Wildlife.

Historically, the Sluice Pond has battled invasives species curly-leaf pondweed *(Potamogeton crispus)* and fanwort *(Cabomba)*, in addition to nuisance pondweeds and algae blooms. The goal of the 2023 program was to manage the invasive species, nuisance pondweeds, and microscopic/filamentous algae while monitoring basic water quality through a proactive monthly 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.

All permitting, treatment and survey tasks were completed without issue and at the proper times. The table below provides the specific dates of each task. Below the table, each visit/task performed is described in additional detail.

Summary Of 2023 Management Activities

Date	Task/Description
April 17, 2023	A pre-treatment survey was accomplished to gauge a baseline condition of the Pond, document vegetation species/densities present, and help guide 2023 management
May 23, 2023	A survey was performed to assess the overall conditions of the Pond and to confirm potential treatment areas; An herbicide treatment was completed
June 21, 2023	A post-survey was conducted to evaluate the effectiveness of the previous treatment
July 12, 2023	A survey was conducted; An herbicide and an algaecide treatment were conducted
August 10, 2023	A post-treatment survey was completed in order to evaluate the effectiveness of the previous treatments; An algae sample was collected
August 24,2023	A brief survey was conducted to assess Pond conditions and document species present; An algaecide treatment was performed
September 25, 2023	The final site visit was completed; A post-treatment survey was performed determine the effectiveness of the previous treatment, to document late-

	season conditions, gauge the overall effectiveness of the 2023 Aquatic Management Program, and to guide recommendations for the 2024 season

<u>April 17, 2023 - Pre-Treatment Survey</u>

Figure 4: Overview of weather conditions at Sluice Pond

On April 17th, Senior Aquatic Biologist, Scott Conrade, completed a site visit to Sluice Pond. The visit consisted of performing a survey and collecting basic water quality data. Weather conditions during the visit were 53 degrees with scattered light rain showers (conditions illustrated in Figure 4).

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Aquatic vegetation was just starting to grow. There were sparse native thin-leaf pondweed (*Potamogeton pusillus)* that were present at the time of survey. This population was only at sparse densities and were scattered throughout the Pond. In addition, there were also some cold water algae species observed floating on the surface. These cold-water species should subside soon due to the increasing temperatures. Native waterlilies (*Nymphaea odorata*) and watershield (*Brasenia schreberi*) were also documented as beginning to grow. No invasive species were documented at this time.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
15.1	11.28	6 ft 3in

<u>May 23, 2023 - Pre-Treatment Survey / Herbicide Treatment</u>

On May 23rd, Aquatic Biologist, Scott Conrade, and seasonal aquatic field assistant, Brian Sweeney, completed a site visit to Sluice Pond. The visit consisted of performing a survey, collecting basic water quality data, and conducting a treatment (treatment being conducted in Figure 5). Weather conditions during the visit were sunny and in the mid-60s.

Figure 5: Brian Sweeney looks on as the application is taking place.

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. Upon completion of the survey, curly-leaf pondweed was only present in the cove with the boat launch and the northwest cove of the Pond. Fanwort had not emerged in Sluice Pond yet; however, it should be germinating soon and will be targeted in a future treatment, based on the survey data. Aside from the curly-leaf pondweed, several native species were documented at non-nuisance levels. Waterlilies were also observed in low densities in various areas around the Pond. There was sparse filamentous algae that was caught up in these areas of waterlilies (conditions illustrated in Figure 6), however, the algae was not in high enough densities to warrant treatment at this time.

Figure 6: Filamentous algae, organic debris, and waterlilies at the surface of Sluice Pond

Based on the previous survey, the treatment was pre-scheduled for this date. As planned and further confirmed by the survey, a treatment was conducted for the control of curly-leaf pondweed. We also anticipate some impacts to lilies only within the treatment area. The liquid 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. Prior to the treatment, the City and Association were notified and provided with the treatment poster. Immediately prior to treatment, neon pink posters were hung around the shoreline noting the treatment, affiliated water-use restrictions, and Water & Wetland contact information.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
18.8	9.18	9ft 8in

June 21, 2023 – Post-Treatment Survey

On June 21st, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Sluice Pond. 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 were fanwort* (*Cabomba caroliniana*), tape grass (*Vallisneria americana*), Japanese knotweed*(*Reynoutria japonica*), thin-leaf pondweed, benthic algae, sago pondweed (*Potamogeton pectinatus*), multiflora rose* (*Rosa multiflora*), water starwort (*Callitriche stagnalis*), and Garlic Mustard*(*Alliaria petiolate*). Several of these species are considered invasive in the state of Massachusetts and annotated utilizing an "*". Additionally, the pH was checked with a calibrated meter and was 7.8 which is within standard range for freshwater and is considered neutral.

Figure 7: Aquatic Biologist, Scott Conrade, holds up a piece of fanwort.

Fanwort (documented in Figure 7) was found in various locations around the Pond in only trace densities. One of the locations was near the boat launch area and was likely where this species first entered the Pond. These areas will be treated during the next visit which will be bumped up to early July, as this will allow time for the proper notifications to be conducted. The start of a small planktonic algae bloom was also noted. Although not urgent, we anticipated copper sulfate to be applied at the same time as the fanwort treatment to stop the bloom in its tracks. Several fish species were documented during our survey including Pumpkinseed (*Lepomis gibbosus*), Bluegill (*Lepomis macrochirus*), Largemouth Bass (*Micropterus salmoides*), and even an extremely large White Koi (*Cyprinus carpio*). Two deceased ducks were documented in the lake in close proximity to each other, this is likely due to a predator.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
21.8	9.91	5ft 2in

July 12, 2023 – Microscopic Algae and Fanwort Treatment

Figure 8: Microscopic algae bloom at Sluice Pond

On July 12th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Sluice Pond. The site visit consisted of conducting a survey, collecting basic water quality data, and completing two treatments. Conditions during the site visit were sunny, hot, and calm.

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. The purpose of the survey was to confirm potential treatment areas and to evaluate the microscopic algae bloom. Upon arrival, it was documented that the start of a planktonic algae bloom was occurring (bloom conditions illustrated in Figure 8). There were also sparse filamentous algae mats observed as Water and Wetland navigated further out into the Pond. Patches of fanwort that were located during the last survey were treated in these localized areas. Plants documented during the survey were fanwort*, waterlilies, duckweed (*Lemna sp.*), watermeal (*Wolffia)*, common waterweed (*Elodea sp.*), planktonic algae, Japanese knotweed*, multiflora rose*, and filamentous algae. As mentioned previously, (*) 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. During the survey, the pH was checked using a calibrated meter and was 7.9 which is within a standard range and is considered neutral, however, leaning towards basic.

