Stonewater Lakes

Lake Management Plan 2024 Update

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Lake Management Plan Update

Introduction

Purpose of the Update

This management plan includes updates on the bathymetric survey, vegetation survey, water quality monitoring, and document management activities to date during the 2024 season. This data helps us to better examine the current conditions in the lake and provide management recommendations for future years. The plan will detail an integrated approach to lake management activities including, but not limited to exotic weed control, water quality monitoring, and aquatic vegetation surveying.

Characteristics of the lake

Stonewater Lakes consists of 6 lakes totaling an area of 112 acres located in Wayne County, Northville Township, Michigan. There is no public access site on the lake, but the Association provides a launch site for residents. The area the lakes now encompass was originally established as a sand and gravel mining area following World War 2 by the Starkweather Family. In 1999, mining operations transferred to Stonewater L.L.C., and the development of the subdivision was started. In the early stages of development, the lake bottom was comprised of fine sand and small filtered gravel. As the lake has aged, the accumulation of organic sediment and the effects of residential development have contributed to increased aquatic plant growth. Currently, rooted vegetation is moderately dense in areas of the shoreline with a fair amount of diversity of submerged aquatic plants. Aquatic vegetation is also found at a medium density along drop-off areas and shallow flats. The lake continues to experience changes in aquatic plant species and density as conditions for aquatic plant growth change.

Limnology

Limnology is the study of freshwater lake ecosystems. This is affected by a variety of factors including chemical, biological, physical, and geological properties. The main goal of any Limnologist is to understand these factors to help better evaluate the aquatic environment.

Management Goals for Stonewater Lakes

- The primary goal of aquatic plant management in Stonewater Lakes is the control of exotic aquatic plants. The exotic plant species, Curly Leaf Pondweed and Starry Stonewort, should be controlled throughout Teal, Spring Hill, and Parkshore Lakes. The abundance of these species should be reduced to the maximum extent possible, and efforts should be made to reduce their recovery after treatment.
- Aquatic plant management should preserve species diversity and cover of native plants sufficient to provide habitat for fish and other aquatic organisms. Native plants should be managed to encourage plant growth that supports the Stonewater Lake fishery (by creating structure and habitat) provided that they do not excessively interfere with recreational uses of the lake (e.g., swimming and fishing) in high-use areas. Where they must be managed, management techniques that reduce the stature of native plants without killing them (e.g., harvesting, contact herbicides) should be used whenever possible. Specific areas should be set aside where native plants will not be managed, to provide habitat for fish and other aquatic organisms. Muskgrass (*Chara*) should be allowed to grow throughout the lake, except where it grows so tall as to interfere with boating and swimming.

- The species Starry stonewort, should be actively controlled and managed. Starry stonewort is in the same family as Muskgrass (Chara) but is considered to be an exotic invasive species. Starry stonewort, which looks very similar to the beneficial species Chara, is appearing in more and more lakes. Chara is a highly desired plant because it is typically low growing, keeps the water clear, and can slow down the invasion of exotic weed species. Starry stonewort also forms dense mats, but unlike Chara, it can grow from 5 to 7 feet tall. Starry stonewort can be very detrimental to a lake's ecosystem and has the ability to kill off native plants and have a negative impact on a lake's fisheries.

- The differences between Muskgrass (Chara) and Starry Stonewort are very subtle. In the photos below the two can also be differeniated by noticing the rough edges of the Muskgrass (Chara) as compared the the relatively smooth large mass of Starry. In addition, Starry tends to prefer cooler water temperatures and will tend to grow in deeper areas or along the 5 -10 ft contour, whereas Chara tends to grow near shore in waters 0-5 feet. Another way to differentiate between the two is referred to as the pop test. This is done by holding a sample in your palm and making a fist. If the material in your hand pops it is more than likely Starry Stonewort and if not it is Muskgrass. During this test, you can also notice a very distinct musky smell if the material is Muskgrass.

Muskgrass (Chara)

Starry Stonewort

- The invasive terrestrial plants, Purple loosestrife, and Phragmites should be controlled along the shoreline and adjacent wetlands where present. Both species are exotic and have the ability to displace beneficial native vegetation. Purple loosestrife grows 2 -4 feet tall and is a vibrant magenta color. It is very aggressive and can quickly become the dominant wetland vegetation. Phragmites (common reed) is a wetland grass that ranges in height from 6 to 15 feet tall. "Phrag" quickly becomes the dominant feature in aquatic ecosystems, aggressively invading shorelines, wetlands, and ditches. This plant creates dense "stands" - walls of weeds crowding out beneficial native wetland vegetation and indigenous waterfowl habitats. Spreading by fragmentation and an extensive root system, Phragmites ultimately out-compete native plant life for sun, water, and nutrients.

Phragmites

- Phragmites presence has been noted in the vicinity of Mystic Lake, Teal Lake, and Heather Pond. In efforts to address this issue, a treatment was administered this autumn using a product known as Aqua Neat, which contains glyphosate. This systemic herbicide is designed to be absorbed into the tuber structure of the Phragmites. Generally, successful containment of Phragmites and prevention of further spread can be achieved with 1-2 years of treatment.
- Conditions in Stonewater Lakes should not be allowed to deteriorate below present levels. Expansion of exotic aquatic plant problems should trigger an adjustment in the aquatic vegetation management strategy. To support such responses, an annual record of vegetation and management should be maintained.
- Preventative measures that protect the lake from further nutrient enrichment should be identified and implemented.

Lake Management Activities Conducted in 2024

Water Quality

Water quality in the lake was evaluated on April 10th & Sept. 19th, 2024. A depth profile of water temperature and dissolved oxygen concentrations was measured at one-meter intervals and the Secchi disk depth was measured in the deepest part of the lake (Deep Hole Site). Lake Check analysis was collected from the deep part of the lake. Spring samples are pulled from the top layer of the lake whereas fall samples are pulled from the bottom meter of each sampling location. Lake Check measures conductivity, total dissolved solids, pH, alkalinity, total phosphorus, soluble reactive phosphorus, nitrates, and ammonia. A complete water quality report is attached to the back of this report for each separate sampling period.

Planning/Evaluation

A complete survey of the aquatic vegetation of the lake was conducted on September 19, 2024. Several brief checks of the lake were also made throughout the summer. Vegetation surveys determine the locations of target and non-target plant species. The results of the surveys are used to determine the most appropriate management strategy. The vegetation surveys also document the success of the prescribed management program. An AVAS survey is the State of Michigan's method for conducting a complete aquatic vegetation survey.

The Aquatic Vegetation Assessment Site (AVAS) survey divides the parts of the lake capable of growing plants (littoral zone) into subareas and records the cover of each aquatic plant found in each "site". This method of surveying considers not only the types of plant species present in the lake but also the densities of those species. AVAS surveys are also an excellent way to track plant species trends over time. A goal of invasive plant management is to have native plants increase while exotic plants decrease over time. The success of this goal can be illustrated through the use of the AVAS data collected over several years.

