KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

Technical Memorandum

To:	Rex Vaughn, Chairperson Cedar Lake Improvement Board	**Date:**	November 18, 2025
From:	Mark Kieser, Senior Scientist Kieser & Associates, LLC	**cc:**	Project Files www.cedarlakewmp.net
RE:	Cedar Lake Nearshore and Tributary Monitoring to Assess Possible Phosphorus Sources Stimulating Nuisance Algal Growths Near Jones Ditch		

Background

Over the past two years of K&A aquatic vegetation monitoring on Cedar Lake, recurrent and persistent heavy growths of *Chara* (a calcareous macroalga species) and filamentous green algae have been observed in front of shoreline residences at K&A's LakeScan™ Aquatic Resource Observation Site (AROS) 358 (see Figure 1). This location lies just south of Jones Ditch along the northwestern shoreline of Cedar Lake. Dense growths of macrophytes are consistently noted at the mouth of, and just north of Jones Ditch at AROS 357 (see also Figure 1), though rarely at the level of filamentous green algae and *Chara* noted to the south of Jones Ditch. Aquatic applicator 2024 treatments in the vicinity of AROS 357 and 358 (Figure 2) did not appear to suppress these growths through last year's growing season. These growths remained heavy through the 2025 recreational season at nuisance levels. Soluble phosphorus was suspected to be driving the luxuriant levels of algae growth at AROS 358.

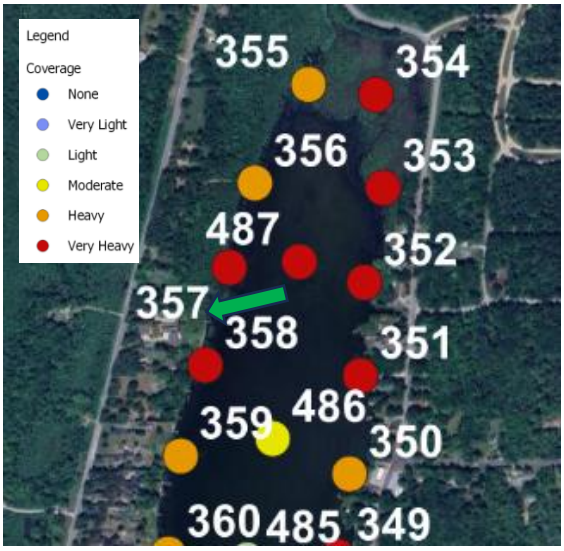

Figure 1. Aquatic Resource Observation Sites (AROS) map of the northern section of Cedar Lake with 3-D Density of aquatic macrophytes from August 27, 2025 LakeScan™ survey. Notable are densities in the vicinity of Jones Ditch (Green Arrow indicates mouth of Jones Ditch to the lake). AROS 357 begins at the mouth of the ditch extending northward; 358 starts just south of Jones Ditch.

Figure 2 – Excerpted Figure B3 – Solitude Lake Management treatment map for Cedar Lake, Alcona and Iosco counties, on June 18, 2024 (appearing in K&A's February 24, 2024 Final LakeScan™ Report for Cedar Lake North) highlighting (in red) treatment in the areas of AROS 357 and 358.[1]

The level of growth (using density and coverage LakeScan™ metrics) in this nearshore area was the highest in not only the northern portion of Cedar Lake, but across the entire northern and southern portions of the lake in 2025. This appears to now be a persistent condition at AROS 358. Conversations with adjacent shoreline homeowners in the late summer of 2025 by the Cedar Lake Improvement Board (CLIB) chairperson Rex Vaughn, for example, suggested that besides being so shallow, heavy nearshore weed growth dissuaded homeowners from accessing the lake for swimming, or even placement of docks. At this location, the two residential properties situated just south of Jones Ditch have septic systems that appear to be less than 20 years old. One of these appears to have replaced an older system. In anticipation of planned CLIB ditch restoration efforts in 2025 to 2026, Jones Ditch phosphorus sampling was conducted in 2024 revealing relatively low concentrations.

The persistent algal growth conditions at AROS 358 led to a K&A recommendation for sampling of phosphorus in the vicinity of these growths to assess whether there was a possible onshore source of this nutrient that could be stimulating excessive algal growth in these nearshore areas. With no chemical treatments prescribed for this area in 2025, select water quality monitoring was therefore alternatively performed just offshore of these residential locations in July of 2025. Results suggested the possibility of such a source. A broader sampling plan was subsequently recommended and implemented in late August.

Results of the more comprehensive sampling in August are reported herein. Results from both sets of 2025 sampling are examined in the context of potential phosphorus sources to this area of the lake, as well as concerns associated with both the presence and sources of detected bacteria

[1] See page B2 at: https://img1.wsimg.com/blobby/go/a080ee0a-11db-41bd-8830-a064f9457faa/downloads/aac88fda-e8ba-4f6e-8d99-9443775dd39d/K%26A%20Cedar%20Lake%20North%20Final%20Report%202024%202-25-25.pdf?ver=1756395098969

in water quality monitoring. Conclusions and next steps follow a discussion of findings in this report.

2025 Water Quality Monitoring

July Preliminary Survey

A preliminary and very limited initial July 2, 2025 sampling was conducted at two locations in nearshore waters of AROS 358. Given the suspicion of possible septic system inputs in this locale, K&A collected samples for phosphorus and bacteria. The latter were processed using a field-screening test kit method to serve as an indicator of possible presence of *E. coli*, a gut-tract fecal coliform bacterium associated with waste from humans, mammals and some avian species. Field screening suggested the presence of *E. coli* and elevated levels of Total Coliform bacteria in July 2025 sampling.[2] (See Attachment A for the preliminary report on bacteria field screening results, photo observations of nearshore plant growths and preliminary data interpretations--SRP results were unavailable at the time of that reporting).

In contrast to the July field-screening bacterial observations, *E. coli* sampling at the Greenbush Township Park on Cedar Lake (conducted by the District Health Department No. 2 since 2006) reveals results typically at very low levels less than 10 MPN/100ml.[3] (Notable, however, were some of the highest levels recorded by the Health Department on July 17, 2025 at this park with levels ranging from 82-105 MPN/100ml across four samples.) State standards suggest safe levels of exposure to *E. coli* are less than 300 CFU/100ml.[4] July 2025 bacteria screening results by K&A at AROS 358 suggested the presence of *E. coli* along with total coliform bacteria levels above 1,000 MPN/100ml.[5] These screening results therefore suggested the potential presence of human or animal organic waste in the two nearshore July samples from the northwestern shoreline. Septic system discharges were suspected and/or possible inputs from Jones Ditch.

As such, the CLIB board chairperson contacted the local home owners just south of Jones Ditch to inform them of preliminary screening results. Phone and in-person communications relayed the potential concerns with the suspected *E. coli* presence in shallow water in front of their homes. Homeowners expressed that they did not typically swim in the lake, nor did they allow

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[2] Total Coliform is a broad group of bacteria found in the environment. *E. coli* is a specific type of coliform that is a strong indicator of recent fecal contamination. The presence of total coliform in surface waters may not be an immediate health concern, but its presence with *E. coli* suggests the presence of sewage and potential human health risks with the possible presence of harmful pathogens that can be found in human waste.

[3] See: https://www.egle.state.mi.us/beach/BeachDetail.aspx?BeachID=2456

[4] Part 31 of the Natural Resources and Environmental Protection Act, 1997 PA 451, as amended; R 323.1062(1) states: "All waters of the state protected for total body contact recreation shall not contain more than 130 E. coli per 100 ml, as a 30-day geometric mean...[or] contain more than a maximum of 300 E. coli per 100 ml."
State of Michigan. (1994). "Natural Resources and Environmental Protection Act 451 of 1994. Accessible online: <http://www.legislature.mi.gov/documents/mcl/pdf/mcl-act-451-of-1994.pdf>.

[5] MPN, or Most Probable Number is considered a screening level metric for Aquagenix samples, though this unit of measure is generally consistent with lab analyses that report *E. coli* as CFU, or Colony Forming Units/100 ml; Health Department #2 reports their results as MPN/100ml.

their pets to swim there either. They expressed full cooperation and agreed that the Board Chair and K&A should contact the District Health Department No. 2 about the preliminary bacterial screening findings.

Subsequent communications with District staff revealed an expressed caution on the meaning of screening results. Further communications with EGLE also stressed caution on the weight of evidence from preliminary sampling. Background research by the District on septic system ages at these locations, site visits and direct conversations with homeowners tended to lead discussions towards other possible sources such as water fowl. Requests for local District and/or state confirmatory sampling for bacterial presence in these nearshore areas were not accommodated. Consistent with reported preliminary findings in Attachment A, EGLE suggested additional sampling with water samples analyzed by a health department or commercial lab for bacteria in addition to phosphorus. No funding assistance was offered by the state in these regards.

Phosphorus data from July 2025, reported subsequent to bacterial screening results, also revealed relatively elevated levels of total phosphorus (TP) at 20 to 25 parts per billion (ppb) accompanied by soluble reactive phosphorus (SRP) levels at 4 to 7 ppb. (This is an update from previously reported information).[6] (See Attachment B for a copy of the Great Lakes Environmental Center—GLEC lab report.) In contrast, voluntary monitoring data collected annually by Cedar Lake volunteers under the Clean Lakes Monitoring Program since 2002, reveal that TP data at Schmidt's Point largely been less than 14 *u*g/L (with a May 2024 exception at 25 *u*g/L)[7] further revealing that July 2025 TP results were elevated.

SRP is the soluble form of total phosphorus that is immediately available to stimulate algal growth when present in the water column. Phosphorus in lake sediments is what drives growth of rooted vascular plants (i.e., macrophytes). Notably, July 2025 nearshore TP data were well above historic lake data, and slightly higher than limited water sampling conducted in July 2024 on Jones Ditch in areas between West Cedar Lake Road and the lakeshore (i.e., 2024 Jones Ditch TP levels of 18 to 20 *u*g/L; 5 to 7 *u*g/L for SRP).[8] July 2025 nearshore SRP concentrations were also

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[6] K&A originally relayed these TP levels to CLIB chairperson, Rex Vaughn by email, inadvertently citing these as SRP results from the July sampling. Incorrect SRP numbers supplied by K&A, were subsequently relayed to the District Health Department on July 18 by Rex Vaughn, which in turn, forwarded these to EGLE. Reporting herein presents actual SRP numbers; the formal lab report for both TP and SRP results from GLEC is included in Attachment B.

[7] CEDAR LAKE (Alcona/Iosco Counties, MI), WATERSHED MANAGEMENT PLAN 2025 Update (FINAL DRAFT for EGLE Review). August 26, 2025, Figure 2-8, page 25. See: https://img1.wsimg.com/blobby/go/a080ee0a-11db-41bd-8830-a064f9457faa/downloads/601aae28-b678-4f86-9e8f-3efb45870ccb/FINAL%20DRAFT%20Cedar%20Lake%20WMP%20for%20EGLE%20Review%208-2.pdf?ver=1756395098926

[8] CEDAR LAKE (Alcona/Iosco Counties, MI), WATERSHED MANAGEMENT PLAN 2025 Update (FINAL DRAFT for EGLE Review). August 26, 2025, page 61. See: https://img1.wsimg.com/blobby/go/a080ee0a-11db-41bd-8830-a064f9457faa/downloads/601aae28-b678-4f86-9e8f-3efb45870ccb/FINAL%20DRAFT%20Cedar%20Lake%20WMP%20for%20EGLE%20Review%208-2.pdf?ver=1756395098926

elevated above expected in-lake levels that are typically found at levels </= 1.5 *u*g/L. Levels above 1.5 *u*g/L are known to stimulate algal growth.

August Expanded Sampling

Based on preliminary findings from the limited July 2025 lake sampling event, subsequent collection of multiple samples for phosphorus and bacteria across the area was deemed appropriate. This focused on a more detailed characterization of site conditions that could be driving excessive algal and plant growth. Septic leachate, as well as native animal populations frequenting streams and wetlands of Jones Ditch, can also add bacteria to the lake. Thus, potential nearshore bacterial contamination also merited broader sampling of Jones Ditch and nearshore areas. Attachment C of this memorandum outlines the scope for this effort. Figure 3 shows locations that were proposed for this extended sampling in relation to the surrounding AROS.