Two treatments were completed during this site visit. The first treatment was conducted for the control of target nuisance/invasive plant growth, specifically fanwort. The liquid contact herbicide was applied using a treatment boat equipped with a calibrated sub-surface injection system. This application methodology allowed for even coverage within the treatment areas. We anticipated plants to die-off within just a few days to a few weeks. Additionally, copper sulfate was mixed into an onboard mixing tank and injected into the water column via a calibrated subsurface injection system from a custom flat bottom jon boat. The copper sulfate was spread evenly throughout the treatment areas, which provided the most effective treatment possible. The copper sulfate was applied to 1/2 of the Pond, as limited by the product label. Both treatments were completed without issue.

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. The city was also notified in advance and was sent all treatment language, etc. Additionally, scheduling was adjusted to ensure the treatment was conducted after 11AM so as not to interfere with any recreational programs.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
27.5	10.14	5ft 2in

August 10, 2023 – Post-Treatment Survey / Algae Sample Collected

On August 10th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Grace Adams, made a visit to Sluice Pond. The site visit consisted of completing a post-treatment survey and collecting basic water quality data in addition to collecting an algae sample. Conditions during the site visit were mostly cloudy with a slight breeze.

Figure 9: Macroalgae floating on the surface of Sluice Pond.

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. The purpose of this survey was to assess the efficacy of the treatments conducted during the last site visit. Since the Pond was experiencing a mild algae bloom, there was limited visibility, so rake tosses were thrown to assess any vegetation. Rake tosses revealed sparse densities of fanwort, chara (*Chara vulgaris)*, bladderwort (*Utricularia sp.)*, bushy pondweed (*Najas guadalupensis)*, and thin-leaf pondweed. Other species noted included waterlilies, cattails (*Typha sp.),* Japanese knotweed, and multiflora rosa. The fanwort population remaining was extremely trace as the previous treatment worked well.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
24.1	8.96	3 ft 3in

August 24, 2023 – Survey / Algaecide Treatment

Figure 10: Purple loosestrife on the shoreline of Sluice Pond

On August 24th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Sluice Pond. The purpose of the site visit was to complete a brief survey, collect basic water quality data, and conduct a treatment. Conditions during the site visit were sunny and calm.

A brief survey was completed in order to document vegetation species present and confirm the presence of microscopic algae. Plants documented during the survey were waterlilies, purple loosestrife (observed in Figure 10), Japanese knotweed, fanwort, muskgrass and microscopic algae. The treatment was completed successfully. Copper sulfate was mixed into an onboard mixing tank and injected into the water column via a calibrated subsurface injection system from a custom flat bottom jon boat. The copper sulfate was spread evenly throughout the treatment areas, which will provide the most effective treatment possible. The treatment was applied to half of the surface area of the Pond, as per the label restriction.

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 (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
23.7	8.62	3ft 11in

September 25, 2023 - Post-Treatment Survey

On September 25th, Aquatic Biologist, Scott Conrade, made a visit to Sluice Pond. The purpose of the site visit was to conduct a post-treatment survey (post-management survey) and collect basic water quality data. Conditions during the survey were mostly cloudy and fairly calm with a light drizzle.

Figure 11: microscopic algae colonies

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. The purpose of the survey was to evaluate the effectiveness of the previous treatment in addition to assessing the 2023 aquatic management program and to help guide recommendations for the 2024 season. A minor microscopic algae bloom was noted, this was predominantly visible as windblown against shorelines (illustrated in Figure 11). It was late in the season so we anticipated this to die-off naturally; however, if selected, sampling could provide more information in terms of species and cell counts. Fanwort as documented in extremely low densities. This was likely regrowth from the previous treatment, which is common to see when using contact herbicides. GPS points were collected where fanwort was documented to assist with 2024 management. Japanese knotweed was documented in various locations around the shoreline. This should typically be managed although it likely extends onto private property. Aside from these notes, no nuisance species were documented. Dissolved oxygen was excellent. Other species documented during the site visit included water starwort, muskgrass, multiflora rose, white waterlilies, and cattails.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
19.1	9.26	3ft 4in

FLAX POND

Flax Pond (pictured to the right in Figure 12) is approximately 55 surface acres and is located in Lynn, MA. Access to the Pond was granted through Flax Pond Playground, where the boat was launched by the swim pad. A fountain is noted within the southern basin adjacent to the playground, which can be observed from Broadway. A buoy barrier swimming line is stretched across the opening of the southern basin, keeping boats and swimmers out of the area containing the fountain. Power to the fountain, along with the barrier swimming line, are stored in the boat house within the Flax Pond Playground (by the swim pad). This waterbody is primarily bordered by developed properties and parks. There are three parks surrounding the Pond including Flax Pond Playground (southern basin), Flax Pond Rest Area (northeastern shoreline), and Magnolia Park (western cove). Several families of waterfowl were documented in/around the Pond throughout the 2023 season.

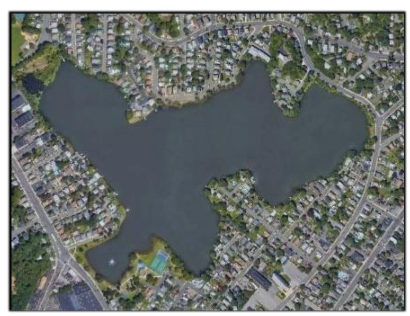

Figure 12: Flax Pond - Lynn, MA

Historically, the primary focus of Flax Pond included managing invasive species curly-leaf pondweed, spiny naiad *(Najas marina)*, and phragmites *(Phragmites australis)*, in addition to nuisance densities of pondweeds, and algae (both filamentous and microscopic algae) blooms. The goal of the 2023 program was to manage the invasive species, nuisance pondweeds, and algae occurrences while monitoring basic water quality through a proactive monthly 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.

All permitting, treatment and survey tasks were completed without issue and at the proper times. The table below provides the specific dates of each task. Below the table, each visit/task performed is described in additional detail.

Summary Of 2023 Management Activities

Date	Task/Description
April 17, 2023	Fountain installation; A pre-treatment survey was conducted
May 23, 2023	A pre-treatment survey was accomplished to gauge a baseline condition of the Pond, document vegetation species/densities present, and help guide 2023 management
June 21, 2023	A general survey was conducted to evaluate the conditions of the Pond
July 12, 2023	A survey was completed; An algaecide treatment was conducted targeting microscopic algae
August 10, 2023	A survey was performed to evaluate the effectiveness of the previous treatment and to assess the overall health of Flax Pond
August 24, 2023	Water and Wetland conducted a survey to confirm potential treatment areas; An herbicide treatment was performed; An algaecide treatment was conducted
September 25, 2023	The final site visit was completed; A survey was performed to evaluate the effectiveness of the previous treatment, document late-season conditions, gauge the overall effectiveness of the 2023 Aquatic Management Program, and to guide recommendations for the 2024 season
November 14, 2023	The fountain was removed and properly stored

<u>April 17, 2023 – Fountain Installation and Pre-Treatment Survey</u>


Figure 13: The fountain at Flax Pond

On April 17th, Aquatic Biologist, Scott Conrade, completed a site visit to Flax Pond. The visit consisted of conducting a survey and collecting basic water quality data. The weather conditions during the visit were 51 degrees with light rain.

