Minutes of the Lake Oakland
Lake Improvement Board Meeting
April 8, 2020

Mr. Sabina called the Teleconference meeting to order at 3:32 p.m.

PRESENT:	Rick Sabina, Citizen Member/Chairperson George Nichols, Oakland County WRC, Member/Secretary Margaret Birch, Waterford Township Treasurer, Member/Treasurer Terri Nallamothu, Independence Township Member Tom Middleton, Oakland County Board of Commissioners, Member Paul Hausler, Progressive AE

Mr. Nichols started the meeting by reading a statement that the meeting will continue to follow Michigan's Open Meetings Act as well as the Governor's Executive Order 2020-15 temporarily suspending the rules regarding physical presence at public meetings.

All participates stated their name and affiliation for the record.

Mr. Sabina welcomed Terri Nallamothu as the new Independence Township member.

Approval of the Meeting Agenda:

Ms. Birch, supported by Mr. Middleton, moved to accept the meeting agenda as presented (see Attachment 'A').

Roll Call Motion Carried Unanimously

Approval of Meeting Minutes:

Mr. Middleton, supported by Ms. Birch, moved to accept the minutes for the meeting of October 22, 2019.

Roll Call Motion Carried Unanimously

Old Business:

A. Herbicide Treatment Update

Mr. Hausler stated that due to the Stay At Home order that is in place by the Governor, all permits are superseded by the order and therefore no treatments will be able to take place until the order is lifted. Right now the Stay At Home order is expected to be extended until April 30th. No survey work can be done on the lake until the order is lifted. The social distancing requirement will prevent others from joining in the survey of Lake Oakland. Mr. Hausler will keep the Board updated on the schedule based on the Governor's orders.

New Business:

A. 2019 Water Quality Monitoring Report

Mr. Hausler stated that due to the Stay At Home order, the spring sample testing has to be postponed. Therefore, the sampling will now take place in the fall (late October or early November) and will follow the same procedures. Unfortunately, these results will not be available until later in the year as opposed to earlier in the year. Will still proceed with taking the late summer (August) sample testing. Mr. Hausler then stepped through the 2019 Water Quality Monitoring Report (see Attachment 'B').

Ms. Birch, supported by Ms. Nallamothu, moved to Receive, Note and File the report.

Roll Call Motion Carried Unanimously

B. Loosestrife Beetle Plants

Mr. Sabina stated that he received notice that due to the COVID-19 pandemic, the supplier in Kalamazoo has suspended the beetle larva program for this year. To really see the maximum benefit of this program, it is recommended that this procedure be in operation for several years. Therefore, the intension is to pick up again next year with this program.

C. DNR Fish Survey

Mr. Sabina stated that he has been in touch with the Michigan Department of Natural Resources (DNR) and they had Lake Oakland on their schedule to perform a fish survey this year. Unfortunately, due to the COVID-19 pandemic their program has been cancelled for this year, and in turn they will perform the fish survey in 2021.

Public Comments:

No public comments.

Lake Oakland Invoice Ratification:

Mr. Sabina outlined the invoices that have been approved by email acknowledgement since the last Board Meeting, as noted in Items '8a' and '8b'.

Mr. Middleton, supported by Ms. Birch, acknowledging the correspondence and to ratify the approval and payment of the invoices.

Roll Call Motion Carried Unanimously

Lake Oakland Invoice Approval:

Mr. Sabina outlined the invoice from Progressive AE (dated April 2, 2020) for Lake Management Administration and Oversight in the amount of $5,000

Mr. Middleton, supported by Ms. Birch, moved to approve the Progressive AE Invoice #177472.

Roll Call Motion Carried Unanimously

Meeting Schedule:

The next Lake Board meeting will be on Wednesday, June 17, 2020 at 3:00 p.m. tentatively set at the Oakland County Water Resources Commissioner Downstairs Lunchroom.

Adjournment:

Mr. Middleton, supported by Ms. Birch, moved to adjourn the meeting at 4:15 p.m.

Roll Call Motion Carried Unanimously

George P. Nichols

George P. Nichols
Lake Improvement Board Secretary
For Lake Oakland

STATE OF MICHIGAN)
) ss:
COUNTY OF OAKLAND)

I hereby certify that the foregoing is a true and complete copy of the minutes of the Lake Improvement Board for Lake Oakland, Oakland County, Michigan held on the 8th day of April 2020, and that the said minutes are on file in the Office of the Oakland County Water Resources Commissioner and are available to the public.