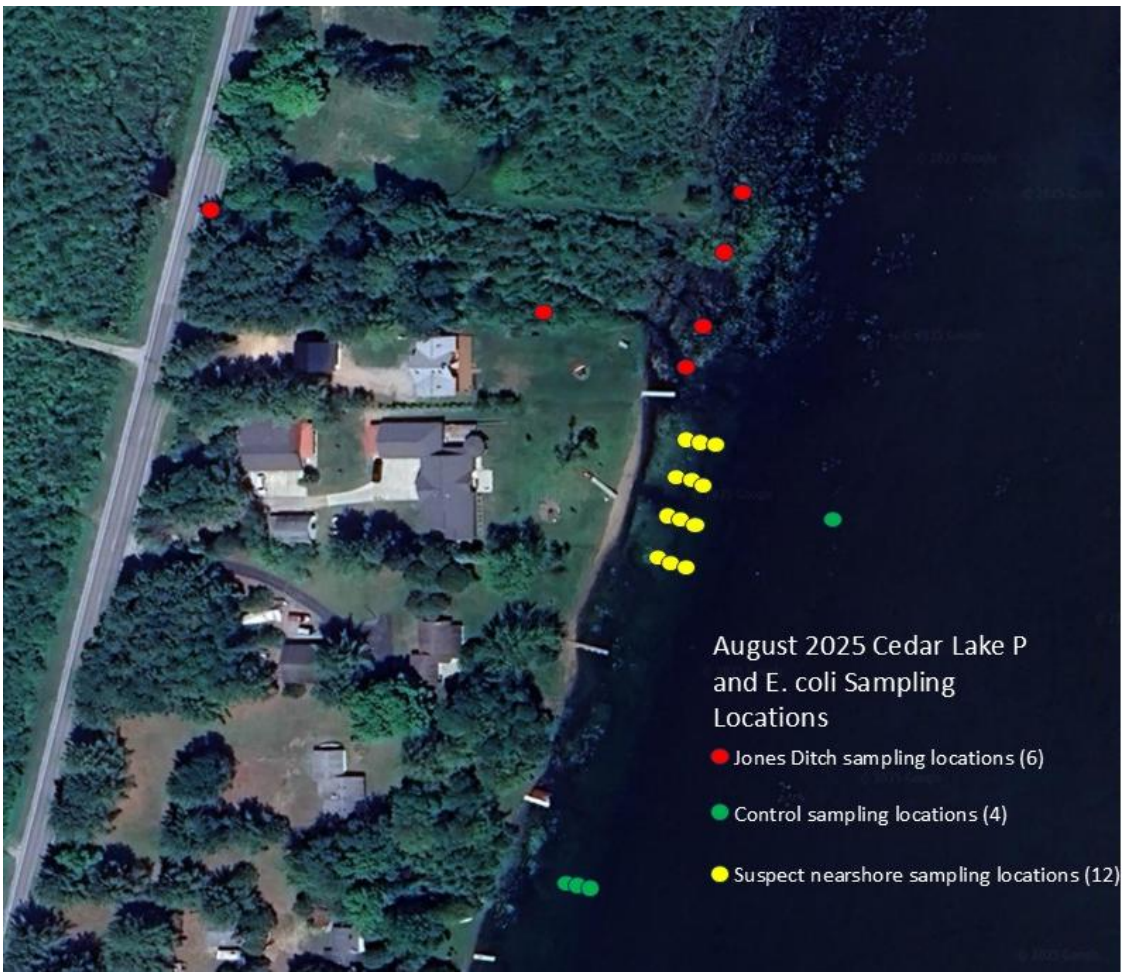

Figure 3. Proposed water quality sampling locations for August 2025 sampling.

Sampling locations were selected to target: 1) Jones Ditch and areas along the shoreline from the mouth of the Ditch extending to the north (AROS 357); 2) four nearshore transect locations (with

three samples each) starting near the water's edge extending lakeward from the shoreline area with suspect septic system discharges and heavy algal growth (AROS 358), and; 3) two locations serving as controls (three nearshore samples south of the suspect septic system discharge area—AROS 359, and one approximately 150 feet from the shoreline at AROS 358).

Nearshore and Jones Ditch water quality samples were retrieved by K&A staff from the shoreline by extending either a 6 or 12-foot length sampling rod to the point of sample collection. Clean 500 ml polypropylene sampling bottles were used for each location for sample collection. Shoreline samples for Transects 1-4 at the water's edge ("0 feet") and at "15 feet" from the shore were retrieved starting at the shoreline moving lakeward. The "30 feet" sample for Transects 1-4 was retrieved by boat due to heavy muck conditions precluding wading access. Transect 1 samples were collected from an existing dock. Samples in front of Jones Ditch were collected by boat using the sampling rod with sampling locations each being approximately 15 feet from the shoreline (where the precise shoreline edge was largely obscured by nearshore emergent wetland vegetation).

At the southern nearshore control area, samples were retrieved by boat with lakeward to shoreward collection using the extended sampler rod. The open lake control was also collected from the boat. Extending the sampling rod to the point of collection avoided water, plant and sediment disturbance. GPS coordinates were collected from each location after sample collection.

From the 500 ml of collected sample, aliquots were transferred to smaller, clean sampling containers provided by the commercial labs. Approximately 25-40 ml of raw water sample were filtered at each location for SRP analysis using a 0.45µ filter. Approximately 100 ml of the collection container were placed in acidified sample containers for TP. Containers for each bacterial sample (filled from the 500 ml collection bottle) were immediately transported in a cooler on ice to the local lab is Oscoda for bacterial analysis. These followed processing procedures for state of Michigan protocols for *E. coli* and Total Coliform Bacteria collection and analysis. A chain-of-custody accompanied bacterial samples for lab delivery by Rex Vaughn of the CLIB shortly after K&A collection while K&A staff remained on-site to process remaining phosphorus samples.

Phosphorus samples were placed on ice in coolers following collection. SRP samples were frozen upon return to the K&A office in Kalamazoo on August 27th. Phosphorus sample delivery to GLEC labs by K&A was accompanied by a Chain-of-Custody form. Field data for dissolved oxygen (DO) and temperature were measured *in situ* with a YSI ProDO meter and probe at the open lake control station and select Jones Ditch locations. Conductivity and pH and were measured from remaining volumes in the original 500 ml containers for each sample in the field using field instrumentation.

August Survey Results

This section of the memorandum presents survey conditions and water quality monitoring results from the expanded sampling conducted concurrently with K&A's late-season LakeScan™ survey on August 27, 2025.

Survey Weather Conditions

Weather leading up to the time of the August 27, 2025 sampling was generally windy. Wind data were obtained from the Cedar Lake Tempest Weather Station website (with equipment situated on the northeast shoreline of Cedar Lake). Table 1 shows modest maximum wind speeds from the east several days prior to the August 27th nearshore sampling (i.e., August 18-21, 2025). East winds would tend to move open lake water into these northwestern shoreline areas mixing with nearshore waters. Generally higher maximum wind speeds with a westerly component were observed for at least four days (August 23-26) leading up to the sampling date. Such winds might tend to move water out of the sampled nearshore areas, though with a wind shadow effect from the shoreline, nearshore waters may have remained relatively undisturbed. This might tend to limit water circulation and mixing in the nearshore zone that was sampled.

During sampling conducted on August 27th, weather throughout the day was mostly sunny with temperatures around 70°F with gentle southwesterly winds around 5-10 mph. Water surfaces were generally calm during the time of nearshore sampling.

Table 1. Wind speeds and direction on Cedar Lake prior to and including August 27, 2025 water quality monitoring.

Date	Maximum Wind (mph)	Wind Direction
8/18/2025	6.2	E
8/19/2025	7	E
8/20/2025	7.9	ESE
8/21/2025	6.8	NE
8/22/2025	9.7	SW
8/23/2025	19.4	WSW
8/24/2025	17.6	W
8/25/2025	18.2	W
8/26/2025	16.6	WNW
8/27/2025	12.6	W

Vegetation Observations

From K&A's 2025 lake-wide vegetation surveys on Cedar Lake, observations of plant growths at and adjacent to the monitoring areas (using the LakeScan™ methodology) revealed the following (refer to Figure 1 for the locations cited):

Early-season Survey (July 2, 2025):

- 3D-density values (a function of observed vegetation coverage and their associated height in the water column) at AROS 358 during the July 2nd sampling event, were over double the values recorded immediately south at AROS 359 and nearly 5 times higher than lakeward observations at AROS 486. These observations indicated a high level of plant density in the area in comparison to surrounding observation areas.
- Coverage estimations at AROS 358 during the July 2nd sampling event were over double the values recorded immediately south at AROS 359 and nearly 5 times higher than lakeward observations at AROS 486. These observations indicated a high level of plant coverage in the area in comparison to surrounding observation areas.

Late-season Survey (August 27, 2025):

- 3D-density values at AROS 357 (at the mouth of Jones ditch) during the August 27th sampling event, were 65% greater than the values recorded at the control transect at AROS 359 to the south. These observations indicated a high level of plant density in the area in comparison to surrounding observation areas.
- Coverage estimations at AROS 357 during the August 27th sampling event were 7.5% greater than the values recorded at the control transect AROS 359. These observations indicated a high level of plant coverage in the area in comparison to surrounding observation areas.

Vegetation survey data tend to confirm that the luxuriant *Chara* growths observed off the shoreline residences at AROS 358 and heavy plant growth at AROS 357were substantially higher than other nearby and/or lake-wide observation areas. These suggest unique phosphorus loading conditions in this area of concern.

Jones Ditch Water Flows/Phosphorus Load

Jones Ditch flows measured by K&A with a Marsh-McBirney Model 5000 Flow Meter at the West Cedar Lake Road culvert were quite low, averaging 25 gallons/minute (or 0.056 cubic feet/second--cfs) on August 27, 2025. This is a typical, very low flow condition in Jones Ditch at this time of the summer. Spring flows in 2024, for example, ranged from about 5-35 cfs from March-June; where August flows ranged from 0-2.5 cfs last year.[9] Using flow and measured concentration of SRP at 4.4 *u*g/L on August 27, 2025 at the "Jones Bridge" sampling location, a daily load of 0.0014 lbs of SRP/day was calculated for the period of sampling.

[9] K&A, 2025. "Findings for 2024 Cedar Lake Groundwater/Surface Water Level Monitoring." Technical Memorandum from K&A to the Cedar Lake Improvement Board, April 4, 2025. (See Figure 26; https://img1.wsimg.com/blobby/go/a080ee0a-11db-41bd-8830-a064f9457faa/downloads/0ae7645d-b22c-455e-b9b0-b0cce513ac88/Final%20K%26A%202024%20Cedar%20Lake%20Hydrology%20Report%204-4.pdf?ver=1756395098605).

Water Quality Results

Water quality sample collection occurred at 22 stations for TP, SRP, *E. coli* and Total Coliform bacteria on August 27, 2025 in conjunction with the late-season LakeScan™ survey of aquatic vegetation across the lake. Phosphorus analyses were conducted by the Great Lakes Environmental Center (GLEC) in Traverse City, Michigan while bacterial samples were analyzed on the date of collection by Enviro Lab Services of Oscoda, MI. Table 2 summarizes all field data and lab results for water quality samples. Attachment D includes copies of all lab reports.

Discussion

This section focuses on the analysis Cedar Lake phosphorus and bacterial sampling results from the August 27th sampling. This sampling provided a much more comprehensive view of water quality conditions over those first observed with limited collection of two nearshore samples on July 2, 2025 in the nearshore area of heavy algal growths. Data from Table 2 are mapped in Figures 4-7 to project spatial conditions at the time of sampling. A discussion is provided accordingly for TP, SRP, *E. coli* and Total Coliform Bacteria. Additional statistical analyses for SRP data are provided in Attachment E, along with nearshore mass balance phosphorus modeling in Attachment F.

Total Phosphorus

Figure 4 portrays all TP data from the August sampling where they were collected. The inset is an enlargement of results specific to the suspect shoreline area. The highest TP concentration noted was the open lake control at 40.8 *u*g/L. This was not expected, and contrasts with typically low TP levels cited earlier from Cedar Lake CLMP sampling at 14 *u*g/L. A cluster of higher TP concentrations appears at Jones Ditch, around the mouth of the ditch and to the north. Nearshore suspect areas to the immediate south of the ditch were generally lower than levels around the ditch. The southern nearshore control area had TP concentrations similar to the range noted in the nearshore suspect area.