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. During the survey it was noted that in Flax Pond there was very little plant growth at this time. Some small-leaf pondweeds were beginning to grow during the survey. There were also sparse waterlily growth noted at various places throughout the Pond. Additionally, there was benthic filamentous algae and cold-water algae noted at non-concerning densities. We anticipated this to dissipate as temperatures increase. The pH was 7.8, which is within the standard range for freshwater and is considered neutral. The fountain which was installed during our previous visit was inspected and was functioning as intended (pictured in Figure 13).

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
15.4	10.31	4ft

May 23, 2023 - Monitoring Site Visit / Survey

On May 23rd, Senior Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, completed a site visit to Flax Pond. The visit consisted of performing a survey and collecting basic water quality data. The weather conditions during the visit were sunny and 60 degrees.

Figure 14: Phragmites at Flax Pond

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. During the survey, several native pondweeds / aquatic plants were observed in multiple locations throughout Flax Pond. This included clasping-leaf pondweed (*Potamogeton perfoliatus*), thin-leaf pondweed, and waterlilies. Several small patches of common reed were also noted during the survey (documented in Figure 14). Some microscopic algae was noted, but not at a level which would warrant algaecide treatment at this time. Pollen was also noted collecting along the shoreline in several areas, especially in windblown areas. The fountain was inspected and was functioning normally.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
18.5	10.49	5ft 4in

June 21, 2023 - Monitoring Site Visit / Survey

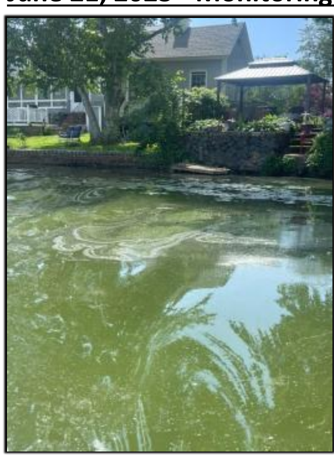

Figure 15: Planktonic algae bloom at Flax Pond

On June 21st, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Flax Pond. The site visit consisted of completing a survey and collecting basic water quality data. Conditions during the survey were mostly sunny and calm.

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 were thin-leaf pondweed, white waterlilies, tape grass, curly-leaf pondweed, clasping-leaf pondweed, coontail (*Ceratophyllum demersum*), benthic filamentous algae, and microscopic algae. During the survey, th pH was checked with a calibrated meter and was 7.5 which is within the standard range and is considered neutral. It was extremely apparent that a planktonic algae bloom (bloom noted with Figure 15) was starting. Based on this, we planned for treatment in early July. This would allow time for the proper notifications to be completed prior to treatment. While some curly-leaf pondweed was documented it was in trace to sparse densities and appeared unhealthy. Additional species documented are all native and were not documented at nuisance densities. Waterlilies would continue to be monitored as GPS points of waterlilies were collected during the survey. If these do warrant treatment, it would occur during the August visit, which is the optimal time for waterlily treatment.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
21.3	12.06	1ft 5in

July 12, 2023 – Pre-Treatment Survey and Algaecide Treatment

On July 12th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Flax Pond. The site visit consisted of completing a survey, collecting basic water quality data, and conducting a treatment. Conditions during the site visit were mostly sunny and calm.

Figure 16: Microscopic bloom being treated at Flax Pond

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. Consistent with our previous survey, a microscopic algae bloom was noted throughout the majority of Flax Pond. There were no nuisance pondweeds or submerged/floating invasive species noted during the visit. Plants documented during the survey were white waterlilies, yellow waterlilies, clasping-leaf pondweed, tape grass, common waterweed, southern water nymph, purple loosestrife*, common reed*, and Japanese Knotweed*. (*) denotes an invasive species. During the survey, the pH of the Pond was measured at 7.7 which is within the standard range for freshwater and is considered neutral leaning towards basic.

Based on the survey results, a copper sulfate treatment was administered. Copper sulfate was mixed into an onboard mixing tank and injected into the water column via a calibrated subsurface injection system from a custom flat bottom jon boat. The copper sulfate was spread evenly throughout the treatment areas, which will provide the most effective treatment possible. The copper sulfate was applied to 1/2 of the Pond, as limited by the product label.

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. The City was also notified well in advance with all required treatment language, etc.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Disk (ft)
26.3	7.75	2ft 9in

August 10, 2023 - Monitoring Site Visit / Post-Treatment Survey

On August 10th, Senior Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Grace Adams, made a visit to Flax Pond. The purpose of the site visit was to conduct a post-treatment survey to evaluate the effectiveness of the previous treatment and document the overall health of Flax Pond. Conditions during the survey were partly cloudy and calm.

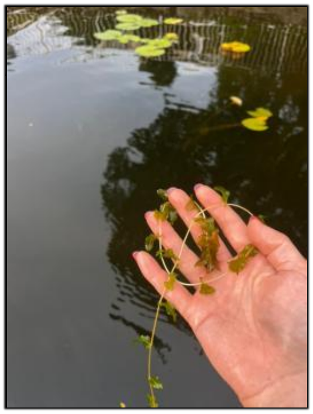

Figure 17: Clasping-leaf pondweed and waterlilies noted during the survey

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. The purpose of this survey was to assess the efficacy of last visits algae treatment. Compared to pre-treatment conditions, there has been a significant reduction in the severity of the algae bloom. There was still an evident bloom occurring, and it should be treated again next site visit. Additionally, there were several healthy populations of native species that were scattered around the Pond. Species noted during the survey were microscopic algae, tape grass, thin-leaf pondweed, common waterweed, clasping-leaf pondweed (pictured in Figure 17), purple loosestrife*, white waterlilies (Figure 17), bladderwort, benthic algae, duckweed, southern water nymph, common reed*, and Japanese knotweed*. (*) denotes an invasive species. In addition to the microscopic algae, there were also patches of benthic filamentous algae. The dominant native species that were observed included: tape grass, waterlilies, and clasping-leaf pondweed.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
23.7	7.43	3ft 11in

<u>August 24, 2023 – Pre-Treatment Survey /Algae and Waterlily Treatment</u>

On August 24th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Flax Pond. The site visit occurred to complete a survey, collect basic water quality data, and to perform two treatments. Conditions during the site visit were sunny and calm.

Figure 18: Waterlilies and cattails at Flax Pond

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. The survey was conducted to evaluate the health of the Pond and to confirm potential treatment areas. Species noted during the survey included white waterlilies, yellow waterlilies, clasping-leaf pondweed, common waterweed, southern water nymph, purple loosestrife*, common reed*, cattails, and Japanese knotweed*. (*) denotes an invasive species that was observed during this visit.