Since different native plants grow at varying times throughout the season, it is important to evaluate the lake multiple times to account for *all* species in the lake. The first evaluation is typically conducted in the spring and is used to determine areas that will require treatment or management. Attached to this report is the AVAS data for all 6 waterbodies. The cumulative cover score on each report indicates the total cover of each plant species for each water body.

Aquatic Vegetation & Aquatic Plant Control

The 2024 treatment season was overall highly successful in achieving our management goals. Initial treatments took place during the last week of April, followed by follow-up treatments throughout the summer. Both Teal and Stoneridge experienced a decrease in the percent cover of native pondweeds due to more targeted treatments in problematic shoreline areas. Additionally, the management changes implemented for Heather Lake for the second consecutive year led to a resurgence of native plant growth, which helped compete with Oscillatoria, a species that has historically caused complaints among residents. Furthermore, the incorporation of EUtroSORB into the Heather Pond treatment protocol resulted in a decrease in overall phosphorus levels, thereby limiting the nutrients that contribute to Oscillatoria blooms. While 2024 was relatively successful, there were still occasional complaints, particularly towards the end of the summer regarding Mystic Lake. The unusually warm and dry weather during late summer and early fall resulted in an algae bloom on Mystic Lake, which was treated promptly upon receiving complaints. Moving forward, PLM recommends adjusting the timing of the last treatment of the season to late September to better manage potential issues during the late season.

Native Plant Species

The images below showcase the two main native plants found in Stonewater Lakes. During the 2024 season, there was a notable leveling off in the populations of both aquatic plants, particularly Illinois pondweed. While Illinois pondweed can create some obstacles to boating and swimming, it is an important indicator of a well-balanced and healthy ecosystem. It provides an ideal habitat for aquatic invertebrates and fish. Additionally, while Chara is often viewed as a submerged aquatic species, it is classified as a macrophyte. Marco algae are, in fact, algae that help filter lake water and prevent sediment from being stirred up, thus improving water quality and clarity. Although Chara can sometimes be seen as a nuisance, it can easily be raked from swimming areas and is highly beneficial to the overall health of the lake. Treatment will continue in shoreline areas where these plants are considered a nuisance, but it will be limited to preserve the delicate balance of the ecosystem.

Illinois Pondweed

Chara

Invasive Aquatic Plant Species

The year-end AVAS results for the 2024 season show a decrease in overall plant densities across all water bodies. Additionally, the management efforts for Eurasian watermilfoil in both Mystic and Springhill have proven successful, with no areas displaying any signs of regrowth. The AVAS data also indicates that there continues to be low populations of Starry Stonewort in Teal and Stoneridge. Although established colonies of Starry Stonewort persist in Parkshore, the year-to-year data shows minimal to no spread. For the 2025 treatment season, we will replicate the approaches used in 2024, with an added late-season treatment aimed at controlling any potential algae blooms.

Eurasian watermilfoil (EWM)

Curly leaf pondweed

Starry stonewort

AVAS Data & Explanation

Each lake map is divided into the parts of the lake capable of growing aquatic plants into subareas and records the cover of each aquatic plant species found in each area. The attached map shows the breakdown of each waterbody and its corresponding AVAS site. Vegetation summary sheets summarize the information from the maps in the table that tracks plant trends from year to year. Species are numbered according to a standardized numbering system with a Code Number. The cover codes A, B, C, and D are used to describe the approximate coverage of each plant within the map area, where 1-2% is A, 3-20% is B, 21-60% is C, and 61-100% is D. The example "3B" refers to Chara (Muskgrass) covering between 3 and 20 percent of the area of the lake in which this code appears. Notations on the map are interpreted as follows: Number (= plant species) Letter (=approximate cover of this plant). For example: "3B" indicates plant species #3 at a density of B. Notations of each species are recorded in the AVAS map site location (see Appendix A fig. 1). The sum of the total number of species and density in quantified as "Total cumulative cover" with a lower number indicating both lower diversity and density. For example, Mystic Lake has the lowest plant density and species resulting in the lowest score. In comparison, Parkshore, Teal, & Stoneridge's density of Chara alone increases the cover by the sheer volume present. In addition, Spring Hill, Heather, & Mystic have lower plant diversity compared to Teal, Stoneridge, & Parkshore due to the decrease of Chara present. Often smaller waterbodies will have a lower diversity due to limited area of growth opportunity referred to as the "littoral zone." Yellow-coded cells indicate an invasive species. The below table list all common plant species observed within each waterbody during the 2024 AVAS. An ideal cumulative cover range for healthy fisheries ranges between 40-60. In this range, it provides enough habitat for the recruitment of fish larvae, and cover for other invertebrates and fish while still not being so dense to reduce predation. Moreover, this range still provides critical nutrient absorption from runoff and substrate, thus improving overall water quality.

Mystic Lake

Plant Name	Percent Cover
Chara	5.65
Thinleaf Pondweed	0.04
Illinois Pondweed	8.96
Large Leaf Pondweed	4.00
Coontail	0.09
Sago Pondweed	1.61
Wild Celery	1.78
Naiad	0.26
Bulrush	2.96
Phragmites	0.17

Total Cumulative Cover 25.52

Parkshore

Plant Name	Percent Cover
Starry Stonewort	6.19
Chara	9.00
Illinois Pondweed	12.00
Floating Leaf Pondweed	0.48
Wild Celery	3.10
Coontail	3.81
Naiad	0.38

Total Cumulative Cover 34.95

Spring Hill Lake

Plant Name	Percent Cover
Curly leaf Pondweed	0.06
Chara	3.69
Illinois Pondweed	9.63
Wild Celery	3.94
Coontail	3.56
Naiad	0.19
Brittle Naiad	0.06
Sago Pondweed	2.06

Total Cumulative Cover 23.19

Stoneridge Lake

Plant Name	Percent Cover
Chara	4.26
Illinois Pondweed	5.85
Wild Celery	23.33
Coontail	1.63
Mini Bladderwort	0.04
Naiad	3.59
Brittle Naiad	0.04