Notable along residential shoreline areas was the localized variability in TP concentrations compared to those around the ditch that were quite consistent. This initially suggests that Jones ditch flows could be creating ubiquitous conditions where it enters the lake amidst rooted macrophytes dominating the shoreline, at least during the time of August sampling.

Table 2. Field and laboratory results for August 27, 2025 water quality monitoring.

Location	Feet from Shoreline	Label	In-field						Enviro Lab Services		GLEC		SRP:TP Ratio
			Latitude	Longitude	DO *mg/L*	Temp *°C*	pH *sU*	Conductivity *µS/cm*	E. Coli *CFU/100 mL*	Total Coliform *CFU/100 mL*	TP µg/L	SRP µg/L	
Jones	--	Jones Culvert Upstream	44.55946707	-83.32935484	8.35	11.1	8.02	474	40	3,440	31.2	7.7	25%
	--	Jones Bridge	44.55939846	-83.32846465	9.06	12.1	7.95	451	40	4,460	39.2	4.5	11%
	--	Jones Confluence	44.55933705	-83.32760656	--	--	7.61	366	60	5,080	33.2	4	12%
	15	Jones North Wetland 1	44.55988129	-83.32741425	--	--	7.99	257	220	9,000	34.8	3.7	11%
	15	Jones North Wetland 2	44.55957636	-83.32746029	--	--	8	250	180	9,020	35.4	2.8	8%
	15	Jones South Wetland	44.55916599	-83.32763662	--	--	7.72	446	380	6,560	33.5	6.8	20%
Suspect Nearshore	0	Transect 1 - Shoreline	44.55903782	-83.32774866	--	--	8.03	256	40	8,100	22.5	3.2	14%
	15	Transect 1 - 15 ft	44.55903825	-83.32769076	--	--	8.64	236	20	3,580	23.4	3.6	15%
	30	Transect 1 - 30 ft	44.55903524	-83.32763166	--	--	8.03	267	200	6,240	21.6	3.6	17%
	0	Transect 2 - Shoreline	44.55892588	-83.32774711	--	--	8.45	241	-	2,440	21.3	3.1	15%
	15	Transect 2 - 15 ft	44.55892261	-83.32769234	--	--	8.37	252	-	2,600	28.2	2.7	10%
	30	Transect 2 - 30 ft	44.558919	-83.32763583	--	--	8.27	246	100	4,120	17.9	2.9	16%
	0	Transect 3 - Shoreline	44.55881732	-83.3277693	--	--	8.29	246	-	4,240	22.7	2.1	9%
	15	Transect 3 - 15 ft	44.55881527	-83.32771771	--	--	8.39	245	20	1,960	23	2.6	11%
	30	Transect 3 - 30 ft	44.55880172	-83.3276644	--	--	8.46	242	20	2,640	33.3	2.7	8%
	0	Transect 4 - Shoreline	44.55869758	-83.32781195	--	--	8.49	251	60	3,800	19.6	1.8	9%
	15	Transect 4 - 15 ft	44.55869184	-83.32775357	--	--	8.48	240	20	3,680	19.6	1.6	8%
	30	Transect 4 - 30 ft	44.55868295	-83.3276964	--	--	8.5	243	20	1,280	34.6	3.3	10%
Control	0	Control - Shoreline	44.55763041	-83.32832171	--	--	8.8	239	60	2,360	32.7	1.7	5%
	15	Control - 15 ft	44.557615	-83.32825215	--	--	8.47	234	60	2,160	26.5	1.6	6%
	30	Control - 30 ft	44.55760622	-83.32819592	--	--	8.44	235	60	2,220	20.3	2	10%
	150	Control - In Lake	44.55863641	-83.32723883	9.59	17.6	8.56	255	40	1,220	40.8	3.4	8%

This ubiquitous distribution of TP is not noted along residential shorelines. In the suspect area with dense algal growth, sampling within the matrix of *Chara* and filamentous green algae may be a reason for varying concentrations ranging from 17.9-34.6 *u*g/L over this small area. Shorelines with limited algal or plant growth will tend to have similar levels where there is no localized source of phosphorus and circulation evenly mixes ambient lake water. Those with dense growths observed along the suspect shoreline area, may impede nearshore circulation. Add possible localized phosphorus sources (Jones Ditch and/or septic systems), such variation in TP concentrations over a limited area might not be unexpected. There is no decisive explanation of higher TP concentrations near the shoreline of the southern control location, diminishing as these move lakeward, other than a possible onshore localized source.

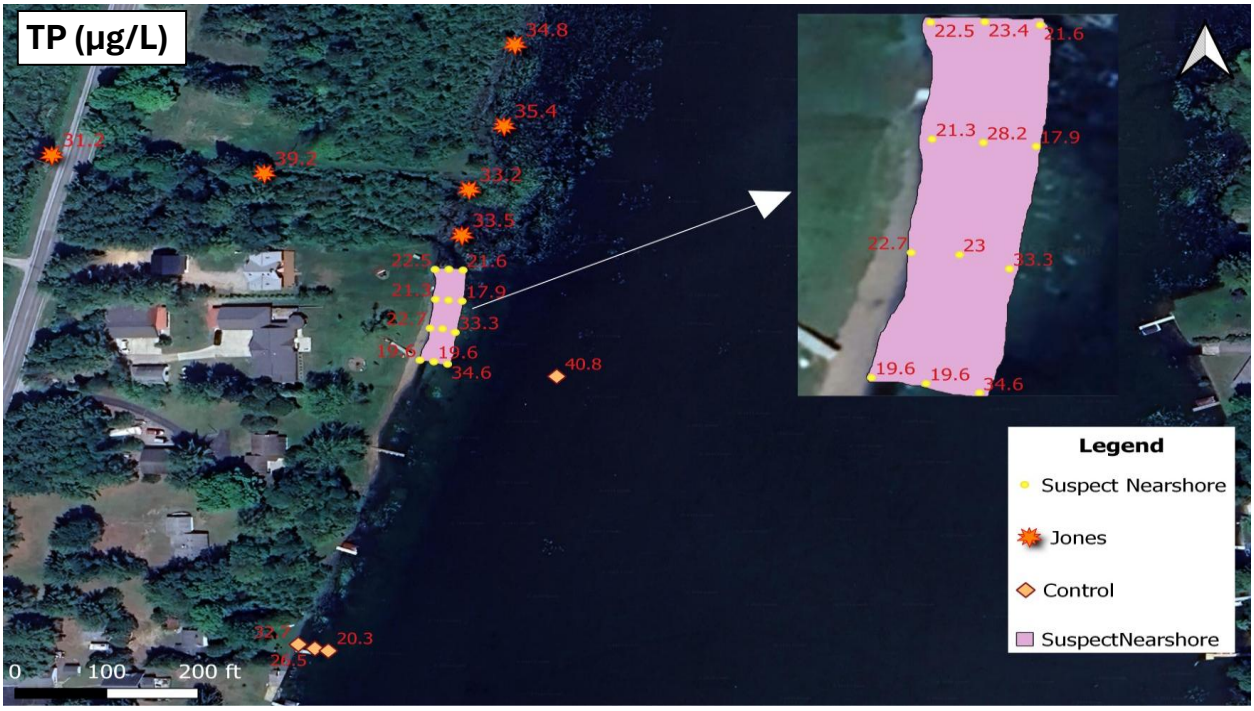

Figure 4. Total Phosphorus results by sampling station for the August 27, 2025 monitoring.

Soluble Reactive Phosphorus

Figure 5 displays SRP concentrations from the August 2025 sampling. Soluble phosphorus (measured as SRP) and particulate phosphorus are the predominant forms of this nutrient measured by a TP analysis. In unproductive ('clean') lakes, the soluble fraction of P is often very low to non-detectable as it is readily taken up by phytoplankton and algae for their growth. These low levels of soluble phosphorus often make it the 'limiting nutrient' for plant and algal growth. Where soluble phosphorus is elevated, it can especially stimulate nuisance algal growth. Its elevated presence in a lake suggests an external (streams, septic systems) or internal (sediment) source. As such, analysis of possible SRP sources is of primary concern.

Levels present in nearshore areas noted in Figure 5 suggest a local source, especially in and around Jones Ditch, as well as possibly the suspect shoreline area. Some of the lowest levels

observed on August 27th were found at the southern nearshore control location. Within the suspect nearshore area, averaged SRP results by transect suggest higher average concentrations in closest proximity to Jones Ditch which decrease moving to the south.

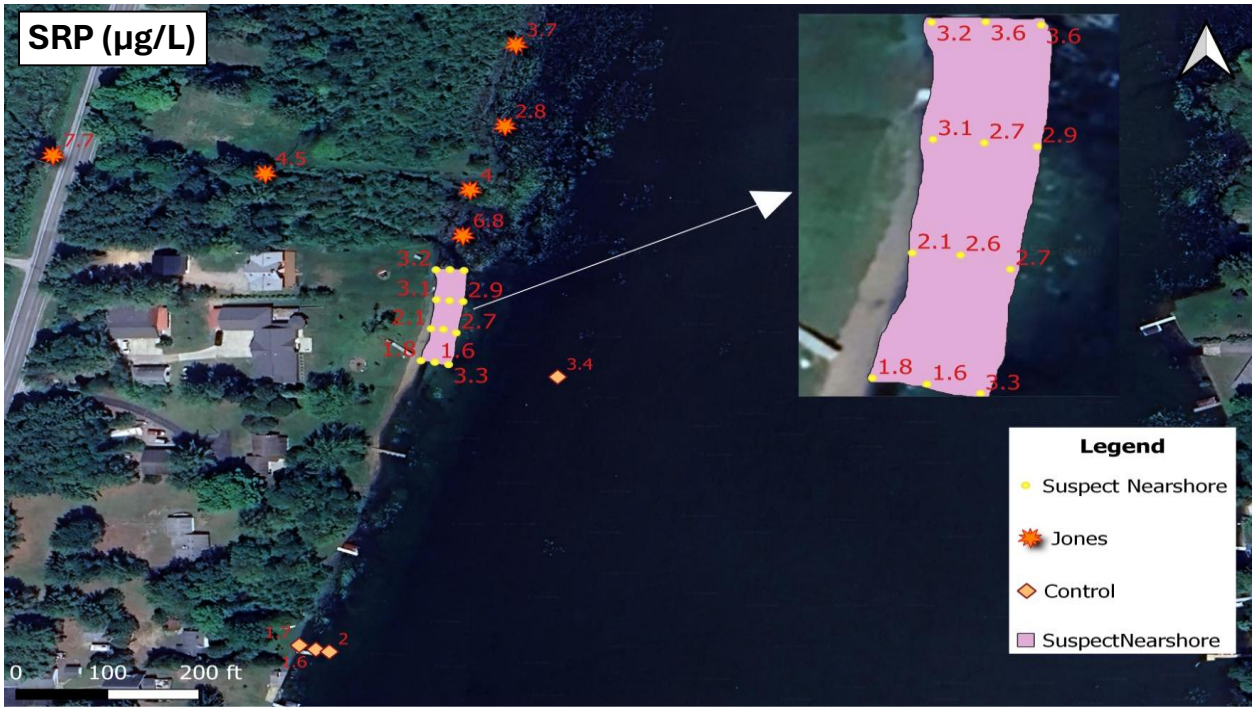

Figure 5. Soluble Reactive Phosphorus results by sampling station for the August 27, 2025 monitoring.

Included in Table 2 were SRP to TP ratios. The higher this ratio is in surface waters, the greater potential there is for a specific SRP source (e.g., human or animal waste). On average, this ratio was highest for Jones Ditch samples (15%), followed by an average of 12% for suspect nearshore areas and 7% for the average of all 4 control samples. Notably, filamentous algae and *Chara* in the suspect nearshore area will utilize dissolved phosphorus in the water column while established aquatic macrophytes that are more predominant off of Jones Ditch, will draw in phosphorus from sediments. These physiological conditions could affect these ratios as uptake of available SRP in the water column will be greater in the areas of algal growth. This effectively can lower localized SRP concentrations in the water column. This would have the effect of lowering the SRP/TP ratio in the suspect area, confounding the use of the ratio to assert the presence of a local soluble phosphorus source.