Based on the results of the survey, two separate treatments were performed during the site visit. First, a copper sulfate treatment was conducted. The granular algaecide was mixed into an onboard mixing tank and injected into the water column via a calibrated subsurface injection system from a custom flat bottom jon boat. The copper sulfate was spread evenly throughout the treatment areas, which provided the most effective treatment possible. The treatment was applied to 1/2 of the Pond, as limited by the product label. The next treatment was conducted for the control of nuisance level waterlilies. The liquid herbicide was applied using the small jon boat, equipped with a calibrated pump, which is used to target the nuisance lilies via foliar application methodology. The patch, pictured in Figure 18, was one of the areas controlled during the application. This method allows for even and precise coverage. 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. 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 Depth (ft)
23.3	9.07	4ft 2in

September 25, 2023 – Post-Management Survey

On September 25th, Aquatic Biologist, Scott Conrade, made a visit to Flax Pond. The purpose of the site visit was to assess the 2023 aquatic management program and to help guide recommendations for the 2024 season. Conditions during the site visit were mostly cloudy and with rain (see conditions in Figure 19). Due to the weather conditions, the survey heavily relied on rake tosses.

Figure 19: Overview of Flax Pond

Curly-leaf pondweed was found in several areas of the Pond. This was typical of this time of year, as curly leaf is a cold-water species and sprouts when the water temperatures cool. A plethora of native species were also observed during the survey; however, none were at nuisance levels. Invasive Japanese Knotweed was documented along the shoreline but likely was on private property. The microscopic algae also seemed to be at low abundance during this visit. It has greatly improved since the previous treatment. Other species documented during the survey were clasping-leaf pondweed, curly-leaf pondweed*, white waterlilies, yellow waterlilies, common reed, southern water nymph, purple loosestrife*, thin-leaf pondweed, benthic filamentous algae, microscopic algae, duckweed, watermeal, Japanese knotweed*, and common waterweed. The (*) denotes an invasive species.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
18.8	9.32	5ft 3in

FLOATING BRIDGE POND

Floating Bridge Pond (pictured in Figure 20) is a total of 11 surface acres and is located in Lynn, MA. The Pond is made up of two basins, referenced as “East Basin” and “West Basin” throughout the report. The Eastern and Western Basin are split by Western Avenue, with the Eastern Basin compromised of 8 acres and the Western Basin totaling 3 acres. This waterbody is primarily bordered by sparse woodlands and shrubbery, with properties abutting the Western and Southern shoreline of the Eastern Basin. Several families of Waterfowl were documented in/around the Pond throughout the 2023 season. Access to the Pond was granted through a condominium parking lot on the Western side of the East Basin, and off of Linton Road within the West Basin.

Figure 20: Floating Bridge Pond - Lynn, MA

Historically, Floating Bridge Pond has battled invasive species fanwort, curly-leaf pondweed, variable milfoil *(Myriophyllum heterophyllum)*, Eurasian milfoil *(Myriophyllum spicatum)*, and common reed, in addition to filamentous and microscopic algae blooms. The goal of the 2023 program was to manage the microscopic algae while monitoring basic water quality through a proactive monthly 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.

All permitting, treatment and survey tasks were completed without issue and at the proper times. The table below provides the specific dates of each task. Below the table, each visit/task performed is described in additional detail.

Summary Of 2023 Management Activities

Date	Task/Description
April 17, 2023	A pre-treatment survey was accomplished to gauge a baseline condition of the Pond, document vegetation species/densities present; and to help guide 2023 management
May 23, 2023	A general survey was conducted to evaluate the conditions of the waterbody; An herbicide treatment was completed
June 21, 2023	Water and Wetland conducted a survey to evaluate the effectiveness of the previous treatment
July 12, 2023	A survey was completed to confirm potential treatment areas; An herbicide and algaecide treatment were performed
August 10, 2023	A post-treatment survey
September 25, 2023	The final site visit was completed; A survey was performed to evaluate the effectiveness of the previous treatment, document late-season conditions and gauge the overall effectiveness of the 2023 Aquatic Management Program and to guide recommendations for the 2024 season; An herbicide treatment was completed

April 17, 2023 - Pre-Treatment Survey

Figure 21: Overlooking the Western Basin, cattails and phragmites remain dormant

On April 17th, Senior Aquatic Biologist, Scott Conrade, completed a site visit to Floating Bridge Pond. The visit consisted of performing a survey and collecting basic water quality data. Conditions during the visit were cloudy and 51 degrees F.

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. At the time of this survey there was very little plant growth. Sparse fanwort was beginning to appear in various places throughout both basins. The most dominant species at this time was filamentous algae; however it was not at densities which would warrant treatment at this time. Common reed were noted around the East Basin, however it was still dormant at this time (illustrated in Figure 21). At the time of this survey, it was still early in the season. A follow-up survey was scheduled for May to document the most appropriate management and affiliated timing.

	Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
East Basin	15.3	8.45	7ft 4 in
West Basin	14.2	7.61	-

<u>May 23, 2023 - Survey / Herbicide Treatment</u>

On May 23rd, Senior Aquatic Biologist, Scott Conrade, completed a site visit to Floating Bridge Pond. The visit consisted of performing a survey (Water and Wetland conducting a survey in Figure 22), collecting basic water quality data, and conducting a treatment. Conditions during the visit were sunny and 63 degrees.

Figure 22: Phragmites seen during the treatment at Floating Bridge Pond

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. In the Western Basin, sparse curly-leaf pondweed was still present, however the most dominant plant was fanwort. There was also a slight filamentous algae bloom occurring at the time of the visit. Overall, in the West Basin of the Pond, conditions were similar to the East Basin. There was however more Fanwort cover in the West Basin.

As planned, and based on the survey, a treatment was conducted for the control of curly-leaf pondweed and fanwort. The liquid herbicide was applied using a small jon boat equipped with a calibrated sub-surface injection system. This application methodology allows for even coverage within the treatment areas.

	Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
East Basin	19.7	10.12	7ft 7in
West Basin	19.5	9.34	4ft 3in

<u>June 21, 2023 - Post-Treatment Survey</u>

On June 21st, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Floating Bridge Pond. The visit consisted of conducting a survey and collecting basic water quality data. Conditions during the visit were sunny and around 70 degrees.

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. The purpose of the site visit was to document the effectiveness of the previous treatment. Plants documented during the survey were common reed*, fanwort*, waterlilies, filamentous algae, and multiflora rose*. The (*) denotes an invasive species.

Common reed had begun to awaken around both basins, as temperatures had reached the necessary parameters for it to grow. Filamentous and microscopic algae were also beginning to bloom throughout the Pond due to warm water temperatures and high amounts of nutrients from the previously wet conditions. Fanwort was observed in high densities around both basins in some areas. Based on this survey, we planned a treatment for the next visit which would be bumped up into early July. The treatment would target fanwort and likely incorporate copper sulfate for algae control.

