

**Minutes of the Lake Oakland  
Lake Improvement Board Meeting  
October 5, 2021**

Mr. Sabina called the meeting to order at 3:34 p.m. at the Oakland County Water Resources Commissioner 1<sup>st</sup> Floor Meeting Room.

**PRESENT:** Rick Sabina, Citizen Member/Chairperson  
George Nichols, Oakland County WRC, Secretary  
Karen Joliat, Oakland County Board of Commissioners  
Kimberly Markee, Waterford Township Clerk  
Terri Nallamotheu, Independence Township Trustee  
Paul Hausler, Progressive AE  
Michael Perzyk, Resident (3790 Rutherford Court, Waterford, MI)

**Open Meeting**

All participants stated their name and affiliation for the record.

Mr. Sabina reminded everyone to sign the attendance sheet (see Attachment 'A').

**Approval of the Meeting Agenda:**

Karen Joliat, supported by George Nichols, moved to accept the meeting agenda as presented (see Attachment 'B').

***Motion Carried Unanimously***

**Approval of Meeting Minutes:**

Terri Nallamotheu, supported by Karen Joliat, moved to accept the minutes as submitted for the meeting of August 17, 2021.

***Motion Carried Unanimously***

Paul Hausler will post the meeting minutes on the Lake Oakland website.

**Old Business:**

A. Project Work Journal

Paul Hausler provided a Project Work Journal (see Attachment 'C') dated October 4, 2021 that outlines all the services regarding plant control and associated costs to date for the 2021 calendar year. It was stated that since the last meeting, a survey took place on August 20, 2021 and September 1, 2021, and harvesting from August 25 thru August 31 and treatment on September 13, 2021.

The Project Work Journal shows \$3,872.80 in remaining fund balance. Action will be taken on this issue under New Business Item #5b.

B. Herbicide Treatment Update

Paul Hausler stated a herbicide treatment occurred on September 13, 2021 (see Attachment 'D' – September 1, 2021 Treatment Maps). There was an area of milfoil that had been treated with ProcellaCOR that was treated again, which is under the 3-year warranty. Paul stated that a treatment of Procellacor/Diquat was used on the lake and was very affective. Other areas of starry stonewort were also treated.

C. Plant Harvesting Schedule

Paul Hausler stated that harvesting occurred from August 25, 2021 to August 31, 2021 (see Attachment 'E' – August 19, 2021 Harvesting Map). Harvesting a total of approximately 21 acres of material.

D. Harvesting Machine Purchase

Rick Sabina doesn't feel comfortable taking on the responsibility of purchasing and maintaining a harvesting machine. There is issue of storing it and operating it and carrying insurance that would likely far exceed the costs of hiring someone to perform the work. Paul Hausler stated that a new machine could cost anywhere from \$120,000-\$250,000 depending on the size.

E. Storm Drain Cleanout

George Nichols submitted a request to the Road Commission for Oakland County (RCOC) for six (6) catch basin cleaning locations. These are catch basins that drain directly into Lake Oakland. RCOC noted that it is on their schedule for cleaning but could not provide an exact date. Mr. Nichols will periodically contact RCOC for a schedule update and will notify the Board accordingly.

F. Stencil for Labeling Lake Drains

Rick Sabina shared the new stencil that states "No Waste – Drains to Lake". It is recommended to use white paint. It was suggested to contact the homeowner first (property where catch basin is located) to inform them of the stenciling and gain their acknowledgement of the work.

Kim Markee, supported by Karen Joliat, moved to reimburse Rick Sabina for the cost of the stencil upon submittal of the invoice for a cost not to exceed \$50.00

***Motion Carried Unanimously***

## **New Business**

### A. Plant Harvesting Bid Proposals

Paul Hausler stated there were a total of three (3) bids received (see Attachment 'F'), with one of them coming in after the bid time. Savin Lake Services (from Hale, MI) was the low bidder. Progressive AE has worked with them on other lake harvesting projects. There was discussion regarding the bid prices and that prices are high across the industry. Since it was for a one-year contract, the prices may have been slightly higher.

Karen Joliat, supported by Terri Nallamotheu, moved to award the plant harvesting work to Savin Lake Services for calendar year 2023, as outlined in the bid tabulation.

#### ***Motion Carried Unanimously***

George Nichols, supported by Terri Nallamotheu, moved to terminate the contract with Mike's Clearwater Harvesting for treatment year 2023 and to have Paul Hausler coordinate the cancelling of their contract

#### ***Motion Carried Unanimously***

### B. Remaining Funds from 2021 Plant Control

The Project Work Journal shows \$3,872.80 in remaining fund balance.

Karen Joliat, supported by Kim Markee, moved to rollover the remaining fund balance that remains at the end of the 2021 calendar year into the 2022 contingency line item for plant control.