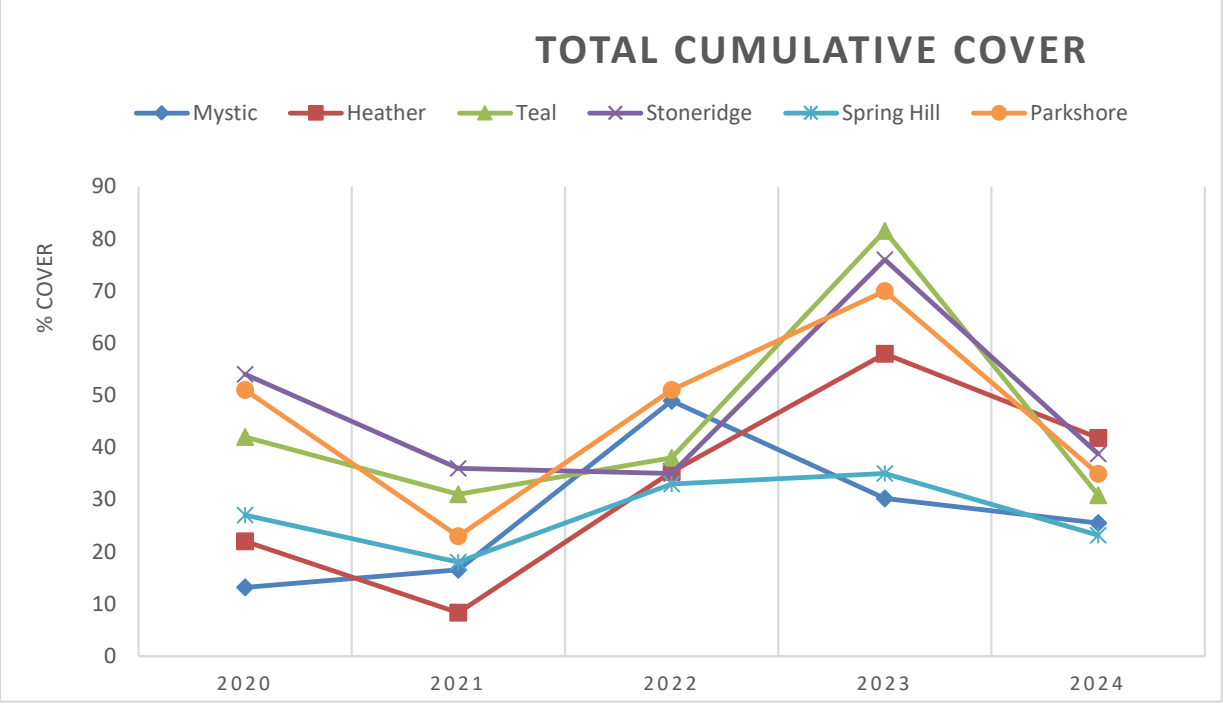
Total Cumulative Cover 38.74

Teal Lake

Plant Name	Percent Cover
Curly Leaf Pondweed	0.05
Chara	5.55
Illinois Pondweed	11.18
Wild Celery	10.36
Coontail	0.82
Naiad	2.86
Phragmites	0.05
Total Cumulative Cover	30.86

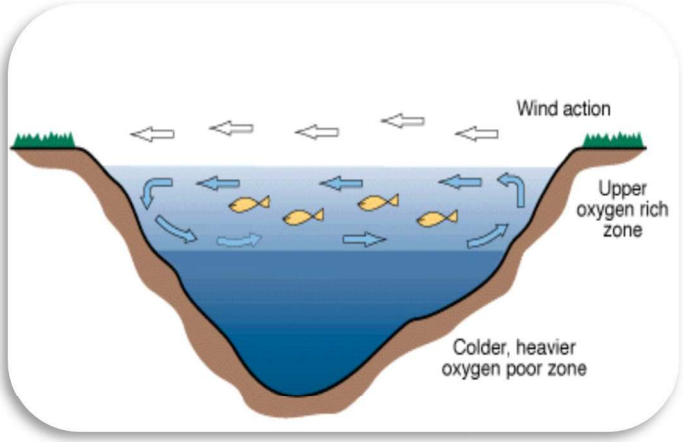
Heather Pond

Plant Name	Percent Cover
Chara	2.33
Illinois Pondweed	8.50
Large Leaf Pondweed	1.67
Naiad	5.50
Sago Pondweed	20.0
Bulrush	2.00
Phragmites	1.83
Total Cumulative Cover	41.83



Water Quality Monitoring

Water quality monitoring is a critical part of lake management. Water quality monitoring provides an ongoing record of conditions in a water body. Changes in water quality can indicate threats from sources such as agricultural and lawn runoff, burgeoning development, and erosion from construction sites. Prompt identification of threats to water quality makes it possible to remedy them before irreversible harm has been done. Riparian's enjoyment of the water resource and the value of their property depends on maintaining water quality. For water sampling locations on each water body (see Appendix Fig 2).



Conductivity Total Dissolved Solids, pH and Alkalinity

Conductivity and Total Dissolved Solids (TDS) measure the total concentration of dissolved salts in the water from a variety of factors including but not limited to local runoff from both surface & groundwater penetration. Values for Stonewater Lake indicate moderate to high concentrations of dissolved materials. Alkalinity and pH measure the number of dissolved bases and the balance of acids and bases in the water. Alkalinity and pH values were within normal ranges for hardwater lakes.

Temperature and Dissolved Oxygen Profiles

Depth profiles of temperature and dissolved oxygen indicate that the lakes were well oxygenated, with surface oxygen concentrations within acceptable ranges for the Fall sampling period conducted on Sept.19th, 2024. (see Table 1).

Table 1.

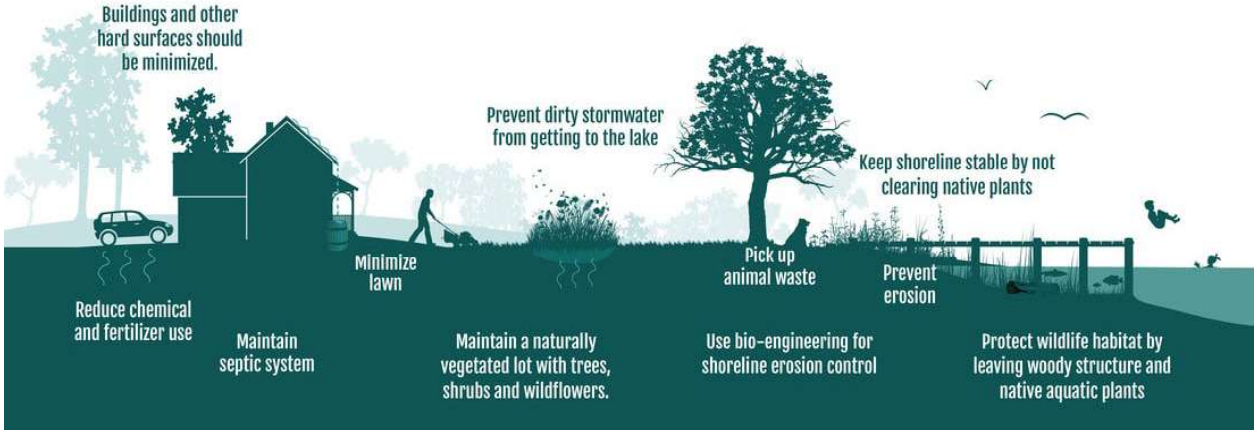
Site Name:	Temp (Celsius)	D.O. (mg/L)	D.O. (%)
Teal	23.4	9.4	110.3
Stoneridge	23.0	10.3	109.9
Parkshore	23.1	9.7	114.2
Heather	22.6	10.3	120.0
Mystic	23.0	9.4	109.3
Spring Hill	23.3	9.9	114.7

Secchi Disk Depths

The Secchi disk depth is a measure of water clarity, determined by measuring the depth to which a black and white disk can be seen from the surface (see Table 2). The larger numbers represent greater water clarity.

