



HIGGINS LAKE WATER ANALYSIS

Report #5 Fifth year



SEPTEMBER 15, 2022

RAVEN ANALYTICAL
104 First Street

Higgins Lake Report

The Higgins Lake Property Owners Association (HLPOA) approached Raven Analytical Laboratory in Roscommon, Michigan in 2018 to provide water testing on Higgins Lake. This was to be a multi year evaluation of the chemistry of the Lake and any changes over time.

This testing began as a project in concert with the Roscommon high school chemistry students (teacher). Raven personnel trained students with all the procedures and testing protocols necessary to complete this study. The actual testing took place in our EPA certified laboratory under the direct supervision of our staff. In this way we help reinforce the chemistry the students are learning and make the community aware of the concern for the total ecology of Higgins Lake.

This report covers the third round of water testing on Higgins Lake on September 15, 2022. Also included is the testing results for May, June, July and August 2022 for comparison as well as the averages for September, 2019, 2020, 2021 and 2022.

Based on the data provided for testing from USGS suggestions and the concern(s) about the water quality on Higgins Lake, the following testing protocols are suggested.

Water Tests:

1. Phosphorus
 - a. Total phosphorus is reported in milligrams/liter (mg/L)
2. Nitrate
 - a. Nitrate is reported in milligrams/liter (mg/L)
3. Nitrite
 - a. Nitrite is reported in milligrams/liter (mg/L)
4. pH
 - a. pH is measured on a 1 to 14 scale with pure water being a pH of 7.0
5. Dissolved Oxygen
 - a. Dissolved oxygen is reported in milligrams/liter (mg/L)
6. Total dissolved solids (TDS)
 - a. measured in parts per million
7. Conductivity
 - a. Conductivity is reported in microsiemens per centimeter (uS/cm)
8. Water Temperature
 - a. Measured in degrees Centigrade
9. Air Temperature
 - a. Measured in degrees Centigrade
10. Beach Plate Count; MPN
 - a. Most probable number (MPN) is measured in colonies per 100 milliliters of cultured water
11. Beach Plate count: E-coli
 - a. E-coli is measured in colonies per 100 milliliters of cultured water

All water analysis was performed at Raven Analytical Laboratory in Roscommon using EPA approved test methods. This lab is an EPA certified water analysis laboratory (#9954) and has two certified water sanitarians on staff at Roscommon.

The listing of testing areas, such as high human concentration, lagoons, both state parks and boat launches along with the marinas and suggestions from the Team resulted in the following test sites:

1. Water quality tests were performed at:

	Site #		
Gerrish Township Marina	1	44.428433	-84.701303
South State Park	2	44.425523	-84.684881
Cut river	3	44.433023	-84.669963
Sam-O-Set	4	44.465303	-84.739635
DNR boat launch	5	44.477728	-84.778012
Gold Coast	6	44.466471	-84.767884
North State Park	7	44.511663	-84.758545
B&B Marina	8	44.511237	-84.742792
Camp Cornelia	9	44.496694	-84.699217
Treasure Island – 1	10	44.477461	-84.727788
Treasure Island – 2	11	44.482555	-84.722664
Kennedy Beach	12	44.457288	-84.670740
Flag Point	13	44.471165	-84.696090

Data collected:

Although there are no maximum limits on Phosphorus and nitrogen for pond and lake waters, as a reference, the EPA regulations for drinking water standards for these are 1 mg/L for Phosphorus and 10 ppm for nitrogen.

Swimming beaches should be tested for water quality before the swimming season begins—to get a baseline of contamination resulting from natural wildlife or run-off—and tested thereafter until the season ends. Beaches may be regulated by local ordinances or local health standards. The standards developed for the Great Lakes in Michigan and may be used for inland beaches are:

- If the E. coli count is greater than 1000 MPN/100 mL, the beach is closed.
- If the E. coli count is greater than 235 MPN/100 mL but less than 1000 MPN/100 mL, an advisory is issued.
- If the E. coli count is under 235 MPN/100 mL, the beach has no advisories or warnings issued.

The data collected from the thirteen sites in the fourth round of testing on May 11, 2022 is shown in Table 1 below.