Statistical analyses of the SRP data were therefore performed to further assess possible source indicators (Attachment E). A series of tests show that there are no statistically significant differences in sampling data between nearshore zones to the south versus to the north of the Jones Ditch confluent. Through there is an apparent trend of decreasing SRP concentrations moving away from Jones Ditch to the south (based on transect data averages), a range of statistical analyses suggest these northern areas are affected by Jones Ditch and other possible localized SRP sources. There is a statistically significant difference between control site data to

the south and these affected areas. This suggests possible sources are localized to the vicinity of Jones Ditch.

A simplified mass balance loading analysis of SRP from Jones Ditch into nearshore waters was additionally performed to assess whether the ditch contributions were sufficient to generate the levels of measured nearshore phosphorus concentrations (Attachment F). Considering a range of circulation patterns with open lake water exchanges that might flush suspect nearshore areas, modeling suggests there is insufficient Jones Ditch discharges to generate measured SRP levels in proximal nearshore areas. This suggests other sources of SRP discharging to these nearshore areas, the primary suspects being septic systems.

Bacteria *(E. coli* and Total Coliform)

Though SRP was a primary focus for August sampling related to nuisance nearshore algal growth, sampling for bacterial presence in nearshore waters is an important secondary consideration, especially if phosphorus sources are septic systems. Gut-tract bacteria measured by *E. coli* and Total Coliform bacteria are strong indicators of human or animal waste in surface waters. For the nearshore areas at and near Jones Ditch, the presence of these bacteria can indicate organic waste sources in Jones Ditch, or from shoreline septic systems.

Sampling results show that *E. coli* and Total Coliform bacteria are broadly distributed throughout the areas sampled (Figures 6 and 7, respectively). This includes at control locations. *E. coli* was detected at levels ranging from non-detect to 380 CFU/100ml across all samples collected on August 27th. All *E. coli* detections were generally higher than what has typically been observed at the Greenbush Township public beach. One sample at the 'southern wetland' location just off the mouth of Jones Ditch exceeded the state standard for full body contact of 300 CFU/100ml. The highest *E. coli* detections appeared to be clustered near the mouth of Jones Ditch and to the north (Figure 6). Notable were the ubiquitous measures of *E. coli* at 60 CFU/100ml in the nearshore control area. Their presence here might suggest a localized source such as a septic system discharge, though SRP data at this control location do not necessarily affirm such an inference.

Total Coliform bacteria (Figure 7) were detected at all 22 sampling locations ranging from 1,220 CFU/100ml at the southern nearshore control site to 9,020 CFU/100ml in nearshore areas just north of Jones Ditch. At the time of sampling, *E. coli* and Total Coliform levels measured at Jones Ditch locations upstream of shoreline areas were below comparable measurements at a number of proximal nearshore locations. The presence of bacteria in Jones Ditch suggests an upstream source, possibly of animal origin given the lack of upstream human development but persistent beaver activity at West Cedar Lake Road and near the mouth of the ditch. Of note, *E. coli* levels in the ditch (40 CFU/100ml) were also lower than those found at the southern control site (60 CFU/100ml). Collectively, these data suggest there may be multiple sources of bacteria to these nearshore waters. These data also affirm July 2025 screening levels detecting the presence of *E. coli* along with Total Coliform levels above 1,000 MPN/100ml in the suspect nearshore area.

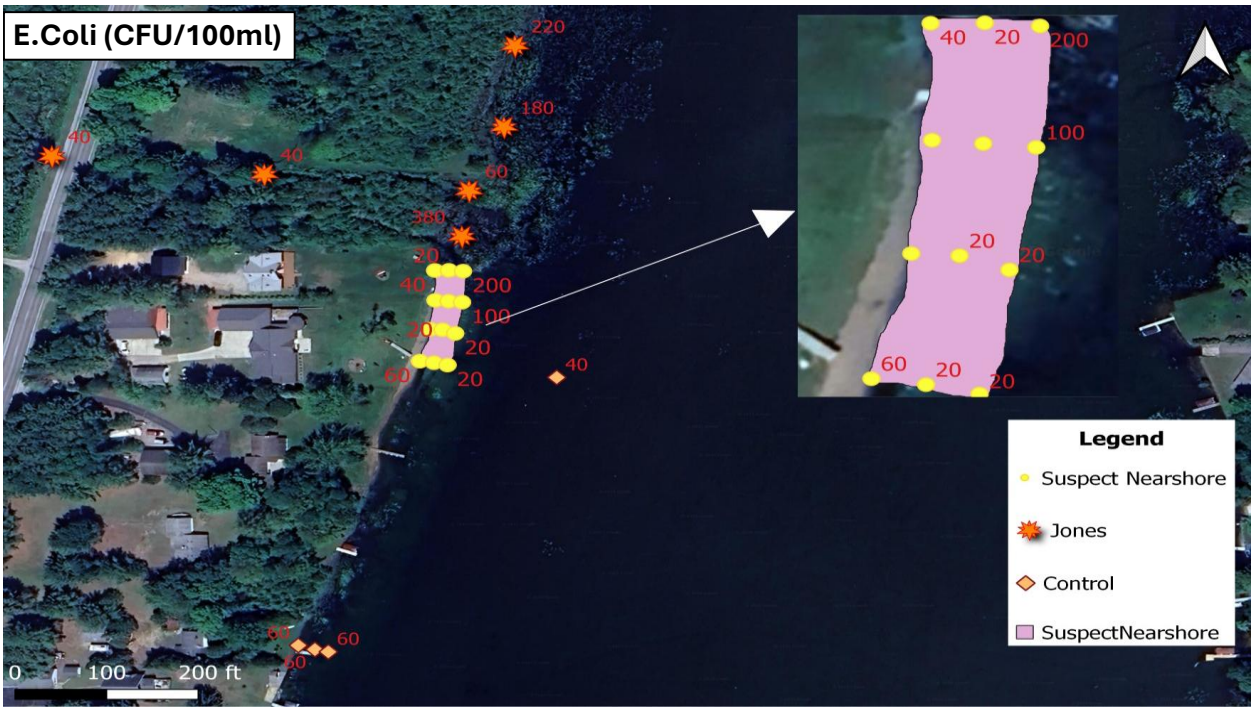

Figure 6. E. coli results by sampling station for the August 27, 2025 monitoring (monitoring locations with no mapped data indicate there were no detections of E. coli bacteria).

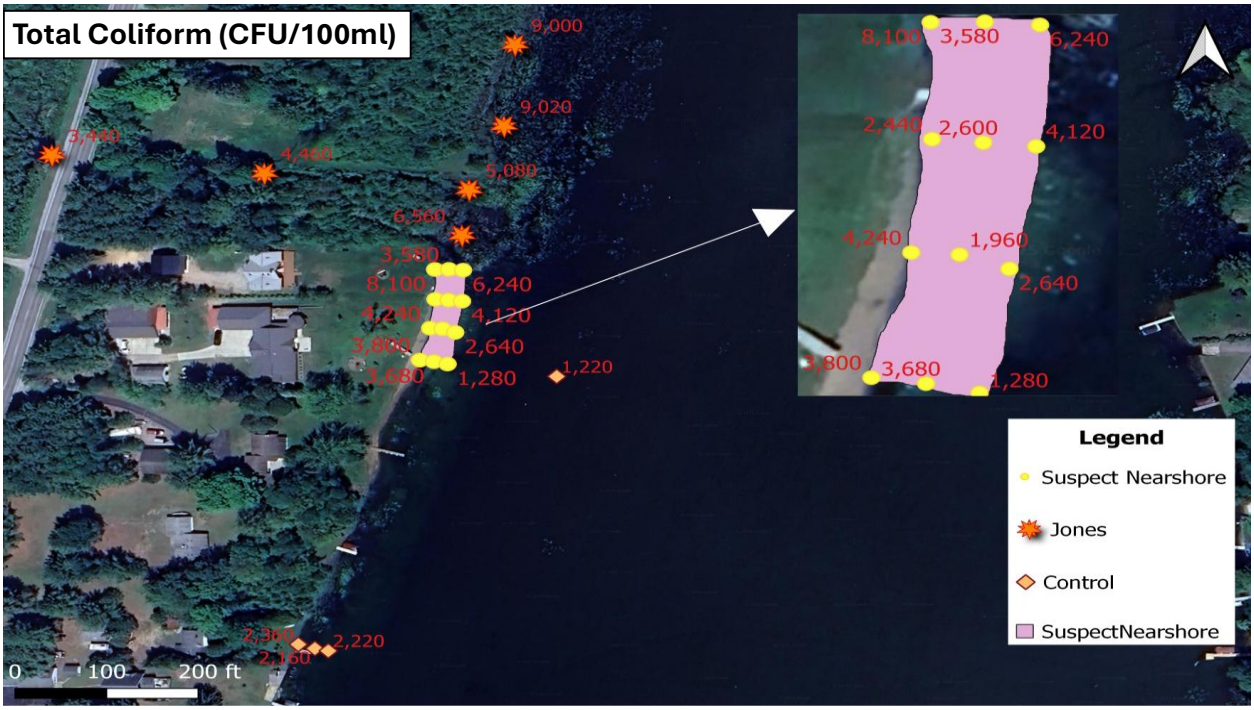

Figure 7. Total Coliform Bacteria results by sampling station for the August 27, 2025 monitoring (Total Coliform bacteria were detected at every monitoring location).

Conclusions

Sampling results from July and August monitoring of nearshore areas of Cedar Lake in the vicinity of Jones Ditch suggest there are likely multiple sources of soluble phosphorus and bacteria to these areas including both the ditch and possibly septic systems. Nearshore averages of SRP transect data revealed the lowest concentrations at the southern control location (1.8 *u*g/L) compared to those for the suspect nearshore area (ranging from 2.2-3.5 *u*g/L on average). Nearshore SRP concentrations at, and north of Jones Ditch ranged from 2.8-6.8 *u*g/L. Statistically, SRP levels in the suspect nearshore area and Jones Ditch shoreline are distinctly higher than the sampled control zone. This suggests that localized phosphorus sources are the cause of the luxuriant algal growths observed in nearshore areas just south of the Jones Ditch confluence with the lake. Such sources are also likely responsible for the high levels of SRP (3.4 *u*g/L) and TP (40.8 *u*g/L) noted 150 feet off the shoreline in front of the suspect nearshore zone.

Levels of bacteria measured in nearshore areas of this northwest shoreline may originate from septic systems that discharge to the lake here. Higher nearshore levels suggest sources near the lakeshore. There also appear to be bacterial sources in Jones Ditch, though not at the levels noted at nearshore locations. With beaver activity at the mouth of the Ditch and upstream at the West Cedar Lake Road culvert, animal sources could be contributing source to these observations. Heavy algal growth at the shoreline in the suspect areas along with elevated SRP levels and the presence of *E. coli* point to possible septic system discharges.

Robust CLIB monitoring of nearshore groundwater conditions at Cedar Lake since 2005 have demonstrated that shallow groundwater along the northwest shoreline of Cedar Lake discharges to the lake. In Alcona County, residential properties along this northwest shoreline are unsewered, with all having septic systems that ultimately discharge to shallow groundwater. As such, it is not unexpected that both soluble phosphorus and bacteria could be moving to the lakeshore. Data and analysis of 2025 monitoring suggests this could be the case, along with discharges from Jones Ditch.

Next Steps

Though monitoring indicates water quality concerns associated with elevated phosphorus and bacterial levels, additional strategic sampling of shallow groundwater and bacterial source tracking are necessary to conclusively pinpoint localized sources. Source identification is a critical next step to determine what, if any remedial strategies could be effectively implemented to address these water quality concerns.

Two monitoring strategies will fill these gaps. Shallow groundwater sampling along the shoreline of the suspect septic system locations will indicate discharges to the lake if SRP and *E. coli* are detected. If *E. coli* is found in shallow groundwater, additional samples will later be collected for microbial source tracking to refute animal contribution sources as speculated by the District Health Department based on July 2nd bacterial screening results. Similar source tracking for

Jones Ditch will be simultaneously conducted to determine if bacteria are of human or animal origins.

During an October 10, 2025 Cedar Lake Improvement Board meeting, K&A was authorized to initiate this additional sampling. As such, near-term monitoring will include shallow groundwater sampling along suspect shorelines at up to seven locations (six in front of the two existing homes and one at the lake shoreline in close proximity to the former septic system at the CLIB Jones Ditch property). Samples will be tested for SRP, *E. coli* and Total Coliform bacteria. Microbial source tracking for DNA analysis will occur at a later date when there is flow in Jones Ditch.