Evaluation of Trophic Status

Carlson's Trophic State Index (TSI) (see appendix A Figure 3.) calculated from Secchi disk depth and total phosphorus measurements made in September yielded values between 33 and 54 (see Table 2). Stonewater Lakes values range with Teal, Stoneridge, Parkshore, & Spring Hill lakes falling under meso-oligotrophic to mesotrophic with Mystic & Heather Lakes falling in the Mesotrophic to Eutrophic range with more sampling is required to track trends. Lakes with this characterization usually have low to medium nutrient levels and productivity, clear water with beds of submerged aquatic plants. Trophic levels vary based on a variety of factors including climate and nutrient load.



Total Phosphorus

Total Phosphorus measures the total amount of phosphorus in the water. Phosphorus is an important plant nutrient (i.e., fertilizer) and the nutrient most likely to limit algal growth. Elevated levels of phosphorus in lakes caused by human activities are a significant cause of cultural eutrophication. According to the concentrations of phosphorus found in Stonewater Lakes during April & September show the levels are low to moderate. The ideal target level of phosphorus is less than 10 ug/L, as shown in Table 2. On September 19th, total phosphorus levels in Heather Pond were measured at 10 µg/L. The reduction in bioavailable phosphorus in this sample was facilitated by the introduction of EutroSORB G into the treatment protocol. The addition of EutroSORB helps by binding to the bioavailable phosphorus and trapping it in the sediment. The Fall samples taken from Mystic and Stoneridge Lakes both showed an increase in total phosphorus between the spring and fall samples. These increased levels of phosphorus likely played a role in the algae blooms seen in Mystic Lake in the early fall. The fall sample for Mystic Lake was less than 21 µg/L, considered a moderate level of phosphorus enrichment. We will continue to monitor these levels and discuss future remediations such as with Heather Pond if these levels become high.

Nitrates

Nitrates measure the total amount of inorganic nitrogen in the water. Nitrogen is an important plant nutrient (i.e., fertilizer) and the nutrient most likely to limit the growth of rooted plants. Overall, nitrate concentrations in the lake were moderate to low. In both spring and fall samples, the nitrate concentrations were all <230 mg N/L at the surface. Nitrate values observed during the 2024 season continue to indicate low levels in the lakes (see Table 2.) US EPA guidelines level of concern for Nitrogen is routine samples above 300 ug/L with 300 ug/L failing into the Mesotrophic range. Samples between 500 ug/L – 1,500 ug/L fail under the Eutrophic scale and all samples above 1,500 ug/L under Hypereutrophic.

Table 2.

Site Name: **Spring (S) Fall (F)**	Total Phosphorus ug/L	Total Nitrogen ug/L	Seechi Depth (m)	TSI from Secchi Disk	TSI from Total Phosphorus
Teal – S	<10	<230	5.0	37	33
Teal – F	<10	<230	5.0	37	33
Parkshore - S	<10	<230	1.5	54	33
Parkshore – F	<10	<230	2.0	50	33
Mystic – S	<10	<230	2.0	50	33
Mystic – F	21	<230	2.0	50	44
Stoneridge – S	<10	<230	4.0	40	33
Stoneridge – F	18	<230	4.0	40	41
Heather – S	<10	<230	4.0	40	33
Heather – F	<10	<230	2.0	50	33
Spring Hill – S	<10	<230	3.0	44	33
Spring Hill – F	<10	<230	3.0	44	33

E-Coli Sampling

Throughout the summer E. coli samples were taken. The below table shows the values for each sampling period. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) standard is "Daily Maximum Geometric Mean: 300 *E. coli* per 100 milliliters (ml)" which is affected by a number of factors including sampling locations, time of day, and recent rain events. From day to day and even location sampled within a water body samples can greatly vary. During the 2024 season, no samples were flagged as a level of concern with the highest Geometric Mean sample.

Lake Name	June	July	Aug
Mystic Lake	<4 cfu/100mL	<4 cfu/100mL	<4 cfu/100mL
Teal Lake	<4 cfu/100mL	<4 cfu/100mL	<4 cfu/100mL
Stoneridge Lake	<4 cfu/100mL	<4 cfu/100mL	<4 cfu/100mL
Heather Pond	<4 cfu/100mL	<4 cfu/100mL	<4 cfu/100mL
Parkshore Lake	<4 cfu/100mL	<4 cfu/100mL	<4 cfu/100mL
Spring Hill Lake	<4 cfu/100mL	<4 cfu/100ml	<4 cfu/100mL

Future Management Recommendations

Management options are dependent on many factors, including but not limited to, species abundance (density), species richness, species location, and many lake characteristics. Whenever an exotic species is found within an aquatic environment, immediate action needs to be taken to prevent long-term ecological damage as well as the recreational and aesthetic loss that will take place.

Submersed Aquatic Plants

Conventional Herbicide treatments

Future aquatic plant management programs should include targeted treatments in areas where invasive species are identified. Special attention should be given to prompt herbicide treatments for Starry Stonewort upon its detection.

To maintain low abundance and prevent interference with recreational activities, ongoing treatments for Curlyleaf pondweed are crucial. This approach also serves to limit the ecological impact of Curlyleaf pondweed in the lakes.

Moreover, the incorporation of nuisance native plant management into lake management programs can be achieved using conventional herbicide treatments if necessary. Native plant treatments specifically in shoreline residential areas are carried out exclusively with contact herbicides, aligning with a comprehensive strategy for effective lake management.

Recommended Management Schedule for 2025:

- Vegetation survey and water quality monitoring (to evaluate conditions in the lake and direct management efforts)
- Herbicide treatments to control any Eurasian watermilfoil and/or curly leaf pondweed areas that are found with Diquat Dibromide to address both species when possible. Early detection is key so routine treatments of the lakes will aid in any unchecked introduction.
- Starry stonewort should be monitored and treated as needed to keep it from spreading and creating recreational and ecological issues. These treatments will be conducted with contact chelated copper products starting in May & June. Follow up treatments will be done with copper sulfate later in the summer to offer more effective control of both Chara & Starry Stonewort.
- During summer months, nuisance native species around docks and swim areas, particularly in Teal and Stoneridge lakes, will be treated with contact herbicides such as Aqua strike and Aquathol, with follow-ups as needed. It's important to note that the treatment of native plants is limited to within 100 feet from the shore along developed shoreline areas. These native plants play a vital role in maintaining the overall health of the lake, providing essential habitat and nutrient abatement, which helps create a balanced and healthy ecosystem. While we may want to reduce their presence from a human perspective, it's essential to maintain their presence for the sake of the lake's overall well-being.
- Continued limited treatment of native plants in Heather Pond to help encourage competition with the problematic Oscillatoria. Furthermore, to best manage Heather Pond continued use of EutroSORB in the treatment program is recommended to abate the legacy phosphorus within the water body.
- Spring and Fall water quality sampling and Fall vegetation survey