I further certify that notice of the meeting was posted at least 18 hours before the meeting at the Office of the Oakland County Water Resources Commissioner, which is the principal office of the Lake Improvement Board for Lake Oakland.

George P. Nichols

George P. Nichols
Lake Improvement Board Secretary
For Lake Oakland

Dated: May 1, 2020

Attachment ‘A’

AGENDA

LAKE OAKLAND LAKE IMPROVEMENT BOARD

Wednesday, April 8, 2020 – 3:30 p.m.

Teleconference with a call in number of 248-289-9359; Access Code 191969

1. Open Meeting

2. Introductions and Attendance

3. Approval of the Meeting Agenda for April 8, 2020

4. Approval of Meeting Minutes from October 22, 2019

5. Old Business
   a. Herbicide Treatment Update

6. New Business
   a. 2019 Water Quality Monitoring Report
   b. Loosestrife Beetle Plants
   c. DNR Fish Survey

7. Public Comments

8. Lake Oakland Invoice Ratification
    a. Ratification of Aqua-Weed Control Invoice #13982 (dated 12/19/19) for 2020 Herbicide Treatment EGLE Permit Fee. Mr. Sabina, supported by Mr. Nichols, to pay invoice in the amount of $1,500.
    b. Ratification of Progressive AE Invoice #176246 (dated 1/7/20) for Lake Management Administration and Oversight. Mr. Nichols, supported by Mr. Sabina, to pay invoice in the amount of $5,000.00

9. Lake Oakland Invoice Approval
    a. Progressive AE Invoice #177472 (dated 4/2/20) for $5,000 for Lake Management Administration and Oversight.

10. All Else
    a. Schedule next meeting date

11. Adjournment

Attachment ‘B’

Water Quality Monitoring

Lake Oakland
2019 Water Quality Monitoring Report

Prepared for:
Lake Oakland Improvement Board
c/o One Public Works Drive
Building 95 West
Waterford, MI 48328-1907

Prepared by:
Progressive AE
1811 4 Mile Road, NE
Grand Rapids, MI 49525-2442
616/361-2664

January 2020

Project No: 56110101

Lake Oakland
2019 Water Quality Monitoring Report

Prepared for:
Lake Oakland Improvement Board
c/o One Public Works Drive
Building 95 West
Waterford, MI 48328-1907

Prepared by:
Progressive AE
1811 4 Mile Road, NE
Grand Rapids, MI 49525-2442
616/361-2664

January 2020

Project No: 56110101

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Introduction

Water quality monitoring of Lake Oakland was conducted by Progressive AE for the Lake Oakland Improvement Board in April and August of 2019 to evaluate baseline water quality conditions in the lake. This report contains background information on the various water quality parameters sampled and a discussion of the data collected to date.

Lakes can be classified into three broad categories based on their productivity or ability to support plant and animal life. The three basic lake classifications are "oligotrophic," "mesotrophic," and "eutrophic" (Figure 1). Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold water fish such as trout and whitefish. By contrast, eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike. Lakes that fall between these two extremes are called mesotrophic lakes. In a recent assessment of Michigan's lakes, the U.S. Geological Survey estimated that statewide about 25% of lakes are oligotrophic, 52% are mesotrophic and 23% are eutrophic (Fuller and Taricska 2012).

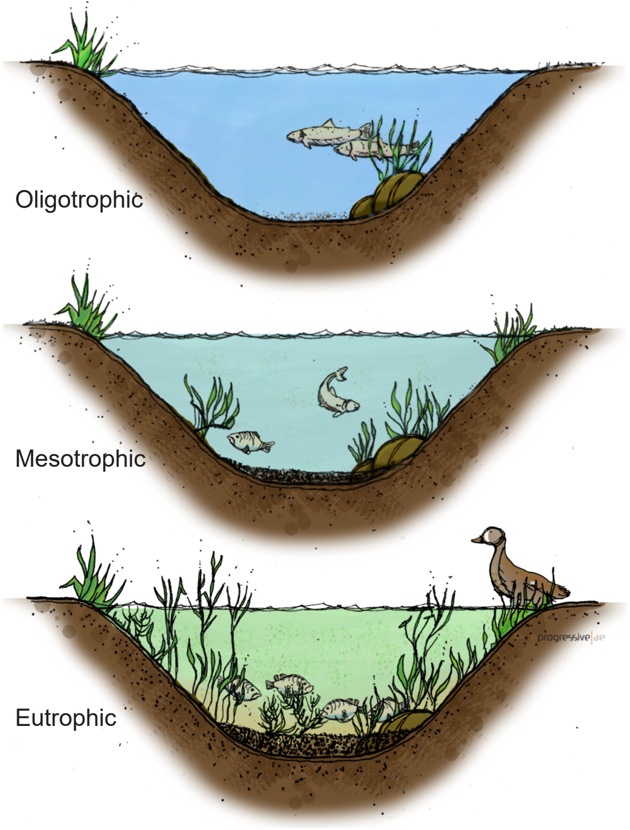

Figure 1. Lake classification.

Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as *cultural eutrophication*.

There are many ways to measure lake water quality, but there are a few important physical, chemical, and biological parameters that indicate the overall condition of a lake. These measurements include temperature, dissolved oxygen, total phosphorus, chlorophyll-*a*, and Secchi transparency.

TEMPERATURE

Temperature is important in determining the type of organisms that may live in a lake. For example, trout prefer temperatures below 68°F. Temperature also determines how water mixes in a lake. As the ice cover breaks up on a lake in the spring, the water temperature becomes uniform from the surface to the bottom. This period is referred to as "spring turnover" because water mixes throughout the entire water column. As the surface waters warm, they are underlain by a colder, more dense strata of water. This process is called thermal stratification. Once thermal stratification occurs, there is little mixing of the warm surface waters with the cooler bottom waters. The transition layer that separates these layers is referred to as the "thermocline." The thermocline is characterized as the zone where temperature drops rapidly with depth. As fall approaches, the warm surface waters begin to cool and become more dense. Eventually, the surface temperature drops to a point that allows the lake to undergo complete mixing. This period is referred to as "fall turnover." As the season progresses and ice begins to form on the lake, the lake may stratify again. However, during winter stratification, the surface waters (at or near 32°F) are underlain by slightly warmer water (about 39°F). This is sometimes referred to as "inverse stratification" and occurs because water is most dense at a temperature of about 39°F. As the lake ice melts in the spring, these stratification cycles are repeated (Figure 2). Shallow lakes do not stratify. Lakes that are 15 to 30 feet deep may stratify and destratify with storm events several times during the year.

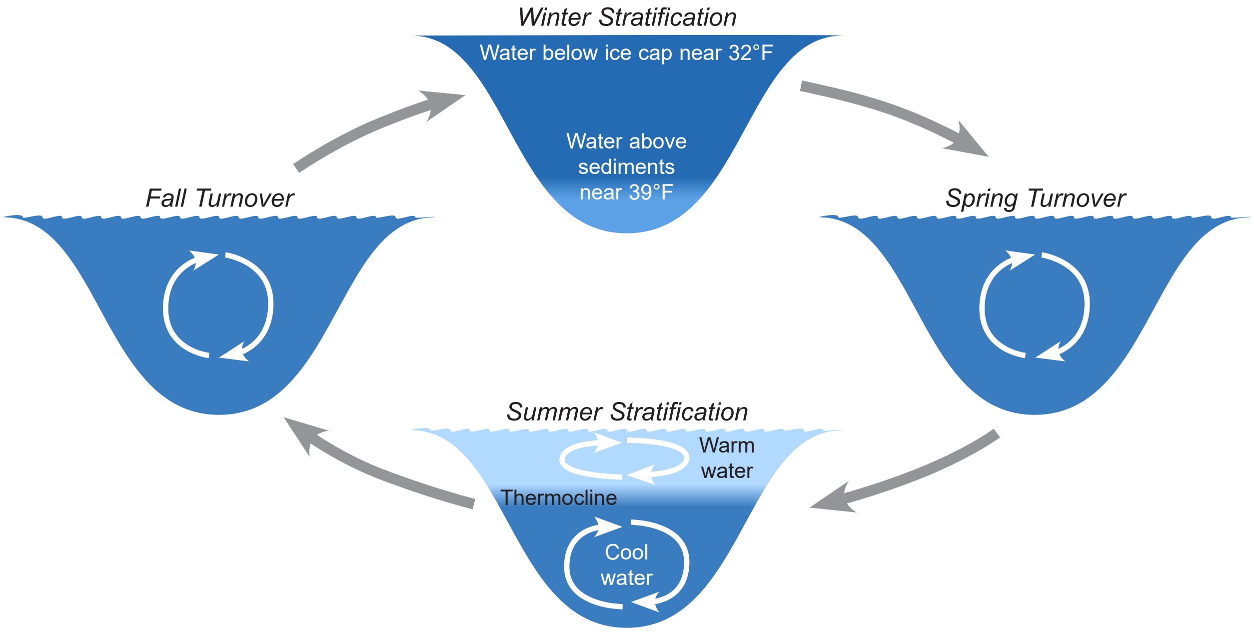

Figure 2. Seasonal thermal stratification cycles.