Once sources of SRP and *E. coli* are confirmed, next steps would be two-fold: 1) additional water quality sampling from several northwest shoreline areas in Alcona County, and; 2) consideration of source mitigation options for the Jones Ditch locale. Shoreline monitoring was envisioned in the 2025 Cedar Lake Watershed Management Plan Update as were education efforts for septic system maintenance. Addressing Jones Ditch bacterial sourcing can be overlain with anticipated stream restoration improvements expected to unfold with the recently approved Midwest Glacial Lakes Partnership grant to the CLIB.

ATTACHMENT A

July 14, 2025 K&A Technical Memorandum on July 2, 2025 Nearshore Sampling

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

MEMORANDUM

To:	Rex Vaughn, Chair Cedar Lake Improvement Board	**Date:**	July 14, 2025
From:	Mark S. Kieser Senior Scientist, K&A	**cc:**	Natalie Crum, K&A
RE:	**Summary of July 2, 2025 Water Quality Sampling of Select Nearshore Areas of Cedar Lake with Preliminary Discussion of Field Screening for E. coli Bacteria**		

Overview

On Wednesday, July 2, 2025, Kieser & Associates, LLC (K&A) collected a limited number of water quality samples from select nearshore locations along the northwest shoreline of Cedar Lake in Alcona County. This sampling occurred during K&A's routine vegetation monitoring of the lake. Nearshore water quality samples for soluble reactive phosphorus (SRP) were collected in front of two residential properties situated directly south of Jones Ditch. Water samples were also screened for the potential presence of *E. coli*, a common gut-tract bacterium associated with fecal wastes from mammals and avian species.

Phosphorus is the primary nutrient of concern that may be released for septic system drain fields near lake shorelines. These discharges can lead to excessive nearshore weed and algae growths. In select instances, phosphorus discharges can be directly related to Harmful Algal Blooms whereby blue-green algae proliferate at the lake surface forming noxious slicks or scum. Some blue-green algal species can also form toxins into surface waters.

The presence of *E. coli* in surface waters can be an indicator of sewage from septic system discharges, or animal waste contamination from resident waterfowl near the shoreline (such as geese or ducks). Human health concerns relate to the possible presence of viral pathogens associated with human waste that can cause diseases through ingestion or skin contact such as gastroenteritis (diarrhea), giardia, hepatitis or cholera. The State of Michigan has established water quality standards for total body contact (e.g., swimming) at a Daily Maximum Geometric Mean at 300 *E. coli* counts per 100 milliliters (ml).

Residential properties along northern Cedar Lake shorelines in Alcona County are serviced by private septic systems. Long-term groundwater monitoring of these areas by K&A has consistently shown that shallow groundwater along its western shoreline discharges directly to the lake. Groundwater along the eastern shoreline discharges east towards Lake Huron. As such, septic system discharges to Cedar Lake via shallow groundwater will only be found along the northwestern shorelines where there are residential properties.

Sampling Conditions on July 2, 2025

K&A sample collection occurred under partly cloudy conditions with temperatures reaching 84°F. Winds ranging from 6 to 15 mph from the northwest resulted in calm conditions in this sampled section of the Cedar Lake shoreline. (Refer to Attachment A of this memo for site photos taken at the time of sample collection.) Two water quality samples were collected at locations shown in Figure 1 by submersing and then inverting 250ml wide-mouth plastic sample containers to capture water from below the lake surface. Water samples were collected amongst dense growths of *Chara* sp. and filamentous green algae. Site 1 (S1) was located approximately 35 ft from the shoreline while Site 2 (S2) was located approximately 16.5 ft from the shoreline. The depth near each site was approximately 2-3 feet.

Figure 1. Water quality sampling locations on July 2, 2025.

This sampling occurred within Aquatic Resource Observation Site (AROS) 358 (refer to Figure 2). AROS locations have been monitored for aquatic vegetation by the K&A team for almost two decades on Cedar Lake using the LakeScan™ survey methodology. Native vegetation located within this AROS during the July 2 survey included the calcareous macroalgae, *Chara*, and vascular macrophytes including Sago Pondweed (*Stuckenia pectinata*), Variable Pondweed (*Potamogeton graminius*), Broadleaf Pondweed (*Potamogeton amplifolius*), Variable Watermilfoil (*Myriophyllum heterophyllum*), Waterlily (*Nymphaea* sp.), Spadderdock (*Nuphar* sp.), Rush (*Juncus pelocarpus*) and Cattail (*Typha* sp.). Mixed in amongst the *Chara* and vascular plants were notable growths of filamentous green algae. Though not observed in July 2025, the invasive hybrid Eurasian watermilfoil was previously observed at this location prompting past chemical treatments in this area. Observed plants at this location this year appeared at high densities; a consistent observation over the years despite periodic chemical

treatments intended to suppress such luxuriant growth. Such aquatic vegetation at other locations along the northwest was not observed at the densities seen at AROS 358.

Figure 2. Aquatic Resource Observation Sites (AROS) map of the northern section of Cedar Lake.

Preliminary Results

SRP samples have been submitted to the Great Lakes Environmental Center (GLEC) laboratory in Traverse City, MI. Analytical results should be reported by GLEC before the end of July. The luxuriant growth observed in the sampling area (particularly the level of filamentous green algae) suggests a higher level of soluble phosphorus here than is likely present in other observed shoreline areas with little to no algae and lower plant densities. In anticipation of July 2 testing results, K&A will compare reported lab data against nearby Jones Ditch phosphorus sampling in 2024.

Water quality screening for *E. coli* bacteria at these July 2025 Cedar Lake sampling locations revealed very unsafe levels of total coliforms, indicating a significant potential for fecal contamination (Table 1). The total coliform levels at each site are considered very unsafe by the US EPA's recreational water health risk criteria, especially with screening tests revealing the presence of *E. coli*.

Table 1. E. coli and Total Coliform sample results.

Site	E. coli	Total Coliform Count (MPN)	Upper 95% Confidence Level/100 mL	EPA Recreational Water Health Risk Category
1	Positive	>1000 MPN / 100 mL	94351	Very Unsafe
2	Positive	>1000 MPN / 100 mL	94351	Very Unsafe

The field screening method used to test for the presence of *E. coli* and the broader class of coliform bacteria involved the use of an Aquagenx® CBT EC+TC (Compartment Bag Test), "Most Probable Number" (MPN) Kit.[1,2] This is not an EPA-approved method for typical health department analyses (where sample hold times are only 6 hours between collection and lab analysis). It is intended to provide a semi-quantitative indication of the presence of these bacteria.

Total coliform counts shown in Table 1 for both sampling locations indicate a concerning level of these bacteria. In the summer season, the state of Michigan *E. coli* standards for a daily maximum geometric mean (calculated from three separate sampling locations at a site) are 300 counts/100ml of sample. When these levels are found at public beaches by county health departments, beaches are closed to swimming. The >1,000 counts/100 ml (up to a possible maximum of 94,351 counts/100ml), suggest bathers should avoid these areas, and that further laboratory sample testing should be conducted to confirm or refute concerns with full body contact. (Attachment B provides documentation of field kit screening results; Attachment C provides a summary of field kit results with semi-quantitative interpretation of bacterial counts.)

[1] See: https://www.aquagenx.com/wp-content/uploads/2025/06/1-10-Dilution-Instructions-CBT-ECTC-MPN-202506.pdf
[2] See also: https://www.aquagenx.com/wp-content/uploads/2021/06/Basis-of-Aquagenx-MPN-Table_June2021-.pdf

Implications

Comparable 2024 sampling for phosphorus (but not bacteria) in Jones Ditch to the north of 2025 nearshore sample locations revealed concentrations of <7 parts per billion of SRP. These are very low levels of phosphorus, and common for northern Michigan streams in undeveloped areas. Low levels are also consistent with past water quality testing in Cedar Lake. Any elevated SRP levels found at S1 or S2 over the Jones Ditch concentration will suggest a localized source of phosphorus. With no other indications of diffuse pollution inputs, septic system discharges would be a likely possible source of elevated phosphorus.

With the levels of bacteria observed through field-testing, septic leachate would also be the suspected source based on K&A research of other northern Michigan lakes over the past decades. Thus, additional testing should be performed at this nearshore location. K&A recommends this testing be conducted by the county health department which could also assist residents with recommendations for additional inspections of existing septic system performance.

The high total coliform levels and presence of *E. coli* suggest a significant potential for fecal contamination and the associated health risks in this section of Cedar Lake. These findings present a public health concern, as fecal contamination is associated with various waterborne illnesses which disproportionately impact children younger than 5, adults 65 and older, as well as people with weakened immune systems (U.S. Centers for Disease Control and Prevention).[3] As such, county health department testing should also include additional sampling to the north and south of these particular nearshore areas.

Of note, research indicates that *Cladophora*, a genus of filamentous green algae, can serve as a secondary habitat for *E. coli* in surface waters. Filamentous algae reduce many of the environmental stressors that affect survivability of *E. coli* bacteria upon introduction to an aquatic environment. This algal species can provide sites for adherence, elevated nutrient concentrations and protection from UV radiation (Beckinghausen et al. 2014, Brettar and Höfle 1992, Byappanahalli et al. 2003, Whitman et al. 2003). Studies show variable survival time of *E. coli* on *Cladophora*, with the longest length recorded being more than 48 days (Engelbert et al. 2008). This suggests that *Cladophora* mats can harbor naturalized strains of *E. coli*, not only allowing *E. coli* to persist, but to also successfully grow (Badgley et al. 2011, Byappanahalli et al. 2007).

[3] Centers for Disease Control and Prevention. (n.d.). *Risk and E. coli infection*. Centers for Disease Control and Prevention. https://www.cdc.gov/ecoli/risk-factors/index.html#:~:text=Some%20groups%20of%20people%20are,immune%20systems%2C%20and%20international%20travelers.

Many filamentous green algae exhibit similar growth habits and are morphologically similar to *Cladophora* (John and Rindi 2015). Because of these similarities, it is possible that the prolific filamentous green algae growths observed as Site 1 and 2 may also act as a secondary habitat for *E. coli,* prolonging its presence in this area. As a substantial source of soluble phosphorus is required for the observed algal growth, these conditions lead K&A to believe that septic system leachate could be the primary reason for observed conditions.

References

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Attachment A

Field Photos of Site Conditions

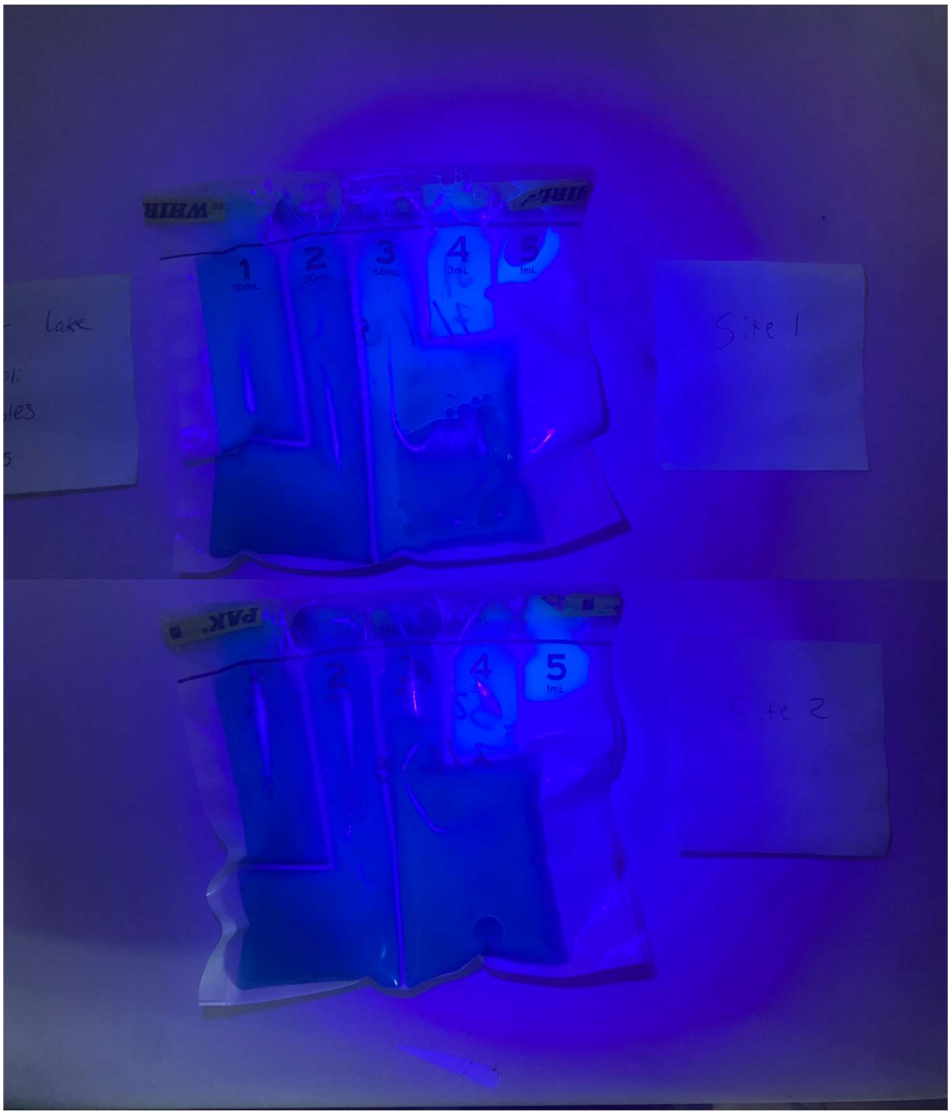
Photos of the excessive growth of *Chara sp.* and filamentous algae near the sampling locations, taken on July 2, 2025.