Appendix A: Figures 1-3

Figure 1: AVAS Map locations

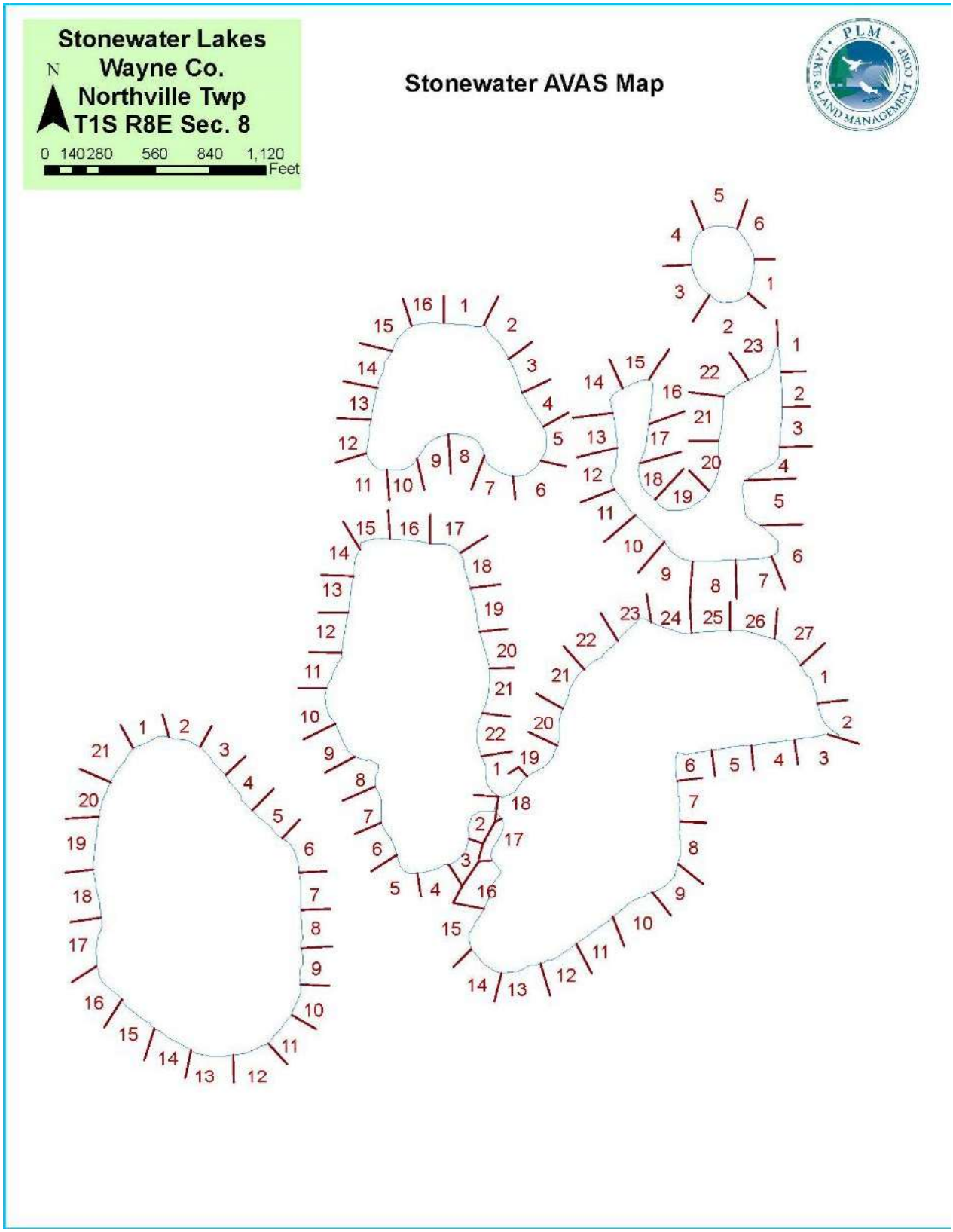


Figure 2: Water Quality Locations

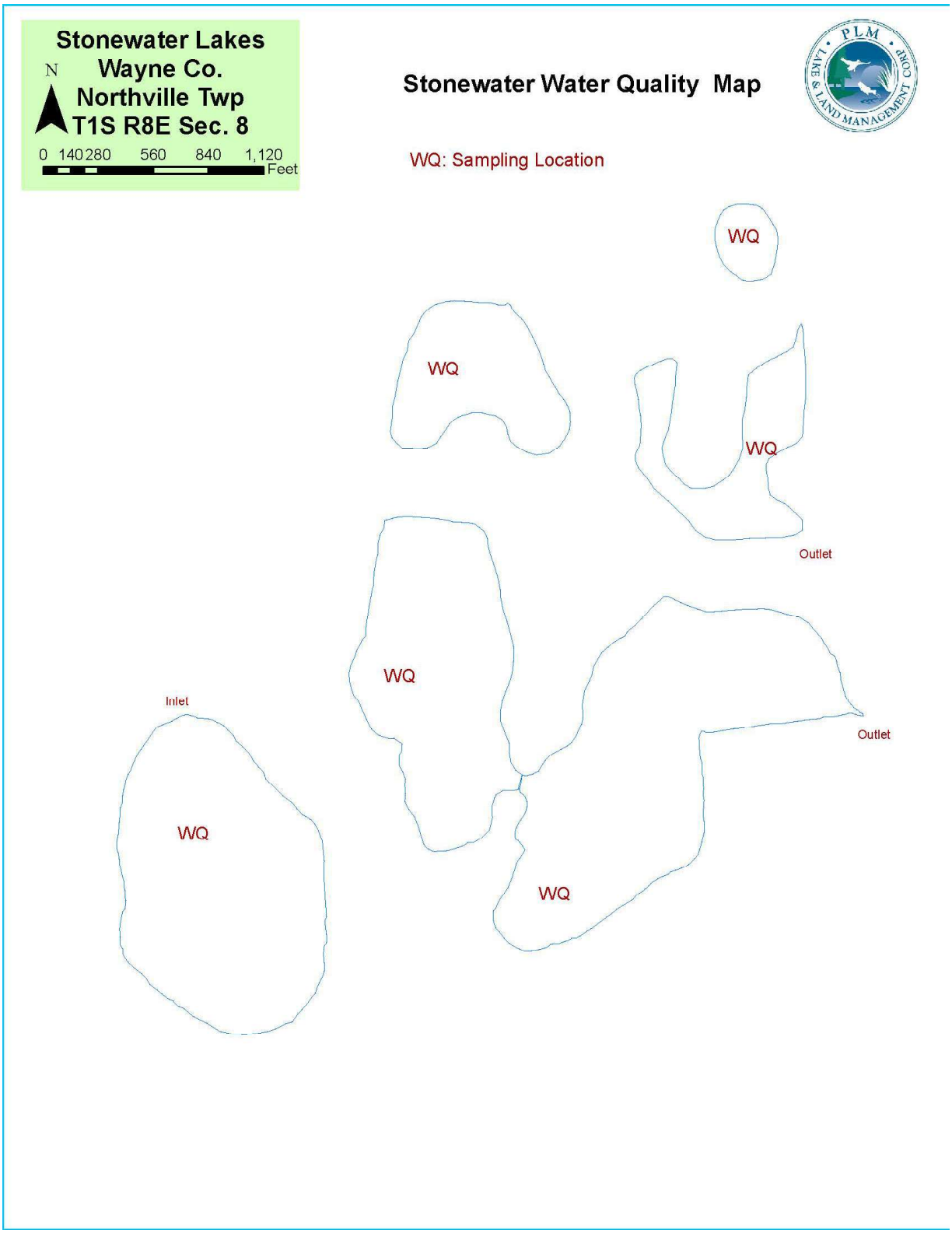
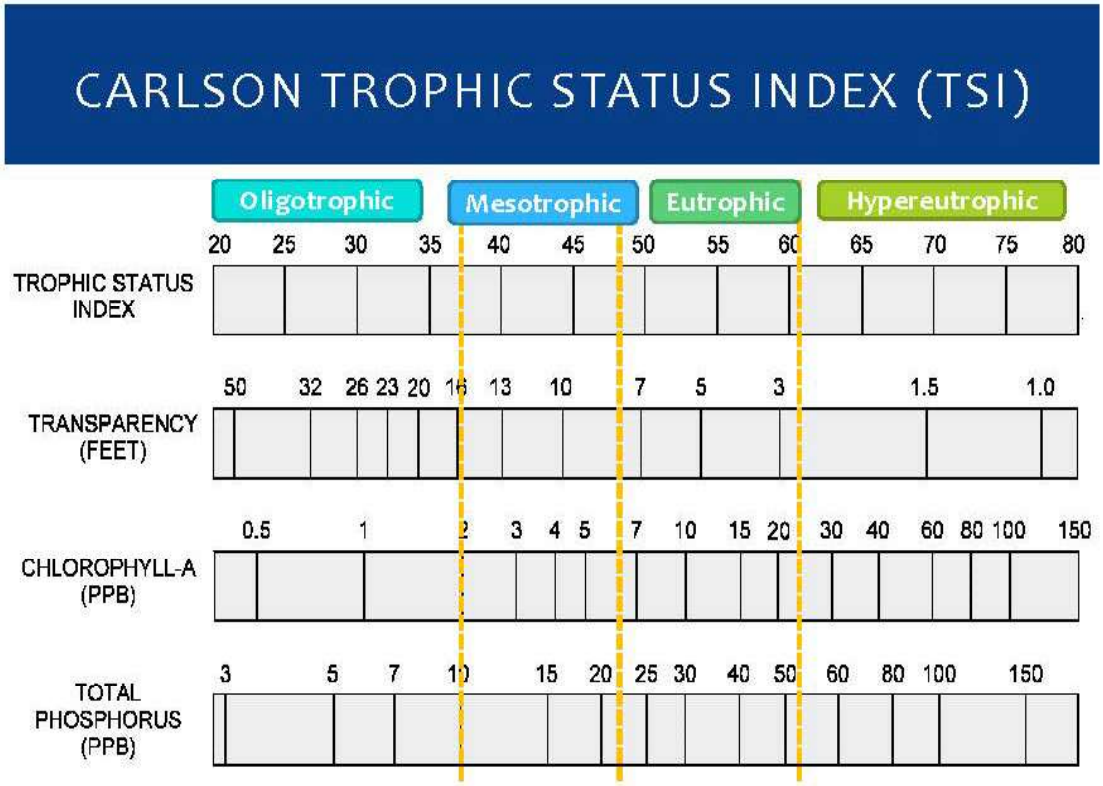


Figure 3: Carlson Trophic Status Index (TSI)



- Oligotrophic – low nutrient level, cooler climate, low plant diversity, good water quality
- Mesotrophic – medium-moderate nutrient levels, high plant diversity, fair water quality
- Eutrophic – excessive nutrient levels, abundance of plant growth, poor water quality
- Hypereutrophic – extreme nutrient levels, toxic algae blooms, low oxygen level, dead zones

2024471

Lake Check Water Quality Monitoring Report

Customer
Stonewater Heather Pond

Waterbody
Stonewater Heather Pond

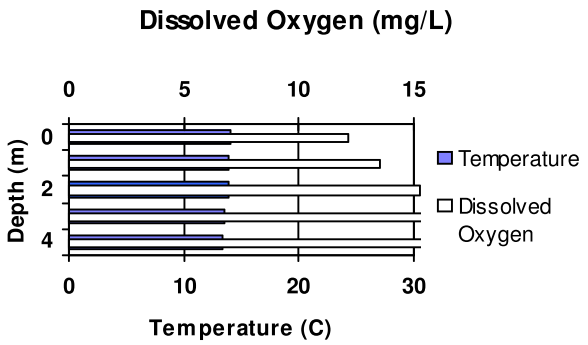
Sample Information
Date: 4/10/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	14.1	12.1	121
1	13.9	13.6	126
2	13.8	15.2	139
3	13.6	15.9	141
4	13.3	15.9	144

Secchi Disk Depth 4.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	431	uS/cm	