#### ***Motion Carried Unanimously***

### C. Aquatic Plant Control Program 2021 Activity Summary

Mr. Hausler stated that the aquatic plants are an important component of lakes. They produce oxygen during photosynthesis, provide food, habitat and cover for fish, and help stabilize shoreline and bottom sediments. The summary provides an explanation of the plant surveys and plant controls within Lake Oakland. There were six (6) surveys performed, five (5) herbicide treatments performed, and two (2) harvesting that occurred. A vegetation survey of Lake Oakland was conducted on September 13, 2021, to evaluate the type and abundance of all plants in the lake. At the time of the survey, nineteen (19) submersed species, one (1) free-floating, three (3) floating-leaved species, and eight (8) emergent species were found in the lake. (see Attachment 'G')

George Nichols, supported by Karen Joliat moved to Receive, Note and File the Aquatic Plant Control Program 2021 Activity Summary and post this information on the website.

#### ***Motion Carried Unanimously***

#### D. Mann Road Development

George Nichols stated that he has spoken to the soil erosion and sedimentation control department within WRC and they are still trying to determine what the source is regarding the murky water. The developer has been cooperative and following the soil erosion requirements.

#### **Public Comments:**

Michael Perzyk commented on the algae blooms popping up and the sediment buildup is terrible, especially in the cove area. There are a lot of lily pads in the area as well. His top three concerns are the weeds, muck, and algae blooms. He is looking to the Board for some help to clean up the area.

#### **Lake Oakland Invoice Ratification:**

Mr. Sabina outlined invoice #16550 from Aqua-Weed Control (dated August 31, 2021) in the amount of \$3,663.75 for Herbicide Treatment on August 11, 2021, that was approved by email acknowledgement since the last Board meeting, as noted in Item '7a'.

Terri Nallamothu, supported Karen Joliat, acknowledged the correspondence and to ratify the approval and payment of the invoice.

***Motion Carried Unanimously***

#### **Lake Oakland Invoice Approval**

Rick Sabina outlined invoice #184190 from Progressive AE (dated October 1, 2021) for Lake Management Administration and Oversight Quarterly Services thru September 24, 2021, in the amount of \$5,000, as noted in Item '8a'.

Rick Sabina, supported by George Nichols, to pay invoice #184190 in the amount of \$5,000.

***Motion Carried Unanimously***

Rick Sabina outlined invoice #152 from Mike's Clearwater Harvesting (dated August 30, 2021) for harvesting work performed from August 25, 2021 to August 31, 2021 in the amount of \$8,705.25, as noted in Item '8b'.

Rick Sabina, supported by Karen Joliat, to pay invoice #152 in the amount of \$8,705.25.

***Motion Carried Unanimously***

Rick Sabina outlined invoice #16594 from Aqua-Weed Control (dated September 14, 2021) for herbicide treatment on September 13, 2021 in the amount of \$262.50, as noted in Item '8c'.

Rick Sabina, supported by Karen Joliat, to pay invoice #16594 in the amount of \$262.50.

***Motion Carried Unanimously***

### **Board Member Comments**

Terri Nallamotheu asked about the results of the Mobile Aquatic Invasive Species (AIS) Station that was provided Oakland County Parks & Recreation Department in conjunction with DNR. Rick Sabina stated that usage data was collected but still waiting on the results and usage records. He will bring any information to the next meeting.,

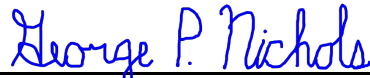
### **Meeting Schedule:**

The next Lake Board meeting will be held on May 17, 2022, at 3:00 p.m. The meeting will take place at Oakland County Water Resources Commissioner office. The address is One Public Works Drive, Building 95W, Waterford, Michigan. This will be posted on the website.

### **Adjournment:**

Kim Markee, supported by Terri Nallamotheu, moved to adjourn the meeting at 4:59 p.m.

***Motion Carried Unanimously***



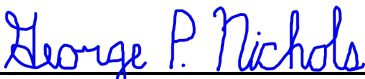
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George P. Nichols  
Lake Improvement Board Secretary  
For Lake Oakland

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 5<sup>th</sup> day of October 2021 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  
Lake Improvement Board Secretary  
For Lake Oakland