ATTACHMENT B

Field Test Kit Results

Photo of S1 and S2 Aquagenex Field Test Kit results in ambient lighting after a 5-day incubation period at room temperature. Blue coloration indicates the presence of *E. coli* (Channels 1-3 for Site 1; Channels 1-4 for Site 2).

Photo of Aquagenex samples under UV lighting after a 5-day incubation period at room temperatures. The blue fluorescence (Channels 4 and 5 in each sample pack) indicates the presence of other coliform bacteria.



Attachment C

Explanation of the Upper 95% Confidence Limit with MPN

The Upper 95% Confidence Limit (CL) is the highest possible Most Probable Number (MPN) that could be present in the water sample if the same sample is repeatedly tested. That is, the "true" concentration of bacteria in the sample will be at or below the 95% CL. It represents a worst-case upper limit of the quality of the water that would not be exceeded 95 times out of 100 on average if the same sample is analyzed over and over again."[4] (Basis of Aquagenx® MPN Table, 2021)

Using the Aquagenx® MPN table: Total coliform analysis is based on the yellow cells that fluoresce under UV light (representing positive for coliforms). Cells that are blue in ambient light are positive for *E. coli*, which also means they are positive for coliforms (Attachment B). This means that both Sites 1 and 2 would fall under the last row of the MPN estimation table provided by Aquagenx®.[5] Therefore, the MPN/100mL of both samples is greater than 1,000 MPN/100mL, with an upper 95% confidence level of 94,351.

[4] See Footnote 2.
[5] See Footnote 1.

ATTACHMENT B

GLEC Lab Report for July 2, 2025 Phosphorus Samples

Great Lakes Environmental Center

Project Number: 2592-B10

July 15, 2025

Kieser & Associates-Cedar Lake-Jones Ditch
536 E. Michigan Ave., Suite 300
Kalamazoo, MI 49007

Attention: Natalie Howard

Project Description: Water Quality Sampling

Dear Client,

Enclosed is a copy of your laboratory report relating to samples, as they were received. All tests were performed within the maximum holding times and have met or exceeded QC criteria. Test results are in compliance with The NELAC Institute Standards. Visit our web site for a full list of tests for which GLEC (Lab 2059) is accredited through the New Hampshire Environmental Laboratory Accreditation Program (NH ELAP).

Please don't hesitate to call if you have questions or require further information.

Sincerely,

Michelle A. Moore
Laboratory Coordinator and Research Scientist/Nutrient Chemistry

Great Lakes Environmental Center, Inc.
739 Hastings St., Traverse City, MI 49686
Phone: 231-941-2230; Fax: 231-941-2240; www.glec.com

Great Lakes Environmental Center

739 Hastings St., Traverse City MI 49686 - (231) 941-2230 - FAX: (231) 941-2240

Client ID:

Kieser-Cedar Lake

REPORT OF ANALYSIS

Phosphorus

Lab ID	*Sample Description*	*Sample Date*	*Result*	*Units*	*Rep Limit*	*MDL*	*Qualifier*	*Analysis Date*	*Comments*	*Initials*
3K070200008	Cedar S1	7/2/2025	0.0251	mg/L	0.003	0.0012		7/15/2025		BSC
3K070200009	Cedar S2	7/2/2025	0.0200	mg/L	0.003	0.0012		7/15/2025		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Method: SM 4500-P F

Great Lakes Environmental Center

739 Hastings St., Traverse City MI 49686 - (231) 941-2230 - FAX: (231) 941-2240

Client ID:

Kieser-Cedar Lake

REPORT OF ANALYSIS

Soluble Reactive Phosphorus

Lab ID	Sample Description	Sample Date	Result	Units	Rep Limit	MDL	Qualifier	Analysis Date	Comments	Initials
3K070200010	Cedar S1	7/2/2025	0.0039	mg/L	0.001	0.00047		7/14/2025		BSC
3K070200011	Cedar S2	7/2/2025	0.0068	mg/L	0.001	0.00047		7/14/2025		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Method: SM 4500-P F

Tuesday, July 15, 2025

GLEC
Great Lakes Environmental Center

GREAT LAKES ENVIRONMENTAL CENTER, INC.

CHAIN OF CUSTODY RECORD

Traverse City, MI - Laboratory
739 Hastings Street
Traverse City, MI 49686

www.glec.com
Phone (231)941-2230
Fax (231)941-2240

Section I.

Submitting Company: Kieser & Associates LLC
Report Results To: Natalie Crum
Address: 536 E. Michigan
Phone: (269)364-7117 E-mail: data@kieser-associates.com

Section II.

Project Name: Cedar Lake
Project Number:
P.O.#:
Sampled by: (initials)
☐ GLEC _____ ☒ Client NC

Section III. Sample Information at Collection

#	GLEC No.	Sample Identification	Sample Information: Date	Time	Matrix	Grab or Composite	Preservative	Filtered Y or N	Sample Containers: Type	Size	No.	Requested Analysis: SRP	TP							pH of Sample Upon Receipt
1		Cedar S1	7/2/25	1:22	SW	grab	Y(TP)	Y(SRP)	glass	250	2	X	X							≤2
2		Cedar S2	7/2/25	1:35	SW	grab	Y(TP)	Y(SRP)	glass	250	2	X	X							≤2
3																				
4																				
5																				
6																				
7																				
8																				

Section IV. Requested Analysis

Client Notes:

RELEASED BY / ORGANIZATION	DATE	TIME	RECEIVED BY / ORGANIZATION	DATE	TIME
Print Name & Organization: Josh Kieser			Print Name & Organization		
Signature	7-10-25	14:10	Signature	7-10-25	14:10
Print Name & Organization			Print Name & Organization		
Signature			Signature		

FOR LAB USE ONLY

Temperature of Samples: 1.9 °C Initials: L Bottle ID #, if applicable Glen ☒ Received on Wet Ice

Notes/Anomalies/Discrepancies:

GLEC may subcontract out analyses that we do not perform.

MATRIX CODES: S = SEDIMENT; SW = SURFACE WATER; E = EFFLUENT; GW = GROUNDWATER; SL = SLUDGE; AO = AQUATIC ORGANISM

ATTACHMENT C

K&A Proposed Work Scope for August Nearshore Water Quality Monitoring

ATTACHMENT A

K&A Internal Field Scope – Cedar Lake (8-18-25 v1.0)

(derived from Rex Scope 8-12-25; v3.0)

ADMINISTRATIVE SCOPE (as an FYI)

1. Identify Regulatory Positions with Preliminary Findings *(Completed)*
    a. County and State Health Departments
    b. EGLE
2. Sharing info with CLIB *(Rex to board with updated information)*
3. Further CLIB conversations with home owners for property access *(Rex…Mark can provide a written draft)*

FIELD SAMPLING SCOPE

4. Water quality re-testing during August LakeScan survey *(K&A)*
    a. Lake water sampling at the two suspect shoreline properties [FROM THE BEACH…not the boat] (4 sample sets for TP, SRP and *E. coli* bacteria – Oscoda lab, and Aquagenix testing)
        i. At suspect nearshore locations in front of two homes…four equally spaced sampling transects marked with survey flags for sampling reference:
            1. 4 samples in splash zone (≤ 6 inches of water) taken from standing on shore with no staff disturbance of water)
            2. 4 at 15 ft from shore (taken with extension pole sampler reaching out with two extensions to sample 1 foot below surface at locations perpendicular to nearshore grab samples while minimizing sediment disturbence)
            3. 4 at 30 ft from shore (at about the 3 feet of depth per EGLE, 1 foot below the surface, again using the extension pole sampler and reaching out to deeper water while minimizing sediment disturbance)
        ii. 1 open lake sample (as a control) *from the boat* at 100-150 feet from shore in front of the 4 nearshore sampling areas.
        iii. 1 additional nearshore sample set to the south…maybe 2-3 houses to the south, and *from the boat* (1 in splash zone, 1 at 15 feet, 1 at 30 feet from shore)
        iv. Get a few DO/temp readings at the 15 and 30 locations

5. Concurrent Jones Ditch/CLIB site WQ sampling
    a. Surface water samples (TP, SRP and bacteria – Oscoda lab, and Aquagenix testing) at up to six locations as follows:
        i. Jones Ditch just upstream of W. Cedar Lake Road culvert (+flow upstream and downstream of culvert)
        ii. Jones Ditch adjacent to the CLIB property and the stream crossing bridge
        iii. Jones Ditch at the approximate confluence with Cedar Lake and downstream of any beaver dam activity
        iv. Very nearshore/wetland standing water at two (2) locations to the north of location #3
        v. Very nearshore/wetland standing water at 1 location to the south of location #3

Field Procedures:

- Chest waders (muck and limited body contact) and life jackets
- If very mucky, have safety rope/harness for 2nd staffer to help getting back to shoreline as needed
- Long gloves (protection from bacteria)
- Wash off waders after finishing samples
- Hand-sanitizer for post-sampling personal hygiene
- Drop pin location at each sampling location
    - For sample collect at shoreline, drop pin on flags; then estimate 15 and 30 foot locations using know length of sampling rod with extension
- For extension rod sampling bottle use at 15 and 30 foot locations, liquinox wash, tap water rinse, DI water rinse (no brushes needed, just use 5-gallon buckets for quick clean-up between)
- Have CoCs prepped in advance
- Rex will deliver in one trip, bacteria samples to the lab in Oscoda by 1 pm
- Aquagenix samples to be prepped at the site
- At Jones Ditch:
    - Samples will be collected from downstream locations moving upstream with care to avoid sediment disturbances at points upstream of the surface water sample collection.
    - Signs of beaver and other wildlife activity will be noted during sample collection. A field measurement of flow (if it exists), will be taken at upstream and downstream ends of the road culvert along with DO, temperature and conductivity measurements in the ditch.