DISSOLVED OXYGEN

An important factor influencing lake water quality is the quantity of dissolved oxygen in the water column. The major inputs of dissolved oxygen to lakes are the atmosphere and photosynthetic activity by aquatic plants. An oxygen level of about 5 mg/L (milligrams per liter, or parts per million) is required to support warm water fish. In lakes deep enough to exhibit thermal stratification, oxygen levels are often reduced or depleted below the thermocline once the lake has stratified. This is because deep water is cut off from plant photosynthesis and the atmosphere, and oxygen is consumed by bacteria that use oxygen as they decompose organic matter (plant and animal remains) at the bottom of the lake. Bottom-water oxygen depletion is a common occurrence in eutrophic and some mesotrophic lakes. Thus, eutrophic and most mesotrophic lakes cannot support cold water fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.

PHOSPHORUS

The quantity of phosphorus present in the water column is especially important since phosphorus is the nutrient that most often controls aquatic plant growth and the rate at which a lake ages and becomes more eutrophic. In the presence of oxygen, lake sediments act as a phosphorus trap, retaining phosphorus and, thus, making it unavailable for algae growth. However, if bottom-water oxygen is depleted, phosphorus will be released from the sediments and may be available to promote aquatic plant growth. In some lakes, the internal release of phosphorus from the bottom sediments is the primary source of phosphorus loading (or input).

By reducing the amount of phosphorus in a lake, it may be possible to control the amount of aquatic plant growth. In general, lakes with a phosphorus concentration greater than 20 µg/L (micrograms per liter, or parts per billion) are able to support abundant plant growth and are classified as nutrient-enriched or eutrophic.

CHLOROPHYLL-*A*

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 µg/L is considered characteristic of a eutrophic condition.

SECCHI TRANSPARENCY

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line (Figure 3). The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Generally, it has been found that aquatic plants can grow at a depth of approximately twice the Secchi transparency measurement. In eutrophic lakes, water clarity is often reduced by algae growth in the water column, and Secchi disk readings of 7.5 feet or less are common.

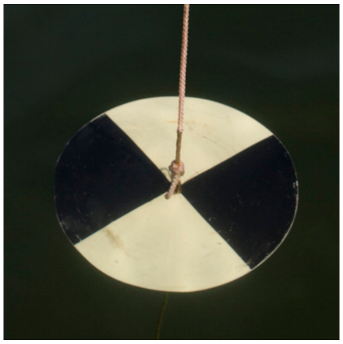

Figure 3. Secchi disk.

LAKE CLASSIFICATION CRITERIA

Ordinarily, as phosphorus inputs (both internal and external) to a lake increase, the amount of algae will also increase. Thus, the lake will exhibit increased chlorophyll-*a* levels and decreased transparency. A summary of lake classification criteria developed by the Michigan Department of Natural Resources is shown in Table 1.

TABLE 1

LAKE CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)[1]	Chlorophyll-*a* (µg/L)[1]	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5

In addition to the parameters commonly used to evaluate lake trophic state, there are several other measurements that can be made to characterize water quality. A brief description of some of these parameters follows:

pH AND TOTAL ALKALINITY

pH is a measure of the amount of acid or base in the water. The pH scale ranges from 0 (acidic) to 14 (alkaline or basic) with neutrality at 7. The pH of most lakes in the Upper Midwest ranges from 6.5 to 9.0 (MDEQ 2012; Table 2). In addition, according to EGLE (2019):

> While there are natural variations in pH, many pH variations are due to human influences. Fossil fuel combustion products, especially automobile and coal-fired power plant emissions, contain nitrogen oxides and sulfur dioxide, which are converted to nitric acid and sulfuric acid in the atmosphere. When these acids combine with moisture in the atmosphere, they fall to earth as acid rain or acid snow. In some parts of the United States, especially the Northeast, acid rain has resulted in lakes and streams becoming acidic, resulting in conditions which are harmful to aquatic life. The problems associated with acid rain are lessened if limestone is present, since it is alkaline and neutralizes the acidity of the water.
>
> Most aquatic plants and animals are adapted to a specific pH range, and natural populations may be harmed by water that is too acidic or alkaline. Immature stages of aquatic insects and young fish are extremely sensitive to pH values below 5. Even microorganisms which live in the bottom sediment and decompose organic debris cannot live in conditions which are too acidic. In very acidic waters, metals which are normally bound to organic matter and sediment are released into the water. Many of these metals can be toxic to fish and humans. Below a pH of about 4.5, all fish die.