Table 1

<u>Site</u>	11-May <u>Result</u>							
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Phosphorus	0.06	0.02	0.02	0.12	0.04	0.02	0.02	0.02
Nitrogen (Nitrate)	0.187	0.177	0.2	0.42	0.125	0.205	0.087	0.162
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	24	25	93	40	83	81	119	109
Beach Plate Count; e-coli	0	0	0	7	1	1	6	0
pH	7.17	7.01	7.29	7.6	7.08	7.19	7.1	7.09
Dissolved Oxygen	8.57	8.89	8.93	8.7	8.6	8.49	8.42	8.32
Total Dissolved Solids	202	203	203	204	139	131	131	135
Water Temperature; C	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
Air Temperature; C	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Conductivity; uS	267	256	258	328	276	341	244	260

	9	10	11	12	13
Phosphorus	0.05	0.02	0.02	0.01	0.02
Nitrogen (Nitrate)	0.224	0.14	0.275	0.153	0.088
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	113	135	133	127	105
Beach Plate Count; e-coli	0	0	0	0	4
pH	7.08	7.3	7.23	7.22	7.19
Dissolved Oxygen	8.52	8.36	8.27	9.19	8.57
Total Dissolved Solids	138	120	121	147	129
Water Temperature; C	9.8	9.8	9.8	9.8	9.8
Air Temperature; C	14.4	14.4	14.4	14.4	14.4
Conductivity; uS	275	284	274	296	259

Note, there were excessively high winds, thunder storm and wave action on the date collected and tested.

Table 2

	16-Jun Result							
<u>Site</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Phosphorus	0.04	0.02	0.03	0.04	0.02	0.02	0.01	0.03
Nitrogen (Nitrate)	0.3	0.7	0.4	0.7	0.5	0.6	0.4	0.4
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	158	120	126	152	114	138	150	120
Beach Plate Count; e-coli	6.2	7.5	5.2	41	6.3	0	4.1	1
pH	6.84	6.98	6.86	6.34	6.87	6.92	6.88	7.05
Dissolved Oxygen	6.54	6.41	6.41	6.53	6.37	6.35	6.37	6.42
Total Dissolved Solids	157	142	131	130	136	133	130	129
Water Temperature; C	18.8	18.8	18.8	18.8	18.8	18.8	18.8	19.3
Air Temperature; C	18.8	18.8	18.8	18.8	20.5	20.5	20.5	22.2
Conductivity; uS	314	272	262	261	272	265	259	256

<u>Site</u>	9	10	11	12	13
Phosphorus	0.21	0.02	0.01	0.01	0.01
Nitrogen (Nitrate)	0.5	0.5	0.5	0.9	0.6
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	40	46	126	144	158
Beach Plate Count; e-coli	3.1	2	2	4.1	8.6
pH	7.03	7.04	6.9	6.94	6.96
Dissolved Oxygen	6.02	6.3	6.44	6.97	7.05
Total Dissolved Solids	129	134	128	131	132
Water Temperature; C	19.3	19.3	19.3	19.3	19.3
Air Temperature; C	22.2	22.2	22.2	22.2	22.2
Conductivity; uS	256	267	256	261	263

Table 3

16-Jul

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.05	0.06	0.05	0.03	0.03	0.04	0.04
Nitrogen (Nitrate)	1.1	0.4	0.3	0.8	0.4	0.3	0.4
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	629	456	416	549	721	574	416
Beach Plate Count; e-coli	20	23	43	29	23	27	41
pH	6.96	6.9	6.91	6.88	6.84	6.31	7.03
Dissolved Oxygen	7.16	6.62	5.96	6.02	5.77	5.99	5.74
Total Dissolved Solids	140	139	137	137	135	137	136
Water Temperature; C	20.9	20.9	20.9	20.9	20.9	20.8	20.8
Air Temperature; C	20	20	20	20	20	22.2	22.2
Conductivity; uS	278	277	273	273	270	274	272

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.01	0.06	0.06	0.02	0.02	0.01
Nitrogen (Nitrate)	0.4	0.4	0.6	0.4	0.6	0.5
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	721	658	344	285	344	689
Beach Plate Count; e-coli	37	16	38	41	44	38
pH	6.92	6.94	6.92	6.88	6.89	7.02
Dissolved Oxygen	5.93	5.76	6.02	5.96	5.68	6.16
Total Dissolved Solids	134	134	138	136	137	136
Water Temperature; C	20.8	20.8	20.8	20.8	20.8	20.8
Air Temperature; C	22.2	22.2	22.2	22.2	22.2	22.2
Conductivity; uS	268	267	274	271	373	272