Total Dissolved Solids	280	mg/L	Moderate concentration of dissolved salts
pH	9.0	S.U.	Water is slightly alkaline
Alkalinity	101	mg CaCO3/L	Water is soft
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	40	mesotrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

FROM YOUR WQ PRO DEALER

PLM Lake & Land Management Corp
P.O. Box 132
Caledonia MI 49316-
Phone: (616) 891-1294

2024472

Lake Check Water Quality Monitoring Report

Customer
Stonewater Heather Pond

Waterbody
Stonewater Heather Pond

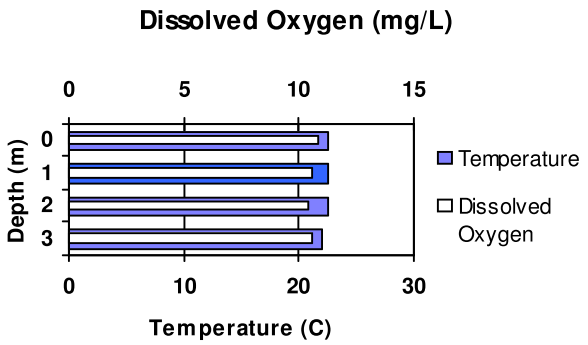
Sample Information
Date: 9/19/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	22.6	10.8	120
1	22.6	10.6	122
2	22.5	10.4	120
3	22.1	10.6	121

Secchi Disk Depth	2.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	414	uS/cm	
Total Dissolved Solids	282	mg/L	Moderate concentration of dissolved salts
pH	8.7	S.U.	Water is slightly alkaline
Alkalinity	169	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	50	moderately eutrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- REPEAT LakeCheck NEXT YEAR!