Basin	Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
East Basin	22.7	7.65	2ft 7in
West Basin	22.4	6.76	-

<u>July 12, 2023 – Survey / Herbicide and Algaecide Treatment</u>

On July 12th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Floating Bridge Pond. The site visit consisted of completing a survey, collecting basic water quality data, and performing two treatments. Conditons during the site visit were mostly sunny and calm.

Figure 23: White waterlilies and Fanwort in Floating Bridge Pond.

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 were waterlilies (pictured in Figure 23), fanwort*, coontail, filamentous algae, common reed*, purple loosestrife, microscopic algae, and common waterweed. The (*) denotes an invasive species. We noticed the start of an algae bloom during our survey. The bloom was mainly microscopic algae; however, there were mats of filamentous algae that were being formed in the shallower, more stagnant areas of the Pond. This was not a huge concern as it was a low percentage of the Pond. Fanwort was the dominant species in both basins, taking up the majority of the water column. The pH of the pond was checked using a calibrated meter. The pH was 7.9 which is fairly neutral, leaning towards basic.

Based on the survey, a treatment was conducted for the control of target fanwort and algae growth. The liquid contact herbicide and algaecide were applied using a small jon boat equipped with a calibrated sub-surface injection system. This application methodology allows for even coverage within the treatment areas. We anticipated plant die-off within just a few days to a few weeks to avoid a depletion of dissolved oxygen in the basins. 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.

Basin	Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
East Basin	26.3	8.02	3’
West Basin	-	-	-

August 10, 2023 – Post-Treatment Survey

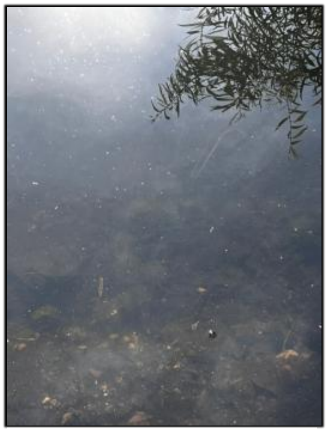
Figure 24: Fanwort just below the surface

On August 10th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Grace Adams, made a visit to Floating Bridge Pond. 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. The purpose of this survey was to assess the management efficacy of the treatment conducted during the last site visit. The treatment was aimed at controlling fanwort and algae growth. After surveying both the Eastern and Western basins, the treatment was deemed a success as only minimal regrowth was observed. The remaining fanwort (documented in Figure 24) was chlorotic and unhealthy. The Eastern Basin was still experiencing an extremely minor algae bloom, which would continue to be monitored. Plants documented during the survey were duckweed, purple loosestrife*, common reed*, and fanwort*. The (*) denotes an invasive species.

Basin	Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)
East Basin	24.2	7.30
West Basin	-	-

September 25, 2023 – Post-Management Survey

On September 25th, Aquatic Biologist, Scott Conrade, made a visit to Floating Bridge Pond (overview of the Eastern Basin in Figure 25). The purpose of the site visit was to conduct a survey to assess the overall 2023 aquatic management program and to help guide recommendations for the 2024 season. Conditions during the site visit were cloudy with occasional rain.


Figure 25: Floating Bridge Pond on September 25th, 2023

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. There was some fanwort observed in both basins, at low densities. This was likely regrowth from the previous treatment and was noted for next season. This can occur after a treatment due to increased availability of light and nutrients near the substrate. Overall, invasive species and nuisance species were greatly controlled through the 2023 program. There was also a minor microscopic algae bloom occurring at the time of the survey. Due to this, the survey mainly relied on rake tosses. Plants documented during the survey were common reed*, benthic algae, cattails, fanwort*, duckweed, watermeal, and microscopic algae. The (*) denotes an invasive species.

Basin	Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)
East Basin	18.2	6.37
West Basin	17.6	9.12

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GOLDFISH POND


Figure 26: Goldfish Pond - Lynn, MA

Goldfish Pond (pictured in Figure 26 to the right) is approximately 0.75 acres surface acres and is located in Lynn, MA. The Pond is found within Goldfish Pond Park, which is off of Lafayette Park. There is an island in the middle of the Pond, approximately 0.25 acres in size. Goldfish Pond is a manmade waterbody that is enclosed and lined by a concrete barrier around the perimeter of the Pond. There are no natural inlets or outlets noted, as water must be lowered through a drain (if necessary). There is a three-diffuser aeration system within the Pond, in addition to three fountains. The power supply is found along the northern shoreline to each unit. Several families of Waterfowl were documented in/around the Pond throughout the 2023 season. The Goldfish Pond is shallow as the average depth is roughly 2-3 feet. A walking path is found around the perimeter of the Pond that is often used by people enjoying the Park.

Historically, the primary focus of Goldfish Pond included managing microscopic algae blooms. The goal of the 2023 program was to manage the microscopic algae while monitoring basic water quality and water sampling data through a proactive monthly 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.

All permitting, treatment and survey tasks were completed without issue and at the proper times. The table below provides the specific dates of each task. Below the table, each visit/task performed is described in additional detail.

Summary Of 2023 Management Activities

Date	Task/Description
April 5, 2023	The initial survey was completed; A PAC treatment was performed
April 17, 2023	Post-treatment survey was conducted to evaluate the effectiveness of the previous treatment; An algaecide treatment was completed; Beneficial bacteria packets were applied
May 8, 2023	Conducted a survey; Algaecide treatment was performed; Applied bacteria packets
May 23, 2023	A survey was performed; Algaecide treatment was completed; Applied bacteria packets; Water samples collected
June 6, 2023	A survey was performed; Algaecide treatment was conducted; Applied bacteria packets
June 21, 2023	A survey was conducted; The algaecide treatment was performed; Applied beneficial bacteria packets
July 12, 2023	Algaecide treatment was performed; Applied bacteria packets
July 26, 2023	Algaecide treatment was conducted; Beneficial bacteria packets were applied
August 10, 2023	Algaecide treatment was conducted; Beneficial bacteria packets were applied; Water samples were collected

August 24, 2023	Algaecide treatment was completed; Applied bacteria packets; Collected water samples
September 6, 2023	Algaecide treatment was performed; Applied bacteria packets; Collected an algae sample
September 25, 2023	The final site visit was completed; A survey was performed to document late-season conditions and gauge the overall effectiveness of the 2023 Aquatic Management Program and to guide recommendations for the 2024 season; An algaecide treatment was conducted; Bacteria packets were applied; Water samples and an algae sample were collected
November 14, 2023	The fountains were removed and properly stored

April 5, 2023 - Initial Monitoring Site Visit / PAC Treatment / Algae Sample

Figure 27: Scott Conrade, from Water & Wetland, treating with PAC

On April 5th, Senior Aquatic Biologist/Co-Owner, Colin Gosselin, and Aquatic Biologist, Scott Conrade, completed a site visit to Goldfish Pond. The visit consisted of performing a survey, collecting basic water quality data, and conducting a treatment. Conditions during the visit were cloudy and windy.