Dated: April 7, 2022

**Attachment 'A'**

**OAKLAND COUNTY WATER RESOURCES COMMISSIONER  
ATTENDANCE SHEET**

**DATE:** October 5, 2021 @ 3:30 p.m. **FACILITATOR:** \_\_\_\_\_

**TYPE** Lake Improvement Board Meeting (WRC 1<sup>st</sup> Floor Conference Room)

**TOPIC:** Lake Oakland Lake Improvement Board Meeting

PRINTED NAME	E-MAIL	ADDRESS	CONTACT NUMBER
PAUL HAUSLER	hauslerp@progressive.com	G. R.	616-450-476
<i>[Signature]</i>	joliette@oakgov		2489356133
Michael Perzyk	batter785@hotmail.com	3790 Rutherford Ct.	248-892-3518
Rick Sabince	sabina@oakland.edu	312 Pine Tree Ct	248-599-7117
George Nichols	nicholsge@oakgov.com		248-841-3006
Kim Markee	kmarkee@waterfordmi.gov		248-674-6211
Terri Nallamothy	tnallamothy@indtup.com		2488920010



# Attachment 'B'

## **AGENDA**

### **LAKE OAKLAND LAKE IMPROVEMENT BOARD**

Tuesday, October 5, 2021 – 3:30 p.m.

Oakland County Water Resources Commissioner 1<sup>st</sup> Floor Meeting Room

1. Open Meeting
  - a. Introductions and Attendance
2. Approval of the Meeting Agenda for October 5, 2021
3. Approval of Meeting Minutes from August 17, 2021
4. Old Business
  - a. Project Work Journal
  - b. Herbicide Treatment Update
  - c. Plant Harvesting Update
  - d. Harvesting machine purchase
  - e. Storm Drain Cleanout
  - f. Stencil for labeling lake drains
5. New Business
  - a. Plant Harvesting Bid Proposals
6. Public Comments
7. Lake Oakland Invoice Ratification
  - a. Ratification of Aqua-Weed Control Invoice #16550 (dated 8/31/21) for Herbicide Treatment on August 11, 2021. Rick Sabina, supported by George Nichols, to pay invoice in the amount of \$3,633.75.
8. Lake Oakland Invoice Approval
  - a. Approval of Progressive AE Invoice #184190 (dated 10/1/21) for Lake Management Administration and Oversight Quarterly Services thru September 24, 2021, in the amount of \$5,000.

- b. Approval of Mike's Clearwater Harvesting Invoice #152 (dated 8/30/21) for harvesting work performed on Lake Oakland from August 25, 2021 to August 31, 2021, in the amount of \$8,705.25.
- c. Approval of Aqua-Weed Control Invoice #16594 (dated 9/14/21) for Herbicide Treatment on September 13, 2021, in the amount of \$262.50.

9. Board Member Comments

10. All Else

- a. Schedule next meeting date – April/May 2022

11. Adjournment

# Attachment 'C'

Project Work Journal  
Lake Oakland

Beginning Balance: \$73,500.00

2021

Date	Type	Results	Qty	Dose Rate	Cost	Remaining Balance
1/13/2021	Permit	2021 EGLE permit fee				
Application Date	Type	Target Species	Qty	Dose Rate	Cost	Remaining Balance
3/1/2021	Permit Fee		1.00 each		\$1,500.00	\$72,000.00
				<b>Invoice 15426 Total</b>	<b>\$1,500.00</b>	<b>\$72,000.00</b>

Date	Type	Results	Qty	Dose Rate	Cost	Remaining Balance
4/19/2021	Other	Harvesting deposit request				
Treatment Date	Type	Target Species	Qty	Dose Rate <td>Cost</td> <td>Remaining Balance</td>	Cost	Remaining Balance
4/19/2021 - 4/19/2021	Harvesting		9.71 acre(s)		\$3,500.45	\$68,499.55
				<b>Invoice 140 Total</b>	<b>\$3,500.45</b>	<b>\$68,499.55</b>

Date	Type	Results	Qty	Dose Rate	Cost	Remaining Balance
5/5/2021	Survey	Found significant curly-leaf and milfoil. Water temp = 57F.				
Treatment Date	Type	Target Species	Qty	Dose Rate <td>Cost</td> <td>Remaining Balance</td>	Cost	Remaining Balance
5/18/2021	2,4-D ester	Eurasian Milfoil	8.25 acre(s)	150.00 lbs/acre	\$3,960.00	\$64,539.55
5/18/2021	Algae control (filamentous and planktonic)	Filamentous or Planktonic Algae	0.50 acre(s)	\$20.00	\$20.00	\$64,519.55
~5/18/2021	Dipotassium salt of endothal for exotics	Curly-leaf Pondweed	16.50 acre(s)	\$2,640.00	\$2,640.00	\$61,879.55
5/18/2021	Flumioxazin and contacts	Curly-leaf Pondweed	1.00 acre(s)	3350.00	\$350.00	\$61,529.55
		Eurasian Milfoil				
		Starry Stonewort				
5/18/2021	Triclopyr dry	Eurasian Milfoil	0.75 acre(s)	180.00 lbs/acre	\$468.75	\$61,060.80
5/18/2021	Triclopyr liquid	Eurasian Milfoil	6.50 acre(s)	3.00 gallons/acre	\$1,625.00	\$59,435.80
5/18/2021	ProcellaCOR + diquat-dibromide	Eurasian Milfoil	23.25 acre(s)	12.80 ounces	\$12,090.00	\$47,345.80
				<b>Invoice 16168 Total</b>	<b>\$21,153.75</b>	<b>\$47,345.80</b>

6/10/2021 Survey Found some milfoil and SSW. Wild celery just starting. Noted harvest areas. Water temp. = 79F.