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

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FROM YOUR WQ PRO DEALER

PLM Lake & Land Management Corp
P.O. Box 132
Caledonia MI 49316-
Phone: (616) 891-1294

2024479

Lake Check Water Quality Monitoring Report

Customer
Stonewater Lake Mystic Pond

Waterbody
Stonewater Mystic Pond

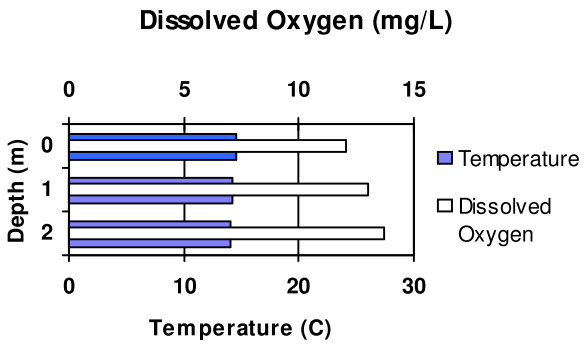
Sample Information
Date: 4/10/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	14.6	12.1	120
1	14.3	13.0	125
2	14.0	13.7	129

Secchi Disk Depth	2.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	521	uS/cm	
Total Dissolved Solids	340	mg/L	Moderate concentration of dissolved salts
pH	8.6	S.U.	Water is slightly alkaline
Alkalinity	153	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	50	moderately eutrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

FROM YOUR WQ PRO DEALER

PLM Lake & Land Management Corp
P.O. Box 132
Caledonia MI 49316-
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2024480

Lake Check Water Quality Monitoring Report

Customer
Stonewater Lake Mystic Pond

Waterbody
Stonewater Mystic Pond

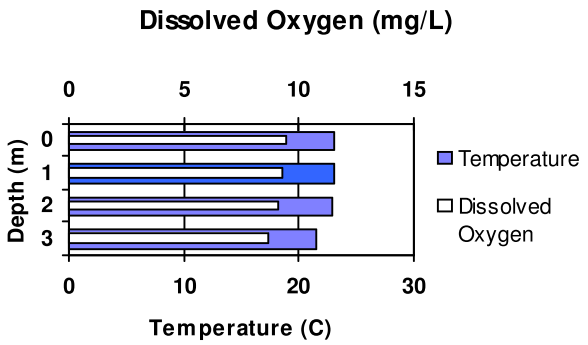
Sample Information
Date: 9/19/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	23.0	9.4	109
1	23.0	9.2	109
2	22.9	9.1	105
3	21.5	8.7	92

Secchi Disk Depth	2.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	486	uS/cm	Moderate concentration of dissolved salts
Total Dissolved Solids	328	mg/L	
pH	863.0	S.U.	ERROR
Alkalinity	190	mg CaCO3/L	Water is very hard
Total Phosphorus	21	ug/L	Moderately phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	50	moderately eutrophic
Based on Total Phosphorus	44	mesotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- REPEAT LakeCheck NEXT YEAR!

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

FROM YOUR WQ PRO DEALER

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2024473

Lake Check Water Quality Monitoring Report

Customer
Stonewater Parkshore

Waterbody
Stonewater Parkshore

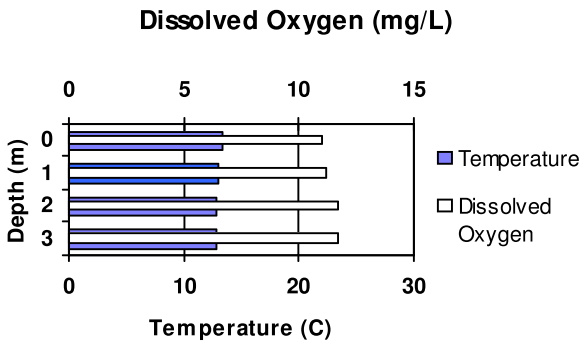
Sample Information
Date: 4/10/2024

Site: middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	13.3	11.0	104
1	13.0	11.2	105
2	12.9	11.7	106
3	12.9	11.7	107

Secchi Disk Depth	1.5 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	669	uS/cm	
Total Dissolved Solids	136	mg/L	Low concentration of dissolved salts
pH	8.5	S.U.	Water is slightly alkaline
Alkalinity	210	mg CaCO3/L	Water is very hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	54	moderately eutrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

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2024474

Lake Check Water Quality Monitoring Report

Customer
Stonewater Parkshore

Waterbody
Stonewater Parkshore

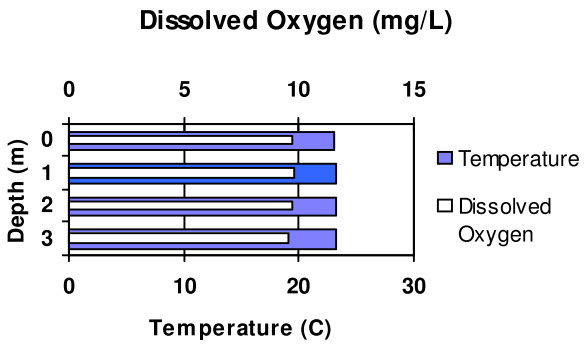
Sample Information
Date: 9/19/2024

Site: middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	23.1	9.7	114
1	23.2	9.8	115
2	23.2	9.7	111
3	23.2	9.5	108

Secchi Disk Depth	2.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	510	uS/cm	
Total Dissolved Solids	344	mg/L	Moderate concentration of dissolved salts
pH	8.8	S.U.	Water is slightly alkaline
Alkalinity	133	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	50	moderately eutrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- REPEAT LakeCheck NEXT YEAR!

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

FROM YOUR WQ PRO DEALER

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2024481

Lake Check Water Quality Monitoring Report

Customer
Stonewater Springhill

Waterbody
Stonewater Springhill

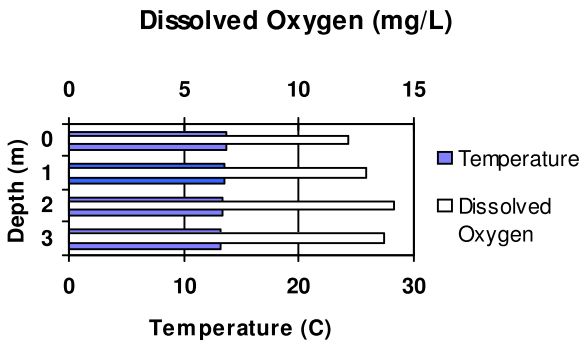
Sample Information
Date: 4/10/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	13.7	12.2	118
1	13.6	12.9	123
2	13.4	14.1	125
3	13.1	13.7	124

Secchi Disk Depth	3.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	525	uS/cm	
Total Dissolved Solids	343	mg/L	Moderate concentration of dissolved salts
pH	8.7	S.U.	Water is slightly alkaline
Alkalinity	165	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	44	mesotrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

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2024482

Lake Check Water Quality Monitoring Report

Customer
Stonewater Springhill

Waterbody
Stonewater Springhill

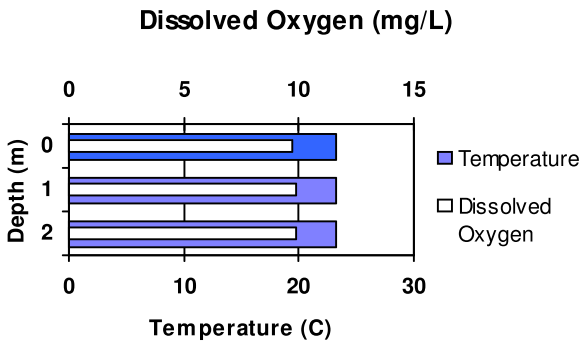
Sample Information
Date: 9/19/2024

Site: middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	23.3	9.7	115
1	23.3	9.9	116
2	23.3	9.9	116

Secchi Disk Depth 3.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	430	uS/cm	
Total Dissolved Solids	288	mg/L	Moderate concentration of dissolved salts
pH	8.8	S.U.	Water is slightly alkaline
Alkalinity	171	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	44	mesotrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- REPEAT LakeCheck NEXT YEAR!