Upon arrival, a survey was conducted using visual observation. During this survey, it was observed that the Pond was experiencing a microscopic algae bloom. No submersed aquatic vegetation was observed during this visit. There was a large waterfowl population that was present at the time of the survey. Waterfowl increase the amount of nutrients that are present within aquatic ecosystems, allowing for an increased risk of hazardous algal blooms (HABs).

As planned, and based on the survey, a treatment was conducted targeting phosphorus in the water column as well as suspended solids. The liquid Polyaluminum Chloride (PAC) was applied by Aquatic Biologist, Scott Conrade, using a calibrated backpack sprayer (Scott treating the Pond in Figure 27). Phosphorus is the limiting nutrient driving nuisance algae growth. One pound of phosphorus can grow up to five hundred pounds of algae. PAC binds with the phosphorus in the water column, making it unavailable to the algae that is trying to grow from it. PAC also binds to other particles in the water to help increase water clarity.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
14.6	8.06	10in

April 17, 2023 - Follow-up Monitoring Site Visit / Algaecide Treatment / Applied Beneficial Bacteria

On April 17th, Aquatic Biologist, Scott Conrade, completed a site visit to Goldfish Pond. The visit consisted of performing a survey, collecting basic water quality data (see Figure 28), and conducting a treatment. Conditions during the visit were cloudy and slightly misting with temperatures around 45 degrees F.

Upon arrival, a survey was conducted using visual observation. An algae bloom was noted throughout the water column, as we are customary to seeing at Goldfish Pond. Foaming was noted on the surface due to subsurface aerators. This is typically from the protien matrix that algae produce as they grow. You will often see this in moving water, such as waterfalls and streams, as foam that accumulates in the area.

Figure 28: Secchi depth being measured at the Pond

Based on the survey, a liquid algaecide was applied to the Pond for the control of microscopic algae. The algaecide was applied utilizing a calibrated backpack sprayer from the shore. This application methodology allows for even coverage throughout the management areas. A liquid bacteria/enzyme product was also applied to the Pond at label rates. We applied this product to bind phosphorus and to hopefully help with the "foaming."

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
16.3	11.03	6in

<u>May 8, 2023 - Algaecide Treatment / Applied Beneficial Bacteria</u>

Figure 29: Overview of Goldfish Pond

On May 8th, Aquatic Biologist, Scott Conrade, completed a site visit to Goldfish Pond (overview of Goldfish Pond pictured in Figure 29). The visit consisted of performing a survey, collecting basic water quality data, applying beneficial bacteria, and conducting a treatment. Conditions during the visit were sunny and 72 degrees.

Upon arrival, a survey was conducted using visual observation paired with a standard throw-rake and handheld GPS/ArcGIS Field Maps, as applicable. No plants were noted at this time, however, a planktonic bloom occurring which is typical of Goldfish Pond (conditions documented in Figure 29). Conditions were noticeably better than they were prior to the previous visit/treatment performed towards the end of April.

As planned, and based on the survey, a treatment was conducted for the control of planktonic algae. The liquid algaecide was applied using a calibrated backpack sprayer. This application methodology allows for even coverage within the treatment areas. A liquid beneficial bacteria product was also applied to assist with nutrients in the Pond; specifically, phosphorus, which is the limiting nutrient fueling algae growth.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
21.5	13.69	6in

<u>May 23, 2023 - Water Samples Collected / Algaecide Treatment / Applied Bacteria Packets</u>

On May 23rd, Aquatic Biologist, Scott Conrade, and seasonal aquatic technician Brian Sweeney, completed a site visit to Goldfish Pond. The visit consisted of performing a survey, collecting basic water quality data, and conducting a treatment. Conditions during the visit were sunny and 50 degrees.

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Figure 30: Microscopic algae bloom noted within the Pond

Upon arrival, a survey was conducted using visual observation. Goldfish Pond looked better than it had previously. This can be seen in Figure 30, as the watercolor is not as green as it has been in the past. The water clarity has increased since the last visit, up to 11in, and we hope to continue that trend through various treatments, bacteria applications, etc. The beneficial bacteria that was applied was to help with the phosphorus that was being released from the die-off of the algae bloom that was occurring. This product does not help with muck removal.

Based on the survey, a treatment was conducted for the control of planktonic algae. The liquid algaecide was applied utilizing a calibrated backpack sprayer from shore. This application methodology allows for even coverage within the treatment areas. Algae blooms continue to plague Goldfish Pond, however, if nothing was done, the blooms would be significantly worse and more toxic.

Additional water quality samples were collected, properly preserved, and shipped via FedEx Overnight to SePro Labs in North Carolina where they will be analyzed for various parameters, including phosphorus. The results from this round of sampling can be found in the water quality section of this report.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
18.5	11.80	11in

June 6, 2023 - Initial Monitoring Site Visit / Algaecide Treatment / Applied Bacteria Packets

Figure 31: Overview of Goldfish Pond

On June 6th, Aquatic Biologist, Scott Conrade, and Seasonal Aquatic Field Assistant, Brian Sweeney completed a site visit to Goldfish Pond. The visit consisted of performing a survey, collecting basic water quality data, and conducting a treatment. Conditions during the visit were overcast and breezy, with an air temperature of 64 degrees F.

Upon arrival, a survey was conducted using visual observation. The conditions have noticeably continued to improve with each visit. The water is noticeably clearer, although still green in color (seen in figure 30). While on-site, basic water quality was collected using calibrated meters. The pH was 7.6, which is within a standard range for freshwater and is considered neutral.

Based on the survey and as we typically anticipate when visiting Goldfish Pond, a treatment was conducted for the control of microscopic algae. The liquid algaecide was applied using a calibrated backpack sprayer from shore. The algaecide that was utilized is formulated to stay in the water column for longer, allowing for longer term control. This application methodology allows for even coverage within the Pond.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
21.5	13.69	6in

June 21, 2023 - Algaecide Treatment / Applied Beneficial Bacteria

On June 21st, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Goldfish Pond. The site visit consisted of completing a survey, collecting basic water quality in addition to a sample, and performing a treatment. Conditions during the site visit were sunny and calm.

Figure 32: Ducks enjoying the Pond

Upon arrival, a survey was conducted. A planktonic algae bloom was documented during the survey, which is typical for Goldfish Pond. During our survey, several Goldfish were observed as well as ducks (noted in Figure 31), geese, and turtles. Despite the algae, the water clarity, although still not excellent, was higher than it had been during all previous 2023 visits. The pH was measured while on site using a calibrated meter and was 9.1, which is within a standard range and is considered basic.