Project Work Journal  
Lake Oakland

2021 Beginning Balance: \$73,500.00

Treatment Date	Type	Target Species	Qty	Dose Rate	Cost	Remaining Balance
6/15/2021	2,4-D ester	Eurasian Milfoil	1.00 acre(s)	150.00 lbs/acre	\$480.00	\$46,865.80
6/15/2021	Algae control (filamentous and planktonic)	Filamentous or Planktonic Algae	8.00 acre(s)		\$320.00	\$46,545.80
6/15/2021	Flumioxazin	Curly-leaf Pondweed	2.00 acre(s)	200.00 ppb	\$980.00	\$45,565.80
6/15/2021	Flumioxazin and contacts	Eurasian Milfoil	0.50 acre(s)	100.00 ppb	\$175.00	\$45,390.80
6/15/2021	Macro-algae control: copper and monoamine salt of endothal	Eurasian Milfoil	8.75 acre(s)		\$612.50	\$44,778.30
6/15/2021	Chelated Copper Complex Granular (Harpoon)	Nuisance Native Plants	2.00 acre(s)	200.00 lbs/acre	\$650.00	\$44,128.30
6/15/2021	ProcellaCOR + diquat-dibromide	Starry Stonewort	3.00 acre(s)	12.80 ounces	\$1,560.00	\$42,568.30
<b>Invoice 16353 Total</b>						<b>\$4,777.50</b>
6/28/2021 - 7/8/2021	Harvesting	Nuisance Native Plants	23.00 acre(s)		\$8,291.50	\$34,276.80
6/28/2021 - 7/8/2021	Harvesting of starry stonewort	Chara	19.25 acre(s)		\$9,913.75	\$24,363.05
<b>Invoice 146 Total</b>						<b>\$18,205.25</b>

7/12/2021 Survey

Harvest about 75 percent done. Found some milfoil treatment areas particularly towards east end. Some spot SSW and wild celery treatments needed. Water temp. = 74F.

**Project Work Journal  
Lake Oakland**

**Beginning Balance: \$73,500.00**

2021

Treatment Date	Type	Target Species	Qty	Dose Rate	Cost	Remaining Balance
7/20/2021	2,4-D ester	Eurasian Milfoil	7.25 acre(s)	150.00 lbs/acre	\$3,480.00	\$20,883.05
7/20/2021	Macro-algae control: copper and monoamine salt of endothall	Starry Stonewort	17.25 acre(s)		\$1,207.50	\$19,675.55
7/20/2021	Chelated Copper Complex Granular (Harpoon)	Starry Stonewort Wild Celery	4.25 acre(s)	200.00 lbs/acre	\$1,381.25	\$18,294.30
7/20/2021	ProcellaCOR + diquat-dibromide	Eurasian Milfoil	3.50 acre(s)	12.80 ounces	\$1,820.00	\$16,474.30
<b>Invoice 16461 Total</b>					<b>\$7,888.75</b>	<b>\$16,474.30</b>

8/5/2021 Survey

Found some spots of milfoil and SSW. Collected late summer water quality samples. Water temp. = 79F.

Treatment Date	Type	Target Species	Qty	Dose Rate	Cost	Remaining Balance
8/11/2021	Chelated copper complex liquid	Wild Celery	7.25 acre(s)		\$2,320.00	\$14,154.30
8/11/2021	Macro-algae control: copper and monoamine salt of endothall	Starry Stonewort	5.00 acre(s)		\$350.00	\$13,804.30
8/11/2021	Triclopyr liquid	Eurasian Milfoil	2.25 acre(s)	3.00 gallons/acre	\$562.50	\$13,241.80
8/11/2021	Chelated Copper Complex Granular (Harpoon)		0.25 acre(s)	200.00 lbs/acre	\$81.25	\$13,160.55
8/11/2021	ProcellaCOR	Eurasian Milfoil	2.00 PDU		\$230.00	\$12,930.55
8/11/2021	Diquat dibromide @ 2 gal/acre	Eurasian Milfoil Nuisance Native Plants	0.50 acre(s)	2.00 gallons/acre	\$90.00	\$12,840.55
<b>Invoice 16550 Total</b>					<b>\$3,633.75</b>	<b>\$12,840.55</b>

8/20/2021 Survey

Pre-harvest survey. Water temp. = 80F.