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

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2024475

Lake Check Water Quality Monitoring Report

Customer
Stonewater Stoneridge

Waterbody
Stonewater Stoneridge

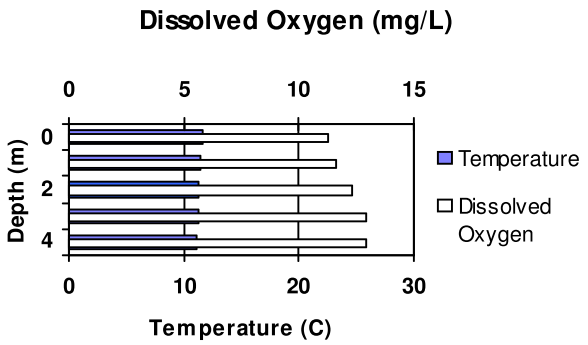
Sample Information
Date: 4/10/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	11.6	11.3	104
1	11.5	11.6	105
2	11.3	12.3	111
3	11.2	12.9	115
4	11.1	12.9	116

Secchi Disk Depth	4.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	518	uS/cm	
Total Dissolved Solids	337	mg/L	Moderate concentration of dissolved salts
pH	8.6	S.U.	Water is slightly alkaline
Alkalinity	142	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	40	mesotrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

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P.O. Box 132
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Phone: (616) 891-1294

2024476

Lake Check Water Quality Monitoring Report

Customer
Stonewater Stoneridge

Waterbody
Stonewater Stoneridge

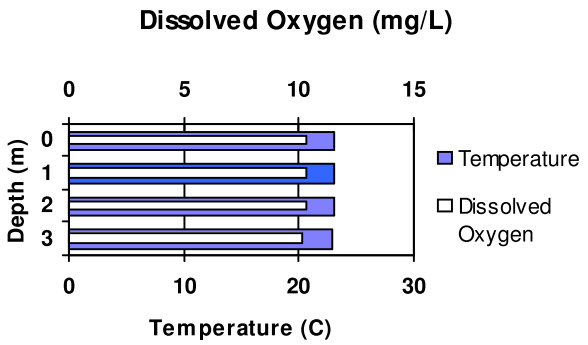
Sample Information
Date: 9/19/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	23.0	10.3	110
1	23.0	10.4	111
2	23.0	10.3	109
3	22.9	10.2	101

Secchi Disk Depth	4.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	400	C uS/cm	
Total Dissolved Solids	270	mg/L	Moderate concentration of dissolved salts
pH	8.9	S.U.	Water is slightly alkaline
Alkalinity	117	mg CaCO3/L	Water is soft
Total Phosphorus	18	ug/L	Moderately phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	40	mesotrophic
Based on Total Phosphorus	41	mesotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- REPEAT LakeCheck NEXT YEAR!

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

FROM YOUR WQ PRO DEALER

PLM Lake & Land Management Corp
P.O. Box 132
Caledonia MI 49316-
Phone: (616) 891-1294

2024477

Lake Check Water Quality Monitoring Report

Customer
Stonewater Teal Lake

Waterbody
Stonewater Teal Lake

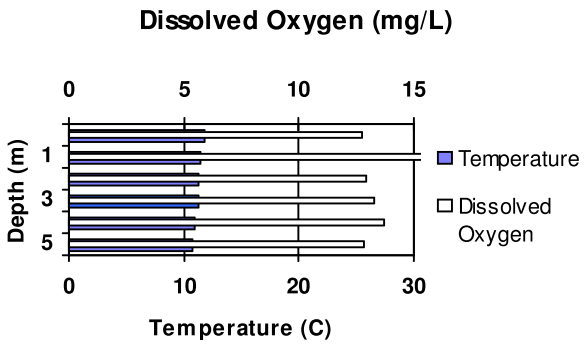
Sample Information
Date: 4/10/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	11.8	12.7	117
1	11.5	118.8	13
2	11.3	12.9	118
3	11.3	13.2	118
4	10.9	13.7	121
5	10.7	12.8	118

Secchi Disk Depth 5.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	489	uS/cm	
Total Dissolved Solids	318	mg/L	Moderate concentration of dissolved salts
pH	8.8	S.U.	Water is slightly alkaline
Alkalinity	139	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	37	meso-oligotrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- No remedial action recommended at this time.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

FROM YOUR WQ PRO DEALER

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P.O. Box 132
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Phone: (616) 891-1294

2024478

Lake Check Water Quality Monitoring Report

Customer
Stonewater Teal Lake

Waterbody
Stonewater Teal Lake

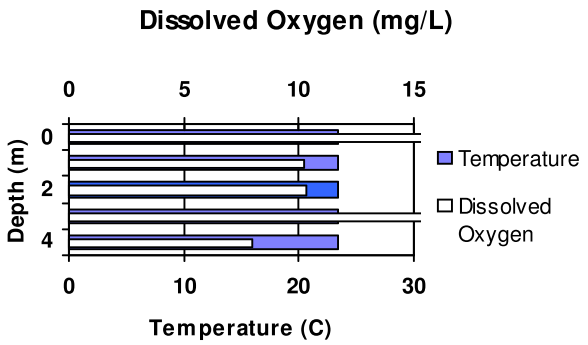
Sample Information
Date: 9/19/2024

Site: Middle

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	23.4	94.2	110
1	23.4	10.3	119
2	23.4	10.3	120
3	23.4	121.9	10
4	23.4	8.0	106

Secchi Disk Depth	5.0 meters



Analytical Results

Parameter	Result	Units	Interpretation
Conductivity	424	uS/cm	
Total Dissolved Solids	284	mg/L	Moderate concentration of dissolved salts
pH	8.9	S.U.	Water is slightly alkaline
Alkalinity	124	mg CaCO3/L	Water is hard
Total Phosphorus	10	ug/L	Slightly phosphorus enriched
Nitrates	230	ug/L	Not nitrogen enriched

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	37	meso-oligotrophic
Based on Total Phosphorus	33	meso-oligotrophic

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Phosphorus and Nitrogen are within acceptable limits.
- REPEAT LakeCheck NEXT YEAR!

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by Jaimee Desjardins Date 11/26/2024

Mrs. Jaimee Desjardins, Technical Services Manager

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