Anticipated time on-site:

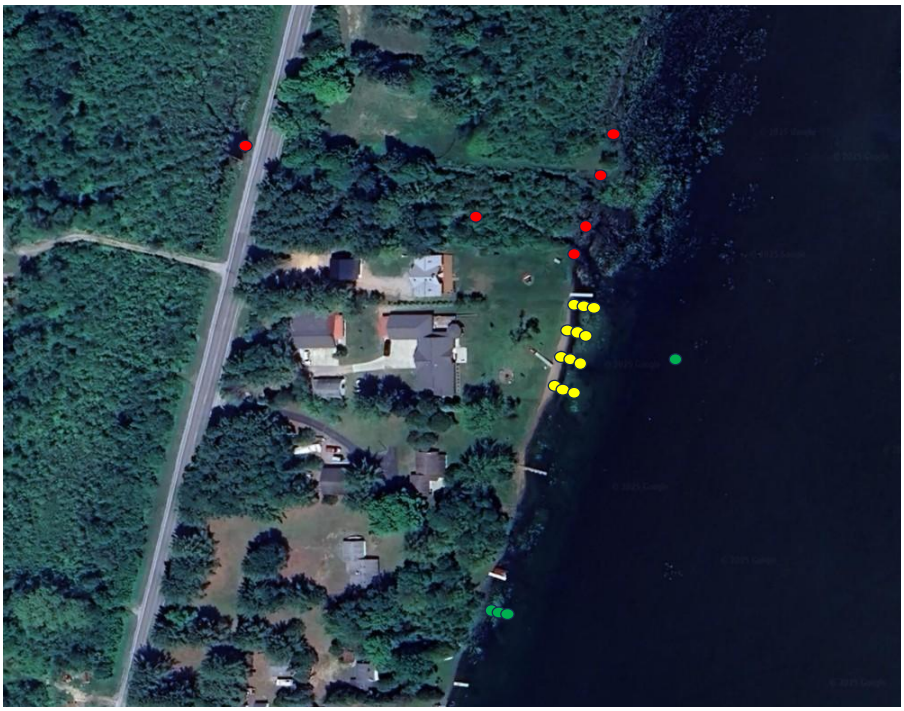
- Jones Ditch: 2-3 hours of additional field time during the late-season LakeScan
- Beach Sampling: 1-2 hours
- Open water/nearshore sampling to south of suspect area, all by boat: 1 hour

Lab Analyses:

- TP & SRP = GLEC
- Bacteria = Local lab in Oscoda (transported by reach in dedicated cooler with ice and CoC)
- Aquagenix = K&A
- Field parameters = K&A

Bottle Needs:

- GLEC:
    - 22 TP
    - 22 SRP (and filters)
- Oscoda Lab
    - 22 Bacteria
- K&A
    - 22 Aquagenix



2025 Cedar Lake P and E. coli Sampling Locations

- Jones Ditch sampling locations (6)
- Control sampling locations (4)
- Suspect nearshore sampling locations (12)

ATTACHMENT D

Laboratory Reports for August 27, 2025 Water Quality Monitoring

Great Lakes Environmental Center

Project Number: 2592-B10

September 12, 2025

Kieser & Associates-Cedar Lake-Jones Ditch
536 E. Michigan Ave., Suite 300
Kalamazoo, MI 49007

Attention: Natalie Crum

Project Description: Water Quality Sampling

Dear Client,

Enclosed is a copy of your laboratory report relating to samples, as they were received. All tests were performed within the maximum holding times and have met or exceeded QC criteria. Test results are in compliance with The NELAC Institute Standards. Visit our web site for a full list of tests for which GLEC (Lab 2059) is accredited through the New Hampshire Environmental Laboratory Accreditation Program (NH ELAP).

Please don't hesitate to call if you have questions or require further information.

Sincerely,

Michelle A. Moore
Laboratory Coordinator and Research Scientist/Nutrient Chemistry

Great Lakes Environmental Center

739 Hastings St., Traverse City MI 49686 - (231) 941-2230 - FAX: (231) 941-2240

Client ID: 2592-B10

Kieser-Cedar Lake

REPORT OF ANALYSIS

Phosphorus

Lab ID	Sample Description	Sample Date	Result	Units	Rep Limit	MDL	Qualifier	Analysis Date	Comments	Initials
3K082700012	Jones Culvert Up	8/27/2025	0.0312	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700013	Jones Bridge	8/27/2025	0.0392	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700014	J-Conf	8/27/2025	0.0332	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700015	J-NW1	8/27/2025	0.0348	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700016	J-NW2	8/27/2025	0.0354	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700017	J-SW	8/27/2025	0.0335	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700018	T1-5	8/27/2025	0.0225	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700019	T-15	8/27/2025	0.0234	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700020	T1-30	8/27/2025	0.0216	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700021	T2-5	8/27/2025	0.0213	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700022	T2-15	8/27/2025	0.0282	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700023	T2-30	8/27/2025	0.0179	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700024	T3-5	8/27/2025	0.0227	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700025	T3-15	8/27/2025	0.0230	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700026	T3-30	8/27/2025	0.0333	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700027	T4-5	8/27/2025	0.0196	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700028	T4-15	8/27/2025	0.0196	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700029	T4-30	8/27/2025	0.0346	mg/L	0.003	0.0012		9/11/2025		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Method: SM 4500-P F

Lab ID	Sample Description	Sample Date	Result	Units	Rep Limit	MDL	Qualifier	Analysis Date	Comments	Initials
3K082700030	C-5	8/27/2025	0.0327	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700031	C-15	8/27/2025	0.0265	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700032	C-30	8/27/2025	0.0203	mg/L	0.003	0.0012		9/11/2025		BSC
3K082700033	C-L	8/27/2025	0.0408	mg/L	0.003	0.0012		9/11/2025		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Method: SM 4500-P F

Great Lakes Environmental Center

739 Hastings St., Traverse City MI 49686 - (231) 941-2230 - FAX: (231) 941-2240

Client ID: 2592-B10

Kieser-Cedar Lake

REPORT OF ANALYSIS

Soluble Reactive Phosphorus

Lab ID	Sample Description	Sample Date	Result	Units	Rep Limit	MDL	Qualifier	Analysis Date	Comments	Initials
3K082700034	Jones Culvert Up	8/27/2025	0.0045	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700035	Jones Bridge	8/27/2025	0.0077	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700036	J-Conf	8/27/2025	0.0040	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700037	J-NW1	8/27/2025	0.0037	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700038	J-NW2	8/27/2025	0.0028	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700039	J-SW	8/27/2025	0.0068	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700040	T1-5	8/27/2025	0.0032	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700041	T-15	8/27/2025	0.0036	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700042	T1-30	8/27/2025	0.0036	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700043	T2-5	8/27/2025	0.0031	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700044	T2-15	8/27/2025	0.0027	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700045	T2-30	8/27/2025	0.0029	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700046	T3-5	8/27/2025	0.0021	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700047	T3-15	8/27/2025	0.0026	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700048	T3-30	8/27/2025	0.0027	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700049	T4-5	8/27/2025	0.0018	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700050	T4-15	8/27/2025	0.0016	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700051	T4-30	8/27/2025	0.0033	mg/L	0.001	0.00047		9/4/2025		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Method: SM 4500-P F

Friday, September 12, 2025

Lab ID	Sample Description	Sample Date	Result	Units	Rep Limit	MDL	Qualifier	Analysis Date	Comments	Initials
3K082700052	C-5	8/27/2025	0.0017	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700053	C-15	8/27/2025	0.0016	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700054	C-30	8/27/2025	0.0020	mg/L	0.001	0.00047		9/4/2025		BSC
3K082700055	C-L	8/27/2025	0.0034	mg/L	0.001	0.00047		9/4/2025		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Method: SM 4500-P F

GREAT LAKES ENVIRONMENTAL CENTER, INC.

CHAIN OF CUSTODY RECORD

Great Lakes Environmental Center

Traverse City, MI - Laboratory
739 Hastings Street
Traverse City, MI 49686

www.glec.com
Phone (231)941-2230
Fax (231)941-2240

Section I.

Submitting Company: Kieser & Associates, LLC
Report Results To: Natalie Crum
Address: 536 E. Michigan Ave, Kalamazoo, MI 49007
Phone: (269) 344-7117 E-mail: data@kieser-associates.com

Section II.

Project Name: Cedar Lake
Project Number:
P.O.#:
Sampled by: (initials)
☐ GLEC _____ ☒ Client JK + NC

Section III. **Sample Information at Collection**

#	GLEC No.	Sample Identification	Sample Information: Date	Time	Matrix	Grab or Composite	Preservative	Filtered Y or N	Sample Containers: Type	Size	No.
1		Jones culvert up	8/27/25	8:40	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
2		Jones Bridge	8/27/25	8:55	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
3		J-conf	8/27/25	9:12	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
4		J-NW1	8/27/25	9:00	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
5		J-NW2	8/27/25	8:55	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
6		J-SW	8/27/25	9:23	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
7		TI-S	8/27/25	10:02	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1
8		TI-15	8/27/25	10:05	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1 1

Section IV. Requested Analysis

TP	SRP							pH of Sample Upon Receipt
X	X							✓
X	X							✓
X	X							✓
X	X							✓
X	X							✓
X	X							✓
X	X							✓
X	X							✓

Client Notes:

RELEASED BY / ORGANIZATION	DATE	TIME	RECEIVED BY / ORGANIZATION	DATE	TIME
Print Name & Organization: Mark S. Kieser K&A			Print Name & Organization: Michelle Moore GLEC		
Signature: Mark S. Kieser	9-2-25	9:15	Signature: Michelle Moore	9/2/25	9:15
Print Name & Organization			Print Name & Organization		
Signature			Signature		

FOR LAB USE ONLY

Temperature of Samples: 5.9 °C Initials: mm Bottle ID #, if applicable 35464 ☑ ☐ Received on Wet Ice

Notes/Anomalies/Discrepancies:

GLEC may subcontract out analyses that we do not perform.

MATRIX CODES: S = SEDIMENT; SW = SURFACE WATER; E = EFFLUENT; GW = GROUNDWATER; SL = SLUDGE; AO = AQUATIC ORGANISM

GLEC
Great Lakes Environmental Center

GREAT LAKES ENVIRONMENTAL CENTER, INC.

CHAIN OF CUSTODY RECORD

Traverse City, MI - Laboratory
739 Hastings Street
Traverse City, MI 49686

www.glec.com
Phone (231)941-2230
Fax (231)941-2240

Section I.

Submitting Company: Kieser & Associates, LLC
Report Results To: Natalie Crum
Address: 536 E. Michigan Ave, Kalamazoo, MI 49007
Phone: (269) 344-7117 E-mail: data@kieser-associates.com

Section II.

Project Name: Cedar Lake
Project Number:
P.O.#:
Sampled by: (initials) ☐ GLEC _____ ☒ Client NC + JK

Section III. **Sample Information at Collection**

#	GLEC No.	Sample Identification	Sample Information: Date ⇄ Time	Matrix	Grab or Composite	Preservative	Filtered Y or N	Sample Containers: Type	Size	No.
1		T1-30	10:09 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
2		T2-S	10:18 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
3		T2-15	10:21 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
4		T2-30	10:28 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
5		T3-S	10:31 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
6		T3-15	10:35 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
7		T3-30	10:52 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
8		T4-S	10:39 8/27/25	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1

Section IV. Requested Analysis

#	TP	SRP							pH of Sample Upon Receipt
1	X	X							✓
2	X	X							✓
3	X	X							✓
4	X	X							✓
5	X	X							✓
6	X	X							✓
7	X	X							✓
8	X	X							✓

Client Notes:

RELEASED BY / ORGANIZATION	DATE	TIME	RECEIVED BY / ORGANIZATION	DATE	TIME
Print Name & Organization: Mark S. Kieser K&A			Print Name & Organization Michelle Moore GLEC		
Signature Mark S. Kieser	9-2-25	9:15	Signature	9/2/25	9:15
Print Name & Organization			Print Name & Organization		
Signature			Signature		

FOR LAB USE ONLY

Temperature of Samples: 5.9 °C Initials: MM Bottle ID #, if applicable 35464 ☐ Received on Wet Ice

Notes/Anomalies/Discrepancies:

GLEC may subcontract out analyses that we do not perform.

MATRIX CODES: S = SEDIMENT; SW = SURFACE WATER; E = EFFLUENT; GW = GROUNDWATER; SL = SLUDGE; AO = AQUATIC ORGANISM

GLEC
Great Lakes Environmental Center

GREAT LAKES ENVIRONMENTAL CENTER, INC.

CHAIN OF CUSTODY RECORD

Traverse City, MI - Laboratory
739 Hastings Street
Traverse City, MI 49686

www.glec.com
Phone (231)941-2230
Fax (231)941-2240

Section I.

Submitting Company: Kieser & Associates LLC
Report Results To: Natalie Crum
Address: 536 E. Michigan Ave
Phone: (269)344-7117 E-mail: ncrum@kieser-associates.com

Section II.