Project Work Journal  
Lake Oakland

2021 Beginning Balance: \$73,500.00

Treatment Date	Type	Target Species	Qty	Dose Rate	Cost	Remaining Balance
8/25/2021 - 8/31/2021	Harvesting	Nuisance Native Plants Water Lillies Wild Celery	15.25 acre(s)		\$5,657.75	\$7,182.80
8/25/2021 - 8/31/2021	Harvesting of starry stonewort		5.75 acre(s)		\$3,047.50	\$4,135.30
<b>Invoice 152 Total</b>					<b>\$8,705.25</b>	<b>\$4,135.30</b>

9/1/2021 Survey Harvest inspection - about 90 percent done. Water temp. = 80F.

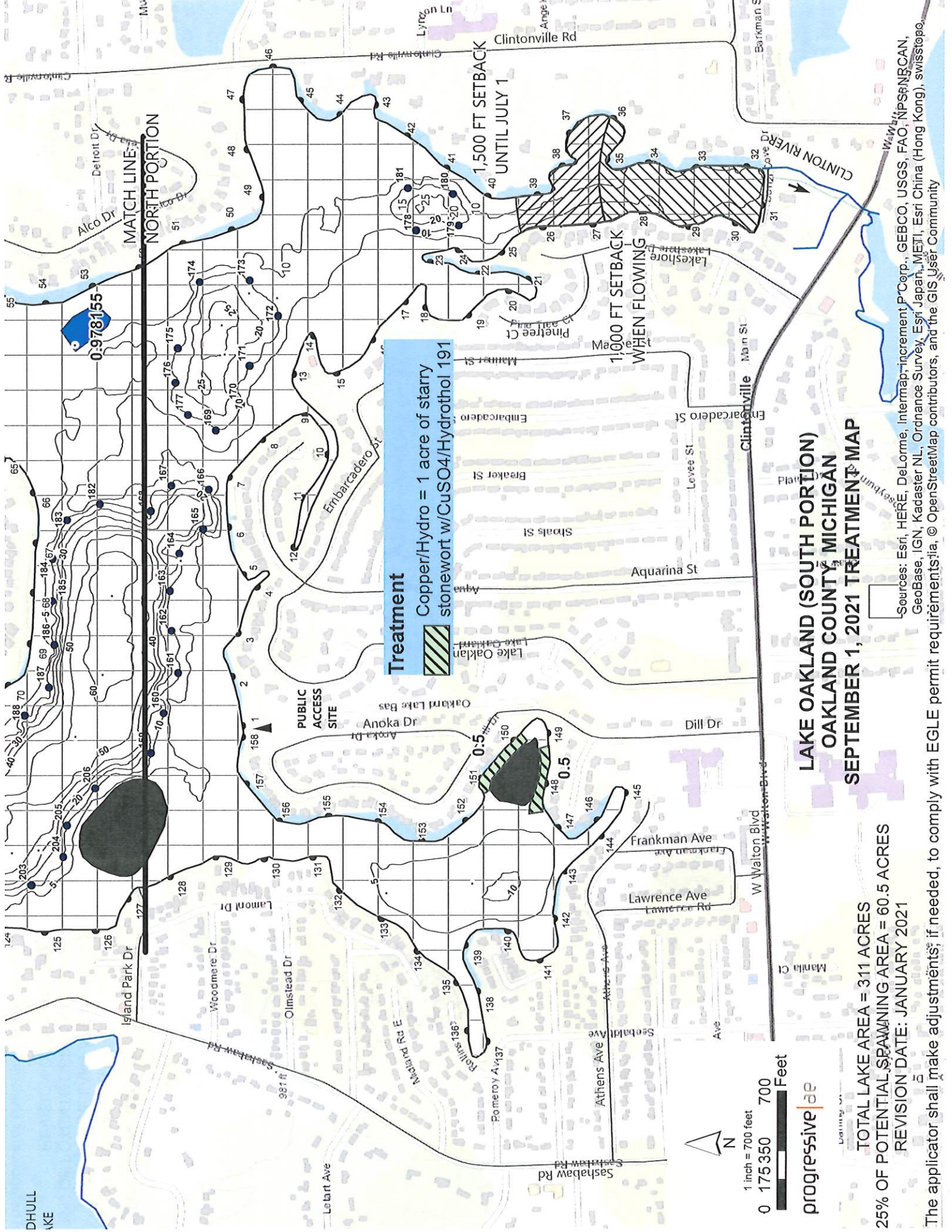
Treatment Date	Type	Target Species	Qty	Dose Rate	Cost	Remaining Balance
9/13/2021	2,4-D ester	Eurasian Milfoil	0.00 acre(s)	150.00 lbs/acre	\$0.00	\$4,135.30
9/13/2021	Macro-algae control: copper and monoamine salt of endoathal	Starry Stonewort	3.75 acre(s)		\$262.50	\$3,872.80
<b>Invoice 16594 Total</b>					<b>\$262.50</b>	<b>\$3,872.80</b>