The Michigan Water Quality Standard (Part 4 of Act 451) states that pH shall be maintained within the range of 6.5 to 9.0 in all waters of the state.

Alkalinity, also known as acid-neutralizing capacity or ANC, is the measure of the pH-buffering capacity of water in that it is the quantitative capacity of water to neutralize an acid. pH and alkalinity are closely linked and are greatly impacted by the geology and soil types that underlie a lake and its watershed. According to MDEQ (2012):

> Michigan's dominant limestone geology in the Lower Peninsula and the eastern Upper Peninsula contributes to the vast majority of Michigan lakes being carbonate-bicarbonate dominant [which increases alkalinity and moderates pH] and lakes in the western Upper Peninsula having lower alkalinity and thus lesser buffering capacity.

The alkalinity of most lakes in the Upper Midwest is within the range of 23 to 148 milligrams per liter, or parts per million, as calcium carbonate (MDEQ 2012; Table 2).

TABLE 2

pH AND ALKALINITY OF UPPER MIDWEST LAKES

Measurement	Low	Moderate	High
pH (in standard units)	Less than 6.5	6.5 to 9.0	Greater than 9.0
Total Alkalinity or ANC (in mg/L as $CaCO_3$[1])	Less than 23	23 to 148	Greater than 148

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[1] mg/L $CaCO_3$ = milligrams per liter as calcium carbonate.

TOTAL SUSPENDED SOLIDS

According to EGLE (2019):

> Total suspended solids (TSS) include all particles suspended in water which will not pass through a filter... Most people consider water with a TSS concentration less than 20 mg/L to be clear. Water with TSS levels between 40 and 80 mg/L tends to appear cloudy, while water with concentrations over 150 mg/L usually appears dirty.

CHLORIDE

Normally, chloride is a very minor component of freshwater systems and background concentrations are generally less than about 10 milligrams per liter (Wetzel 2001; Fuller and Taricska 2012, Figure 4). However, chloride pollution from sources such as road salting, industrial or municipal wastewater, water softeners, and septic systems can increase chloride levels in lakes. Increased chloride levels can reduce biological diversity and, because chloride increases the density of water, elevated chloride levels can prevent a lake from completely mixing during spring and fall. Michigan's water quality standards require that waters designated as a public water supply source not exceed 125 milligrams per liter of chlorides as a monthly average.

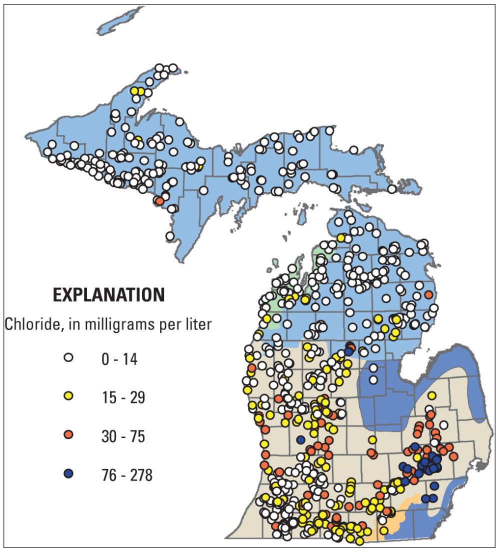

Figure 4. Lake chloride levels (2001–10) in USEPA ecoregions. Fuller and Taricska 2012.

SAMPLING METHODS

Water quality sampling was conducted in the spring and summer of 2019 at the deepest basin within Lake Oakland (Figure 5). Temperature was measured using a YSI Model 550A probe. Samples were collected with a Van Dorn sampler at 10-foot intervals from just below the surface to just above the lake bottom. Samples were analyzed for dissolved oxygen, total phosphorus, chloride, total suspended solids, pH, and total alkalinity. Dissolved oxygen samples were fixed in the field and then transported to Progressive AE for analysis using the modified Winkler method (Standard Methods procedure 4500-O-C). pH was measured in the field using an Oakton EcoTestr pH2 pH meter. Remaining samples were placed on ice and transported to Prein and Newhof Environmental Laboratory[1] and to Progressive AE for analysis. Total phosphorus, chloride, and total suspended solids were analyzed at Prein and Newhof using Standard Methods procedure 4500-P-E, EPA procedure 300.0, and Standard Methods procedure 2540D, respectively. Total alkalinity was titrated at Progressive AE using Standard Methods procedure 2320 B. In addition to the depth-interval samples at each deep basin, Secchi transparency was measured and composite chlorophyll-*a* samples were collected from the surface to a depth equal to twice the Secchi transparency. Chlorophyll-*a* samples were analyzed by Prein and Newhof using Standard Methods procedure 10200 H.