Table 4

August 15,2022

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.05	0.04	1.1	1.4	0.03	0.03	0.06
Nitrogen (Nitrate)	0.7	0.6	0.3	0.8	0.4	0.3	0.4
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	792	755	870	755	792	721	689
Beach Plate Count; e-coli	9.7	11	16.9	23.1	2	3.1	0
pH	6.33	6.98	6.98	7.14	7.22	7.54	6.5
Dissolved Oxygen	5.68	5.77	6.01	6.07	6.84	6.37	6.15
Total Dissolved Solids	140	139	139	137	135	132	136
Water Temperature; C	20.9	20.9	20.9	21	21	21	21
Air Temperature; C	16.1	16.1	16.1	16.1	16.1	16.1	20.6
Conductivity; uS	272	277	275	273	273	274	268

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.01	0.06	0.03	0.02	0.01	0.05
Nitrogen (Nitrate)	0.4	0.4	0.8	0.5	0.6	0.4
Nitrogen (Nitrite)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Beach Plate Count; MPN	601	575	574	689	689	658
Beach Plate Count; e-coli	1	2	1	2	2	1
pH	7.07	7.15	7.29	7.36	7.35	7.23
Dissolved Oxygen	6.45	6.63	6.47	6.47	6.64	6.66
Total Dissolved Solids	134	136	138	136	138	136
Water Temperature; C	21	21	21.3	21.3	21.3	21.3
Air Temperature; C	20.6	20.6	21.6	21.6	21.6	21.6
Conductivity; uS	268	262	274	274	373	271

September 15,2022

<u>Site</u>	1	2	3	4	5	6	7
Phosphorus	0.02	0.275	0.2	0.38	0.44	0.15	0.11
Nitrogen (Nitrate)	0.4	0.4	0.4	0.4	0.4	0.5	0.5
Nitrogen (Nitrite)	0.002	0.003	0.001	0.003	0.002	0.002	0.003
Beach Plate Count; MPN	179	398	344	344	344	399	457
Beach Plate Count; e-coli	1	49	44	36	61	2	48
pH	7.34	7.29	7.44	7.41	7.52	7.44	7.43
Dissolved Oxygen	5.66	5.3	5.97	5.99	5.65	5.65	6.14
Total Dissolved Solids	128	132	133	134	134	132	134
Water Temperature; C	19.3	19.3	19.3	19.3	19.3	19.3	19.6
Air Temperature; C	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Conductivity; uS	255	264	263	267	263	263	266

<u>Site</u>	8	9	10	11	12	13
Phosphorus	0.17	0.43	0.13	0.14	0.26	0.11
Nitrogen (Nitrate)	0.5	0.6	0.6	0.6	0.6	0.7
Nitrogen (Nitrite)	0.002	0.003	0.004	0.001	0.005	0.005
Beach Plate Count; MPN	313	160	231	201	201	165
Beach Plate Count; e-coli	50	1	3	8	2	0
pH	7.54	7.46	7.44	7.46	7	7.58
Dissolved Oxygen	6.92	6.92	6.6	7.04	6.96	6.16
Total Dissolved Solids	135	131	132	133	133	131
Water Temperature; C	19.6	19.6	19.6	19.9	19.9	19.9
Air Temperature; C	14.4	16.1	16.1	16.1	16.1	16.1
Conductivity; uS	267	261	263	265	265	262

Phosphorus
Nitrogen (Nitrate)
Nitrogen (Nitrite)
Beach Plate Count; MPN
Beach Plate Count; e-coli
pH
Dissolved Oxygen
Total Dissolved Solids
Water Temperature; C
Air Temperature; C
Conductivity; uS

9/17/2019	9/27/2020	9/27/2021	9/27/2022
Avg	Avg	Avg	avg
0.17	0.04	0.07	0.21
0.03	N.D.	N.D.	0.5
0	N.D.	N.D.	0.004
279	566	1011	287
5.4	73	50.8	23
9.23	8.46	7.03	7.41
4.75	2.42	7.76	6.23
135.6	146	125	132
16.8	5.6	16.1	19.6
14	4.5	50	15.1
289	290	249	263

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