9/13/2021 Survey PJH: AVAS



# Attachment 'D'





**LAKE OAKLAND (SOUTH PORTION)  
OAKLAND COUNTY, MICHIGAN  
SEPTEMBER 1, 2021 TREATMENT MAP**

TOTAL LAKE AREA = 311 ACRES  
25% OF POTENTIAL SPANNING AREA = 60.5 ACRES  
REVISION DATE: JANUARY 2021

The applicator shall make adjustments, if needed, to comply with EGLE permit requirements.

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, FAO, NPS, NRCAN, Geobase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, OpenStreetMap contributors, and the GIS User Community

progressive

# Attachment 'E'





# Attachment 'F'

Lake Oakland, Oakland County  
 Harvesting Bid Tabulation  
 Bid Date: October 4, 2021

<b>Bidder</b>	<b>Acres Native Plant Harvesting</b>	<b>Bid Price</b>	<b>Subtotal</b>	<b>Acres Starry Stonewort Harvesting</b>	<b>Bid Price</b>	<b>Subtotal</b>	<b>Total</b>
Savin Lake Services, Hale, MI	35	\$ 450	\$15,750	10	\$ 575	\$5,750	<b>\$21,500</b>
Mike's Clearwater Harvesting, Waterford, MI	35	\$ 500	\$17,500	10	\$ 600	\$6,000	<b>\$23,500</b>
Oakland Harvesters, White Lake, MI*	35	\$ 600	\$21,000	10	\$ 700	\$7,000	<b>\$28,000</b>
*Bid received after due date							



# Attachment 'G'



# Lake Oakland 2021 Water Quality Report

A publication of the Lake Oakland Improvement Board

## Lake Oakland Improvement Board

One Public Works Drive  
Building 95 West  
Waterford, MI

Rick Sabina, Chair  
*Lake Oakland Resident Representative*

George Nichols, Secretary  
*Water Resources Commissioner's Office Representative*

Kim Markee, Clerk  
*Waterford Township Representative*

Theresa Nallamotheu, Trustee  
*Independence Township Representative*

Karen Joliat  
*Oakland County Commissioner*

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*Environmental Consultant*  
Progressive AE

*Herbicide Applicator*  
Aqua-Weed Control

*Harvesting Contractor*  
Mike's Clearwater Harvesting

Water quality monitoring on Lake Oakland has been ongoing since 2018. This report provides background information on lake water quality and a discussion of sampling results.

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.

*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.

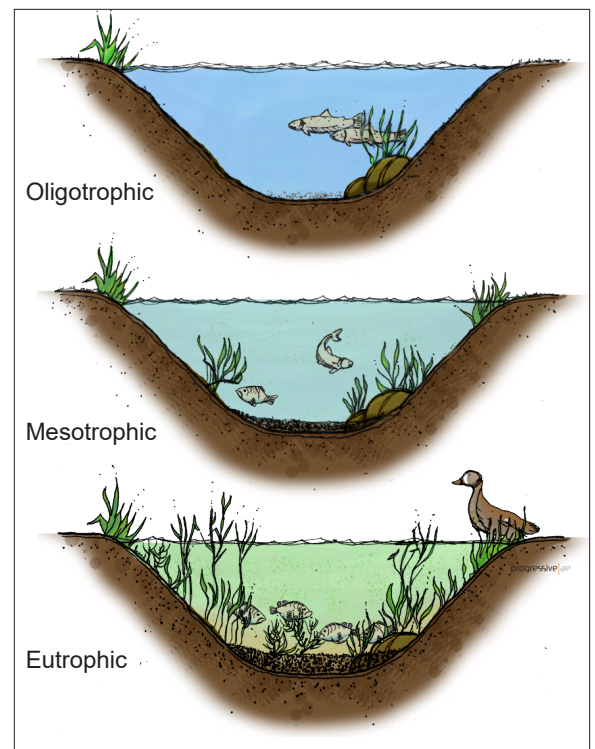
*Eutrophic* lakes have poor clarity, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike.

Lakes that fall between the two extremes of oligotrophic and eutrophic are called *mesotrophic* lakes.

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*.

For more information, visit:  
[www.michiganlakeinfo.com/trophic-state](http://www.michiganlakeinfo.com/trophic-state)



Lake trophic states.