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[1] Prein and Newhof Environmental Laboratory, 3260 Evergreen Drive, NE, Grand Rapids, MI 49525.

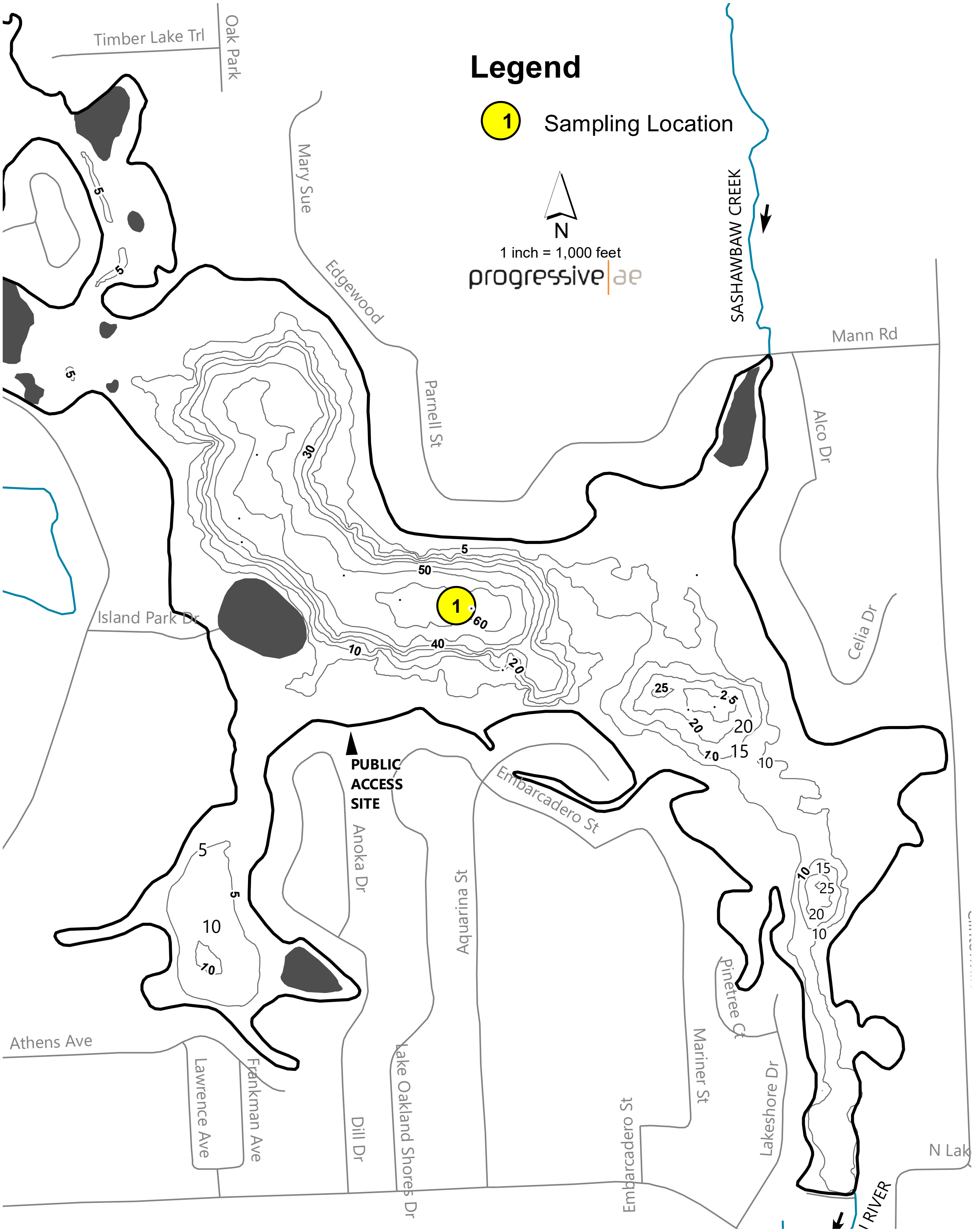

Figure 5. Lake Oakland sampling location map.