As anticipated, a liquid algaecide was applied to the Goldfish Pond to keep up with the algae growth. The liquid contact algaecide was applied using a calibrated backpack sprayer from shore by Aquatic Biologist, Scott Conrade. The liquid algaecide that was applied did not harm any of the wildlife that was observed at the time of the application.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (ft)
20.9	11.26	12in

July 12, 2023 - Algaecide Treatment / Bacteria Packets Applied

On July 12th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Goldfish Pond. Upon arrival to the site, a survey was conducted using visual observation. Only microscopic algae was present at the time of the survey. The pH of the pond was 7.8 which is within standard range for freshwater and is fairly neutral leaning towards basic. A treatment was conducted for the control of planktonic algae. The liquid algaecide was applied utilizing a calibrated treatment backpack sprayer. This treatment method allows for the most effective control of algae in Goldfish Pond. The algaecide that was utilized during this application is formulated to remain in the water column longer to prevent future algae blooms. Beneficial bacteria packets were also applied to the Pond.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
26.0	6.97	8in

July 26, 2023 - Algaecide Treatment / Beneficial Bacteria Packets Applied

On July 26th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Goldfish Pond. Upon arrival to the site, a survey was conducted using visual observation. Only microscopic algae (conditions pictured in Figure 32) was present at the time of the survey. This was likely due to the

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lack of sunlight that penetrates through the water column because of the algae that has been present. The pH of the pond was also measured during the survey. The pH was measured with a calibrated meter and was 7.7 which is neutral and within a standard range for freshwater. In addition to these in water conditions, it was noted that a large population of waterfowl were present at the Pond at the time of the survey.

Figure 33: Microscopic algae bloom occurring at Goldfish Pond.

A treatment was successfully conducted for the control of microscopic algae. The liquid contact algaecide was applied using a calibrated treatment backpack sprayer. It was recommended in future years of management that we start earlier in the season to get ahead of the blooms that plague Goldfish Pond. This would allow for the product that was being used to build a concentration in the water column and allow for longer term control. Beneficial bacteria packets were applied to the Pond during the visit.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Disk (in)
28.0	11.87	7in

August 10, 2023 - Algaecide Treatment / New Fountain Aerators Installed / Applied Bacteria Pallets

Figure 34: New fountains in place at Goldfish Pond Park

On August 10th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Grace Adams, made a visit to Goldfish Pond. The site visit consisted of completing a survey, collecting basic water quality data, installing new fountains, and conducting 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. Only microscopic algae were present at the time of the survey. No invasive species were detected at the time of the survey. With the number of waterfowl present at Goldfish Pond, monitoring for these species should continue. Most invasive species are brought into aquatic ecosystems via waterfowl, as they fly from waterbody to waterbody.

A treatment was successfully conducted for the control of algae. The liquid contact algaecide was applied utilizing a calibrated treatment backpack sprayer. Aquatic Biologist, Scott Conrade, conducted the application due to the severity of the bloom that was present at the time of the visit. This was typical of Goldfish Pond, as the watershed for the Pond is mainly urban which allows nutrients to easily flow into the Pond. Bacteria packets were also applied to the Pond.

New aerating fountains were installed during this visit as well. These fountains help to circulate the Pond and allow for more oxygen to enter the water column. This will help to reduce the amount of nutrients available for algae species, as the beneficial bacteria will have more oxygen to decompose the organic materials in the substrate of the Pond.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
23.2	6.13	6in

August 24, 2023 - Water Samples Collected / Algaecide Treatment / Bacteria Packets Applied

On August 24th, Aquatic Biologist, Scott Conrade, and Aquatic Field Assistant, Brian Sweeney, made a visit to Goldfish Pond. 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. Only microscopic algae were present at the time of the survey. No invasive species were detected at this time. Monitoring will continue for these species, as there was a high population of waterfowl present a the time of this visit (noted in Figure 35).

Figure 35: Numerous waterfowl on Goldfish 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 above. Any concerning results were immediately brought to the attention of the Client.

Another treatment was conducted for the control of microscopic algae. The liquid contact algaecide was applied utilizing a calibrated treatment backpack sprayer from shore. This bloom was likely due to the increased nutrients from the large flock of waterfowl that were present at the time of the visit (see Figure 35). Waterfowl can add a lot of nutrients to the ecosystem as they stay in the area. Beneficial bacteria packets were applied.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
22.0	6.81	6in

September 6, 2023 - Algaecide Treatment / Beneficial Bacteria Packets Applied

On September 6th, 2023, Aquatic Biologist, Scott Conrade, made a visit to Goldfish Pond. 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. At the time of the survey, only microscopic algae was observed. No invasive aquatic species were present at the time of the visit. As anticipated, a treatment was conducted for the control of algae. This is due to the low secchi depth that was present at the time of the visit. Low secchi depths typically indicate either an algae bloom or high turbidity. Due to the secchi depth being 6in and the watercolor being green, a treatment was administered. The liquid contact algaecide was applied using a calibrated treatment backpack sprayer. The treatment was completed without issue. Beneficial bacteria packets were applied.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
25.6	5.48	6in

September 25, 2023 – Final Algaecide Treatment / Beneficial Bacteria Applied / Survey


Figure 36: New fountain and an aerator at Goldfish Ponds

On September 25th, Aquatic Biologist, Scott Conrade, made a visit to Goldfish Pond (Figure 36). Upon arrival to the site, a survey was conducted using visual observation. No aquatic macrophytes were present at the time of the survey. The only aquatic species that was observed was microscopic algae. Upon arrival, the weather was noted as rainy and 63 degrees.

A last treatment was conducted for the control of algae. The liquid contact algaecide was applied utilizing a calibrated treatment backpack sprayer from shore. This application methodology allows for even coverage within the pond. This product will stay in the water column longer due to the formulation that was chosen at this time. Beneficial bacteria packets were applied.

Overall, this season the algae blooms at Goldfish Pond were severe. This is typical of the pond due to the constant inflow of nutrients to the pond. This season was very rainy, allowing for nutrients to constantly be flushed into the pond. Next year, we should do more to combat the nutrient pollution at Goldfish Pond to be more proactive instead of the reactive approach that has been taken in previous years.

Surface Temp (℃)	Surface Dissolved Oxygen (mg/l)	Secchi Depth (in)
17.6	9.27	6in

Water Quality Data

While conducting the site visits on May 23rd and August 24th at Goldfish Pond, water samples were collected to analyze the water quality. Samples were collected from one specifically designated area (mid-Pond). Samples not able to be analyzed on-site were preserved, and immediately taken to a State certified laboratory where they were analyzed for the specific parameters recommended, which included E. Coli, total phosphorus, and soluble phosphorus.