# Trophic State Indicators

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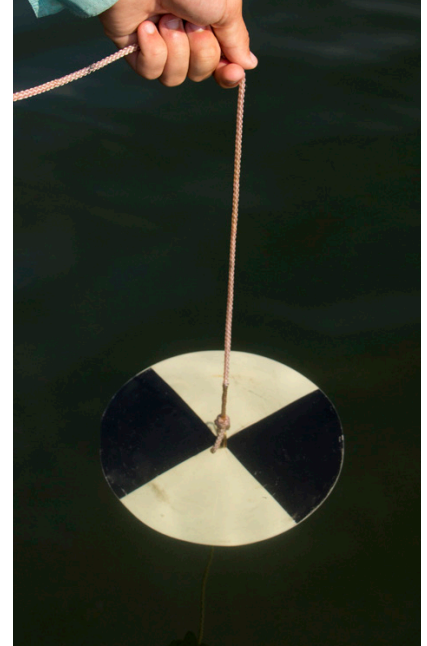
Key parameters used to evaluate a lake's productivity or trophic state include total phosphorus, chlorophyll-a, and Secchi transparency.

*Phosphorus* is the nutrient that most often stimulates excessive growth of aquatic plants and causes premature lake aging. By measuring phosphorus levels, it is possible to gauge the overall health of a lake.

*Chlorophyll-a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in the water column can be made by measuring the amount of chlorophyll-a in the water column.

A *Secchi disk* is a round, black and white, 8-inch disk that is used to estimate water clarity. Generally, it has been found that plants can grow to a depth of about twice the Secchi disk transparency.

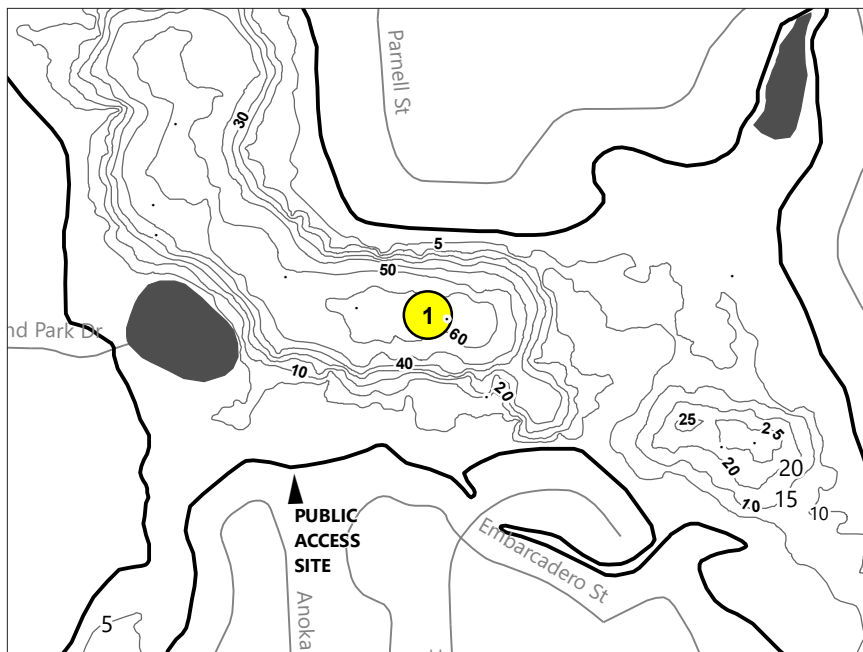
Generally, as phosphorus inputs to a lake increase, algae growth and chlorophyll-a increase and Secchi transparency decreases.



A Secchi disk measures water clarity.

## TROPHIC CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L) <sup>1</sup>	Chlorophyll-a (µg/L) <sup>1</sup>	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 2021, samples were collected during spring and summer at ten-foot intervals over the deepest basin on Lake Oakland.

<sup>1</sup> µg/L = micrograms per liter = parts per billion.

## Lake Oakland Trophic State

**Carlson's Trophic State Index (TSI)** was developed from mathematical relationships that allowed phosphorus, chlorophyll-a, and Secchi transparency readings to be converted to a numerical scale from 0 to 100, with increasing numbers indicating more productive lakes. The TSI can be used to rate the trophic state of Michigan lakes as follows:

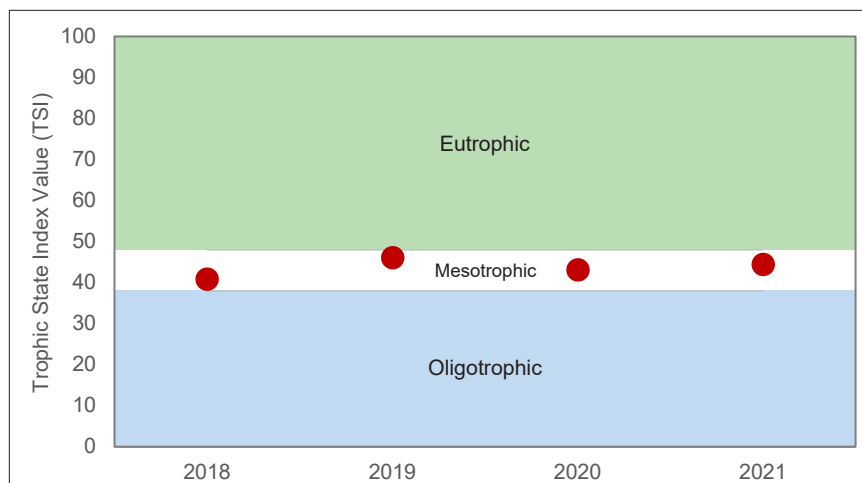
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### TSI INDEX FOR MICHIGAN

Trophic State	TSI Value
Oligotrophic	Less than 38
Mesotrophic	38 to 48
Eutrophic	Greater than 48

The average TSI values for Lake Oakland based on spring phosphorus and summer chlorophyll-a and Secchi transparency data collected between 2018 and 2021 are shown below.

Lake Oakland average Trophic State Index (TSI) values.



Based upon recent and historical water quality data, Lake Oakland is mesotrophic. A recent USGS study of Michigan lakes revealed that the majority of lakes in Michigan are mesotrophic.

## Temperature and Dissolved Oxygen

Temperature and dissolved oxygen strongly influence lake water quality and are very important to a lake's fishery.

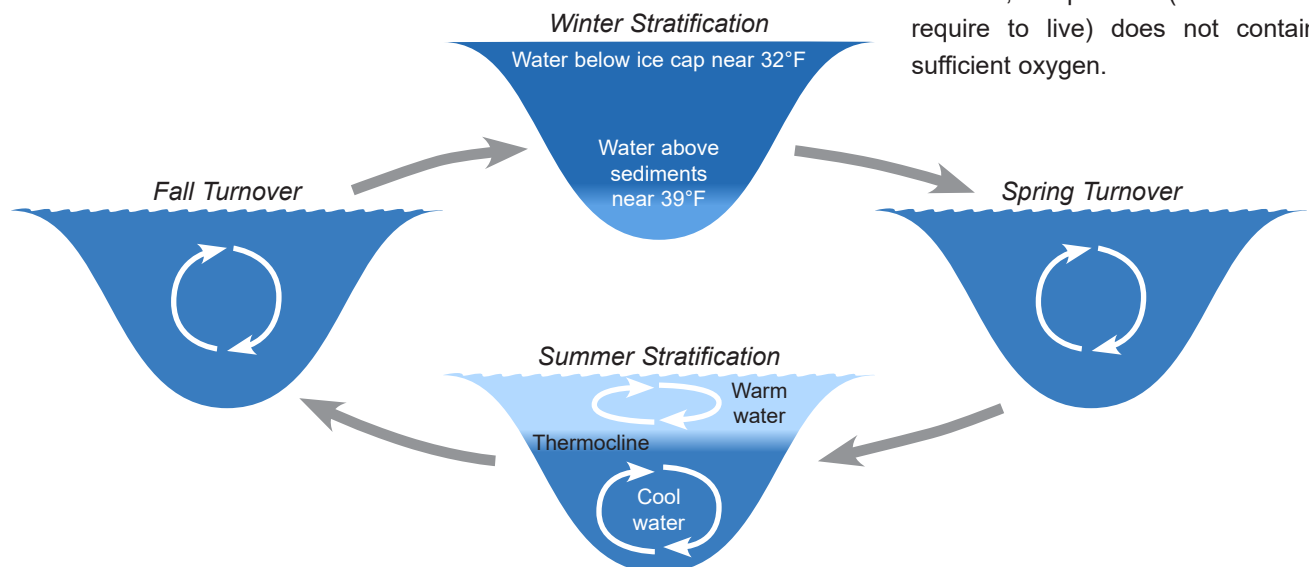
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### Temperature

**4** *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 layer of water. This process is called thermal stratification. In deeper lakes during summer there are three distinct layers. This is referred to as *summer 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. These stratification cycles occur in deep lakes but not in shallow lakes or ponds. Lakes that are about 15 to 30 feet deep may stratify and destratify with storm events several times during the year. Lake Oakland is relatively deep and exhibits strong thermal stratification.

### 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.



**Seasonal thermal stratification.** Stratification cycles occur in deep lakes but not in shallow lakes or ponds.