Lake Oakland Water Quality

In 2019, samples were collected on April 10 and August 15 at ten-foot depth intervals over the deep basin of Lake Oakland to evaluate baseline water quality conditions (Figure 5 and Tables 3 and 4).

During the April sampling, lake waters were cool and well-oxygenated from the surface to the bottom (Table 3). During the August sampling period, the lake was warmer and thermally stratified. The thermocline, where temperature drops rapidly with depth, was between 20 and 30 feet. Dissolved oxygen was nearly depleted below the thermocline. These data indicate that while Lake Oakland can sustain warm- and cool-water fish such as bass and pike, the lake lacks a cold, well-oxygenated refuge for cold-water fish such as trout.

Phosphorus levels in Lake Oakland were moderate and slightly elevated near the surface in April and elevated in August near the lake bottom. Although deep water phosphorus levels are slightly elevated, the volume of water containing high phosphorus is small. Thus, it does not appear that internal phosphorus loading is significant in Lake Oakland.

Secchi transparency measurements in April and August were in the mesotrophic range, while chlorophyll-a readings were well below the eutrophic threshold of 6 parts per billion (Table 4). This data indicates there was sparse algae growth in the water column in both April and August. Total suspended solids in the water column were low in both April and August and were characteristic of clear water.

Chloride levels in Lake Oakland are elevated and exceed normal background levels. (Wetzel 2001 and Fuller and Taricska 2012, Table 3). In highly urbanized areas such as southeast Michigan, chloride levels are often higher due to road salting and other factors (Fuller and Taricska 2012).

Alkalinity in Lake Oakland is high, and the lake is well-buffered against pollution inputs that could impact pH (Table 3). The pH in Lake Oakland is within the moderate range for Upper Midwest lakes.

Current and historical data indicate Lake Oakland is mesotrophic (Table 5, Appendix A). While dissolved oxygen was nearly depleted at the bottom of the deep basin during the August sampling period, sediment phosphorus release was minimal and characteristic of a mesotrophic condition.

TABLE 3
LAKE OAKLAND 2019 DEEP BASIN WATER QUALITY DATA

Date	Sample Site	Sample Depth (feet)	Temperature (°F)	Dissolv. Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]	pH (S.U.)[3]	Total Alkalinity (mg/L as $CaCO_3$)[4]	Total Suspended Solids (mg/L)[1]	Chloride (mg/L)[1]
10-Apr-19	1	1	50	11.1	48	8.3	215	4	148
10-Apr-19	1	10	50	9.8	17	8.3	214	6	149
10-Apr-19	1	20	48	10.9	22	8.3	216	9	150
10-Apr-19	1	30	42	10.6	10	8.3	221	4	147
10-Apr-19	1	40	41	10.2	10	8.0	222	4	152
10-Apr-19	1	50	41	10.1	10	8.0	231	7	153
10-Apr-19	1	60	41	10.0	11	7.9	222	4	152
15-Aug-19	1	1	78	9.6	19	8.2	157	7	154
15-Aug-19	1	10	76	9.6	31	8.2	154	4	32
15-Aug-19	1	20	69	7.0	81	7.9	161	9	31
15-Aug-19	1	30	51	1.5	20	7.5	202	4	31
15-Aug-19	1	40	46	0.4	24	7.4	211	6	32
15-Aug-19	1	50	44	0.4	31	7.4	220	8	32
15-Aug-19	1	60	43	0.2	76	7.4	225	10	32

TABLE 4
LAKE OAKLAND 2019 SURFACE WATER QUALITY DATA

Date	Station	Chlorophyll-*a* (µg/L)[4]	Secchi Transparency (feet)
10-Apr-19	1	1	10.0
15-Aug-19	1	1	9.5

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[1] mg/L = milligrams per liter = parts per million.
[2] µg/L = micrograms per liter = parts per billion.
[3] S.U. = standard units.
[4] mg/L as $CaCO_3$ = milligrams per liter as calcium carbonate.

TABLE 5
LAKE OAKLAND SUMMARY STATISTICS (2002-2019)

	Total Phosphorus (µg/L)[1]	**Chlorophyll-*a* (µg/L)[2]**	**Secchi Transparency (feet)**
Mean	23	1	12.9
Standard deviation	19	2	3.3
Median	19	1	13.0
Minimum	5	0	9.0
Maximum	81	5	18.0
Number of samples	29	7	8

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[1] µg/L = micrograms per liter = parts per billion.