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 sampling events, as well as a description of each parameter are included in the tables below. Below are the results of the samplings:

Goldfish Pond Water Quality		
Parameter	5/23/23	8/24/23
E. Coli (CFU/100ml)	129.6	32.8
Total Phosphorus (ug/l)	230.5	624.3
Soluble Phosphorus (ug/l)	7.4	5.8

Algae Sampling Results

Also incorporated into the April 17th, August 10th, and August 24th site visits were an algae sample from various Lynn Ponds (mid-Pond). The sample was collected and overnighted to SePro Laboratories, where it was identified for algae species and enumeration. Our focus was on blue-green algae/cyanobacteria. 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 scums 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. They can also move around in the water body and grow quickly, making management of them difficult. See results in the tables below:

Algae Sampling Results

Date	Pond Name	Species of Algae	Classification	Counts (cells/ml)
4/17/23	Goldfish Pond	*Dictyosphaerium sp.*	Chlorophyta	2,740,000
	Goldfish Pond	*Pseudanabaene sp.*	Chlorophyta	2,510,000
	Goldfish Pond	*Synedra*	Bacillariophyta	<2,000
	Goldfish Pond	*Chlamydomonas*	Chlorophyta	<2,000
	Goldfish Pond	*Desmodesmus*	Chlorophyta	<2,000
	Goldfish Pond	*Pediastrum*	Chlorophyta	<2,000
	Goldfish Pond	*Aphanocapsa*	Cyanophyta	<2,000
	Goldfish Pond	*Microcystis*	Cyanophyta	<2,000
	Goldfish Pond	*Planktolyngbya*	Chlorophyta	<2,000
8/10/23	Sluice Pond	*Scenedesmus*	Chlorophyta	41,700
	Sluice Pond	*Aulacoseira*	Bacillariophyta	<40
	Sluice Pond	*Cymbella*	Bacillariophyta	<40
	Sluice Pond	*Gloeocystis*	Chlorophyta	<40
	Sluice Pond	*Pandorina*	Chlorophyta	<40
	Sluice Pond	*Planktosphaeria*	Chlorophyta	<40
	Sluice Pond	*Aphanocapsa*	Cyanophyta	<40
	Sluice Pond	*Cuspidothrix*	Cyanophyta	<40
	Sluice Pond	*Trachelomonas*	Euglenophyta	<40
8/24/23	Goldfish Pond	*Microcystis sp.*	Cyanophyta	720,900
	Goldfish Pond	*Desmodesmus sp.*	Chlorophyta	26,100
	Goldfish Pond	*Nitzschia*	Bacillariophyta	<40
	Goldfish Pond	*Dictyosphaerium*	Chlorophyta	<40
	Goldfish Pond	Kirchneriella	Chlorophyta	<40
	Goldfish Pond	Aphanocapsa	Cyanophyta	<40
	Goldfish Pond	Coelosphaerium	Cyanophyta	<40
	Goldfish Pond	*Dolichospermum*	Cyanophyta	<40
	Goldfish Pond	*Euglena*	Euglenophyta	<40
	Flax Pond	*Aphanizomenon*	Cyanophyta	3,700
	Flax Pond	*Coelastrum*	Chlorophyta	<40
	Flax Pond	*Oocystis*	Chlorophyta	<40
	Flax Pond	*Aphanocapsa*	Cyanophyta	<40
	Flax Pond	*Dolichospermum*	Cyanophyta	<40
	Flax Pond	*Trachelomonas*	Euglenophyta	<40

WATER & WETLAND

LAKE, POND & WETLAND MANAGEMENT

Summary / 2024 Recommendations

It has been a pleasure working with the City of Lynn and the various associations during the 2023 season. This marks Water & Wetland, LLC's second season managing the Lynn Ponds. We hope that you were impressed by our expertise, communication, and follow through. We look forward to continuing this work in 2024 and beyond. Overall, the program was successful, below are recommendations and summaries specific to each of the four Lynn ponds.

Sluice Pond – The program at Sluice Pond worked well during the 2023 season. The recommendation for 2024 is to continue with a similar approach to invasive species management based on the monitoring schedule. Because we are targeting various invasive species which grow at different times, a series of treatments will likely again be needed. Various levels of algae blooms occurred during the 2023 season, which warranted algaecide treatment. This could have potentially been driven by the excessive rain of 2023. We will continue to monitor for algae during the 2024 season and welcome any feedback from the Association either in between or after visits. Algae sampling at Sluice Pond is not included in the contract but is recommended. Sampling helps us make educated decisions on treatment and allows us to be proactive towards algae treatment rather than waiting for a dense bloom. This can be incorporated into existing visits for $300 per sample. A potential frequency of sampling would be during the June, July, and August visits for a total additional cost of $900. Please let us know if you'd like more information on this, or if you'd like to proceed with algae sampling at Sluice Pond.

Flax Pond – The weed and algae control program worked extremely well, and we recommend continuing with the same approach during the 2024 season. A minor microscopic algae bloom occurred, similar to Sluice Pond, this may have been conditionally driven. Algae will continue to be monitored and managed accordingly. Algae sampling is recommended to help with this process.

Floating Bridge Pond – The 2023 program at Floating Bridge Pond worked well. We will continue with contact herbicides as these have been used historically and are included in the contract price. Several systemic options are available, which will likely provide better, longer-term control. These can be considered when the contract renews. Algae will continue to be monitored and copper sulfate will be incorporated, as necessary.

Goldfish Pond – Goldfish Pond continues without a doubt to be the most difficult of the four ponds to manage. Due to extremely elevated phosphorus, the algae persists constantly. Consistent with previous data, the phosphorus levels are off the charts. This led to microscopic algae throughout the season. At times we did gain fairly good control, but the algae came back quickly. This led to treatments virtually every visit during the season. This reactive approach is not sustainable. While polyaluminum chloride was applied to the pond throughout the season to target phosphorus, the phosphorus levels are so high that it will take many years to cap the bottom sediments from phosphorus release. DPW may want to consider draining the pond and removing as much muck/organic material as possible. We will also be considering adding new technologies to the program as they become available. EutroSORB filters specifically target phosphorus and could be strategically staged above the aeration diffusers to filter nutrients and possibly in other areas where water enters the pond. Other EutroSORB products have been developed and are not yet approved for use in Massachusetts. If these do become available, we will consider adding EutroSORB WC to the program as this product uses significantly lower rates than aluminum sulfate to target phosphorus. There is also no danger of pH or alkalinity swings, therefore no buffering agent is necessary. We do not know the cost of these products yet, but if EutroSORB WC is in the same cost range as polyaluminum chloride, we will incorporate this at no additional cost. We did receive a free sample of MetaFloc, a new bacteria product which binds phosphorus. We used this in Goldfish Pond early in the season and saw promising results. The manufacturer recommends this be applied to Goldfish Pond each visit. The product is somewhat costly but could be added to the program for an additional cost if selected. Lastly, excessive geese and waterfowl frequent Goldfish Pond. These are adding to the nutrient issue as well as E. Coli bacteria. Several companies exist, which specialize in geese control, such as Geese Police and Goose Patrol. This should be considered moving forward. We are aware that no one swims in Goldfish Pond, but we recommend that pets not drink the water due to the persistent algae. Our approach will continue to be as proactive as possible, while making regular bi-weekly visits throughout the growing season. On top of this, we will continue to collect and analyze water quality data which allows us to make educated management decisions.

Should you have any questions, please do not hesitate to reach out to us. We look forward to working with the City of Lynn and the various associations in 2024 and beyond.

Sincerely,

Scott Conrade

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