References

Fuller, L.M. and C.K. Taricska. 2012. Water-Quality Characteristics of Michigan's Inland Lakes, 2001-10: U.S. Geological Survey Scientific Investigations Report 2011-5233, 53 p., plus CD-ROM.

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Appendix A
Historical Lake Oakland Water Quality

TABLE A-1
LAKE OAKLAND HISTORICAL DEEP BASIN WATER QUALITY DATA
Collected by Progressive AE

Date	Station	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]	pH (S.U.)[3]	Total Alkalinity (mg/L $CaCO_3$)[4]
1-May-02	1	1	51	10.8	24		199
1-May-02	1	10	51	10.8	16	8.7	198
1-May-02	1	20	50	10.6	28	8.7	196
1-May-02	1	30	48	10.9	19	8.7	197
1-May-02	1	40	43	11.7	12	8.6	198
1-May-02	1	50	42	11.1	53	8.6	202
1-May-02	1	60	42	9.7	19	8.6	200
16-Jul-02	1	1	32	7.5	6	8.8	166
16-Jul-02	1	10	32	7.3	11		
16-Jul-02	1	20	32	6.1	12		
16-Jul-02	1	30	32	5.3	5	8.2	197
16-Jul-02	1	40	32	4.4	10		
16-Jul-02	1	50	32	2.8	16		
16-Jul-02	1	60	32	0.8	25	8.0	199

TABLE A-2
LAKE OAKLAND HISTORICAL SURFACE WATER QUALITY DATA
Collected by Progressive AE

Date	Station	Chlorophyll-*a* (µg/L)[2]	Secchi Transparency (feet)
1-May-02	1	0	16.0
16-Jul-02	1	2	15.0
22-Apr-15	1	1	12.0
1-Sep-15	1		9.0

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[1] mg/L = milligrams per liter = parts per million.

[2] µg/L = micrograms per liter = parts per billion.

[3] S.U. = standard units.

[4] mg/L as $CaCO_3$ = milligrams per liter as calcium carbonate.

TABLE A-3
LAKE OAKLAND HISTORICAL DEEP BASIN WATER QUALITY DATA
Collected by Michigan Department of Environmental Quality

Date	Station	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]	pH (S.U.)[3]
19-Apr-04	1	6	56	10.0	14	8.0
19-Apr-04	1	12	56	9.8		8.0
19-Apr-04	1	18	56	9.7		8.0
19-Apr-04	1	24	55	10.0		8.0
19-Apr-04	1	30	45	10.5	16	8.0
19-Apr-04	1	36	44	10.0		7.9
19-Apr-04	1	42	43	10.0		7.9
19-Apr-04	1	48	42	9.5		7.9
19-Apr-04	1	54	42	9.3		7.8
19-Apr-04	1	60	42	9.1	11	7.8
19-Apr-04	1	65	41			7.8
11-Aug-04	1	3	73	9.1	15	8.2
11-Aug-04	1	9	73	8.9		8.2
11-Aug-04	1	15	73	8.8		8.2
11-Aug-04	1	18	71	7.8		8.0
11-Aug-04	1	21	64	7.0	13	7.7
11-Aug-04	1	24	57	5.2		7.7
11-Aug-04	1	27	53	2.8		7.7
11-Aug-04	1	30	50	2.7		7.6
11-Aug-04	1	33	48	2.7		7.7
11-Aug-04	1	36	46	2.9		7.8
11-Aug-04	1	39	46	2.9		7.7
11-Aug-04	1	42	45	2.1		7.7
11-Aug-04	1	45	43	1.7		7.7
11-Aug-04	1	50	43	1.3		7.7
11-Aug-04	1	56	43	1.0		7.8
11-Aug-04	1	60	42		39	
11-Aug-04	1	62	42	1.0		7.8

TABLE A-4
LAKE OAKLAND HISTORICAL SURFACE WATER QUALITY DATA
Collected by Michigan Department of Environmental Quality

Date	Station	Chlorophyll-*a* (µg/L)[2]	Secchi Transparency (feet)
19-Apr-04	1	1	14.0
11-Aug-04	1	5	18.0

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[1] mg/L = milligrams per liter = parts per million.

[2] µg/L = micrograms per liter = parts per billion.

[3] S.U. = standard units.