Project Name: Cedar Lake
Project Number:
P.O.#:
Sampled by: (initials)
☐ GLEC _____ ☒ Client NC + JK

Section III. **Sample Information at Collection**

#	GLEC No.	Sample Identification	Sample Information: Date	Time	Matrix	Grab or Composite	Preservative	Filtered Y or N	Sample Containers: Type	Size	No.
1		T4-15	8/27/25	10:43	SW	grab	Y (H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
2		T4-30	8/27/25	10:55	SW	grab	Y (H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
3		C-5	8/27/25	8:35	SW	grab	Y (H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
4		C-15	8/27/25	8:37	SW	grab	Y (H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
5		C-30	8/27/25	8:40	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
6		C-L	8/27/25	8:44	SW	grab	Y (TP, H_2SO_4)	Y (SRP)	glass plastic	250 mL 125 mL	1
7											
8											

Section IV. Requested Analysis

#	TP	SRP	pH of Sample Upon Receipt
1	X	X	✓
2	X	X	✓
3	X	X	✓
4	X	X	✓
5	X	X	✓
6	X	X	✓
7			
8			

Client Notes:

RELEASED BY / ORGANIZATION	DATE	TIME	RECEIVED BY / ORGANIZATION	DATE	TIME
Print Name & Organization: Mark S. Kieser K&A			Print Name & Organization: Michelle Moore	9/2/25	9:15
Signature: Mark J Tf	9-2-25	9:15	Signature:		
Print Name & Organization			Print Name & Organization		
Signature			Signature		

FOR LAB USE ONLY
Temperature of Samples: 5.9 °C Initials: mm Bottle ID #, if applicable 35464 ☐ Received on Wet Ice
Notes/Anomalies/Discrepancies:
GLEC may subcontract out analyses that we do not perform.

MATRIX CODES: S = SEDIMENT; SW = SURFACE WATER; E = EFFLUENT; GW = GROUNDWATER; SL = SLUDGE; AO = AQUATIC ORGANISM

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-1		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	C-5		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:35	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**2360**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**60**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

This report is for informational purposes only. This report may not be used for compliance pursuant to 40 CFR Part 141 and related regulations applicable to public water systems.

The results herein relate only to the items/batch tested, calibrated, or sampled in this report. "ND" indicates that the analyte was not detected nor present in the sample tested at levels at or above the limit of quantitation. Results only pertain to sample as recived or sampled by Enviro Lab Services Inc.

Enviro Lab Services, Inc.
4150 Arrow Street, Oscoda, MI 48750
Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-2		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	C-15		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:37	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**2160**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**60**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

This report is for informational purposes only. This report may not be used for compliance pursuant to 40 CFR Part 141 and related regulations applicable to public water systems.

The results herein relate only to the items/batch tested, calibrated, or sampled in this report. "ND" indicates that the analyte was not detected nor present in the sample tested at levels at or above the limit of quantitation. Results only pertain to sample as recived or sampled by Enviro Lab Services Inc.

Enviro Lab Services, Inc.
4150 Arrow Street, Oscoda, MI 48750
Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-3		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	C-30		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:40	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**2220**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**60**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

This report is for informational purposes only. This report may not be used for compliance pursuant to 40 CFR Part 141 and related regulations applicable to public water systems.

The results herein relate only to the items/batch tested, calibrated, or sampled in this report. "ND" indicates that the analyte was not detected nor present in the sample tested at levels at or above the limit of quantitation. Results only pertain to sample as recived or sampled by Enviro Lab Services Inc.

Enviro Lab Services, Inc.
4150 Arrow Street, Oscoda, MI 48750
Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-4		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	C-L		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:44	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**1220**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**40**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

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Enviro Lab Services, Inc.
4150 Arrow Street, Oscoda, MI 48750
Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-5		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	Jones-Culvert-UP		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:40	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**3440**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**40**	CFU/100mL	20	NA	NA

Definitions:
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POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

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Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-6		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	Jones-Bridge		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:55	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**4460**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**40**	CFU/100mL	20	NA	NA

Definitions:
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POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-7		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	J-Conf		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	9:12	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**5080**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**60**	CFU/100mL	20	NA	NA

Definitions:
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MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-8		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	J-NW1		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	9:00	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**9000**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**220**	CFU/100mL	20	NA	NA

Definitions:
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MCLG = Maximum contaminant level goal
Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-9		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	J-NW2		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:55	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**9020**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**180**	CFU/100mL	20	NA	NA

Definitions:
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MCLG = Maximum contaminant level goal
Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-10		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	J-SW		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	9:12	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**6560**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**380**	CFU/100mL	20	NA	NA

Definitions:
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MCLG = Maximum contaminant level goal
Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-11		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T1-5		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	9:00	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**8100**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**40**	CFU/100mL	20	NA	NA

Definitions:
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Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-12		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T1-15		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	8:55	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**3580**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**20**	CFU/100mL	20	NA	NA

Definitions:
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Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-13		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T1-30		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	9:23	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**6240**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**200**	CFU/100mL	20	NA	NA

Definitions:
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Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-14		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T2-5		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:02	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**2440**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**ND**	CFU/100mL	20	NA	NA

Definitions:
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MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-15		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T2-15		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:05	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**2600**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**ND**	CFU/100mL	20	NA	NA

Definitions:
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Comments:

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APPROVED BY:		Lab Director	Date:	8/29/2025

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-16		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T2-30		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:09	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**4120**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**100**	CFU/100mL	20	NA	NA

Definitions:
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MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

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APPROVED BY:		Lab Director	Date:	8/29/2025

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-17		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T3-5		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:18	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**4240**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**ND**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
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MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-18		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T3-15		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:21	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**1960**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**20**	CFU/100mL	20	NA	NA

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Comments:

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APPROVED BY:		Lab Director	Date:	8/29/2025

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Enviro Lab Services, Inc.
4150 Arrow Street, Oscoda, MI 48750
Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-19		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T3-30		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:28	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**2640**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**20**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

FINAL APPROVAL

APPROVED BY:		Lab Director	Date:	8/29/2025

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Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-20		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T4-5		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:31	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**3800**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**60**	CFU/100mL	20	NA	NA

Definitions:
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POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

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APPROVED BY:		Lab Director	Date:	8/29/2025

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Phone: (248)882-1245

USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-21		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T4-15		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:35	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**3680**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**20**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

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APPROVED BY:		Lab Director	Date:	8/29/2025

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USEPA Lab ID: MI9885 Michigan EGLE Lab ID: 9115

Laboratory Report

Order ID:	25082701		**Client:**	Kieser & Associates	
Sample ID:	25082701-22		**Project Name:**	Cedar Lake Improvement Board	
Client Sample ID:	T4-30		**Address:**	Cedar Lake, Oscoda MI 48750	
Sample Matrix:	Surface Water		**Contact:**	Rex Vaughn	
Sample Date/Time:	8/27/2025	10:52	**Reporting To:**	data@kieser-associates.com	
Received Date/Time:	8/27/2025	12:31			
Sample Collected By:	Crum/Kieser		**Phone #:**	269-344-7117	
			Report Date:	8/29/2025	

TEST: E. coli / Total Coliforms **Analyst:** Jonas Berenkowski **Analysis Date:** 8/27/2025 1:00:00 PM

Analyte	CAS #	Method	Result	Units	Reporting Limit	MCL[A]	MCLG[A]
Total Coliforms	N/A	mColiBlue-24	**1280**	CFU/100mL	20	NA	NA
E. coli	N/A	mColiBlue-24	**20**	CFU/100mL	20	NA	NA

Definitions:
ND = Not detected
POS = Analyte detected in sample above reporting limit
MCL = Maximum contaminant level
MCLG = Maximum contaminant level goal
Comments:

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APPROVED BY:		Lab Director	Date:	8/29/2025

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Chain of Custody

Form #FO-20

Enviro Lab Services, Inc.
4150 Arrow Street
Oscoda, MI 48750

Contact
Phone: (620) 417-3608
www.envirolabservice.com

USEPA Lab ID: MI9885
Michigan EGLE Lab ID: 9115

Client Name:	Kieser & Associates
Address:	536 E Michigan Ave, ste 300, Kalamazoo, MI 49007
Report To:	Natalie Crum
Phone #:	269-344-7117
Email:	data@kieser-associates.com
Sampler Name:	Crum / Kieser
Order ID (Lab Use Only):	25082701
Sampling Address:	Cedar Lake, Oscoda, MI

Sample Identification	Matrix	Sample Type	Preservatives	Date Collected	Time Collected	Container #	Lab Sample Identification (Lab Use Only)	EPA 200.8 Metals	Partial Chemistry	EPA 537.1 PFAS in Drinking Water	EPA 1633 Aqueous PFAS	EPA 1633 Solids PFAS	Bacteria (E. coli/Coliform)	Notes	Sample Receipt (Lab Use Only) Temp °C	Sample Receipt (Lab Use Only) pH
C-5	SW	grab		8/27/25	8:35	1	25082701-1						X			
C-15					8:37		25082701-2						X			
C-30					8:40		25082701-3						X			
C-L					8:44		25082701-4						X			
Jones-culvert-up					8:40		25082701-5						X			
Jones-Bridge					8:55		25082701-6						X			
J-conf					9:12		25082701-7						X			
J-NW1					9:00		25082701-8						X			
J-NW2					8:55		25082701-9						X			
J-SW					9:23		25082701-10						X			

Tran. #	Released By	Received By	Date	Time
1			8-27-25	15:00
2				
3				

Chain of Custody

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Oscoda, MI 48750

Contact
Phone: (620) 417-3608
www.envirolabservice.com

USEPA Lab ID: MI9885
Michigan EGLE Lab ID: 9115

Client Name:	Kieser & Associates		
Address:	536 E Michigan Ave, ste 300, Kalamazoo, MI 49007		
Report To:	Natalie Crum		
Phone #:	269-344-7117		
Email:	data@kieser-associates.com		
Sampler Name:	Crum / Kieser	Order ID (Lab Use Only):	25082701
Sampling Address:	Cedar Lake, Oscoda, MI		

Sample Identification	Matrix	Sample Type	Preservatives	Date Collected	Time Collected	Container #	Lab Sample Identification (Lab Use Only)	EPA 200.8 Metals	Partial Chemistry	EPA 537.1 PFAS in Drinking Water	EPA 1633 Aqueous PFAS	EPA 1633 Solids PFAS	Bacteria (E. coli/Coliform)	Notes	Sample Receipt (Lab Use Only) Temp °C	Sample Receipt (Lab Use Only) pH
T1-S	SW	grab		8-27-25	10:02	1	25082701-11						X			
T1-15					10:05		25082701-12						X			
T1-30					10:09		25082701-13						X			
T2-S					10:18		25082701-14						X			
T2-15					10:21		25082701-15						X			
T2-30					10:28		25082701-16						X			
T3-S					10:31		25082701-17						X			
T3-15					10:35		25082701-18						X			
T3-30					10:52		25082701-19						X			

Tran. #	Released By	Received By	Date	Time
1			8-27-25	15:05
2				
3				

Chain of Custody

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4150 Arrow Street
Oscoda, MI 48750

Form #FO-20
Contact
Phone: (620) 417-3608
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USEPA Lab ID: MI9885
Michigan EGLE Lab ID: 9115

Client Name:	Kieser & Associates		
Address:	536 E Michigan Ave, Ste 300, Kalamazoo, MI 49007		
Report To:	Natalie Crum		
Phone #:	269-344-7117		
Email:	data@kieser-associates.com		
Sampler Name:	Crum / Kieser	Order ID (Lab Use Only):	25082701
Sampling Address:	Cedar Lake, Oscoda, MI		

Sample Identification	Matrix	Sample Type	Preservatives	Date Collected	Time Collected	Container #	Lab Sample Identification (Lab Use Only)	EPA 200.8 Metals	Partial Chemistry	EPA 537.1 PFAS in Drinking Water	EPA 1633 Aqueous PFAS	EPA 1633 Solids PFAS	Bacteria (E. coli/Coliform)	Notes	Sample Receipt (Lab Use Only) Temp °C	Sample Receipt (Lab Use Only) pH
T4-5	SW	grab		8-27-25	10:39	1	25082701-20						X			
T4-15					10:42		25082701-21						X			
T4-30					10:55		25082701-22						X			

Tran. #	Released By	Received By	Date	Time
1	RA Vaughn		8/27/25	12:31 PM
2				
3				

ATTACHMENT E

Statistical Analyses for August 27, 2025 SRP Data

ATTACHMENT E

Statistical Analysis of Nearshore SRP Data from August 27, 2025

K&A completed select statistical analyses of SRP sampling results from the August 2025 water quality survey. These analyses were conducted to examine the nature of three targeted nearshore areas including: Jones Ditch, Suspect Nearshore and Control sampling zones. Results are reported herein.

Average SRP Concentrations by Nearshore Zone

Figure E-1 compares the mean SRP values across the three sampling zones. Findings indicate that Jones Ditch exhibits the highest mean SRP concentration at 4.3 µg/L, followed by the suspect nearshore area at 2.8 µg/L and the control at 1.7 µg/L.

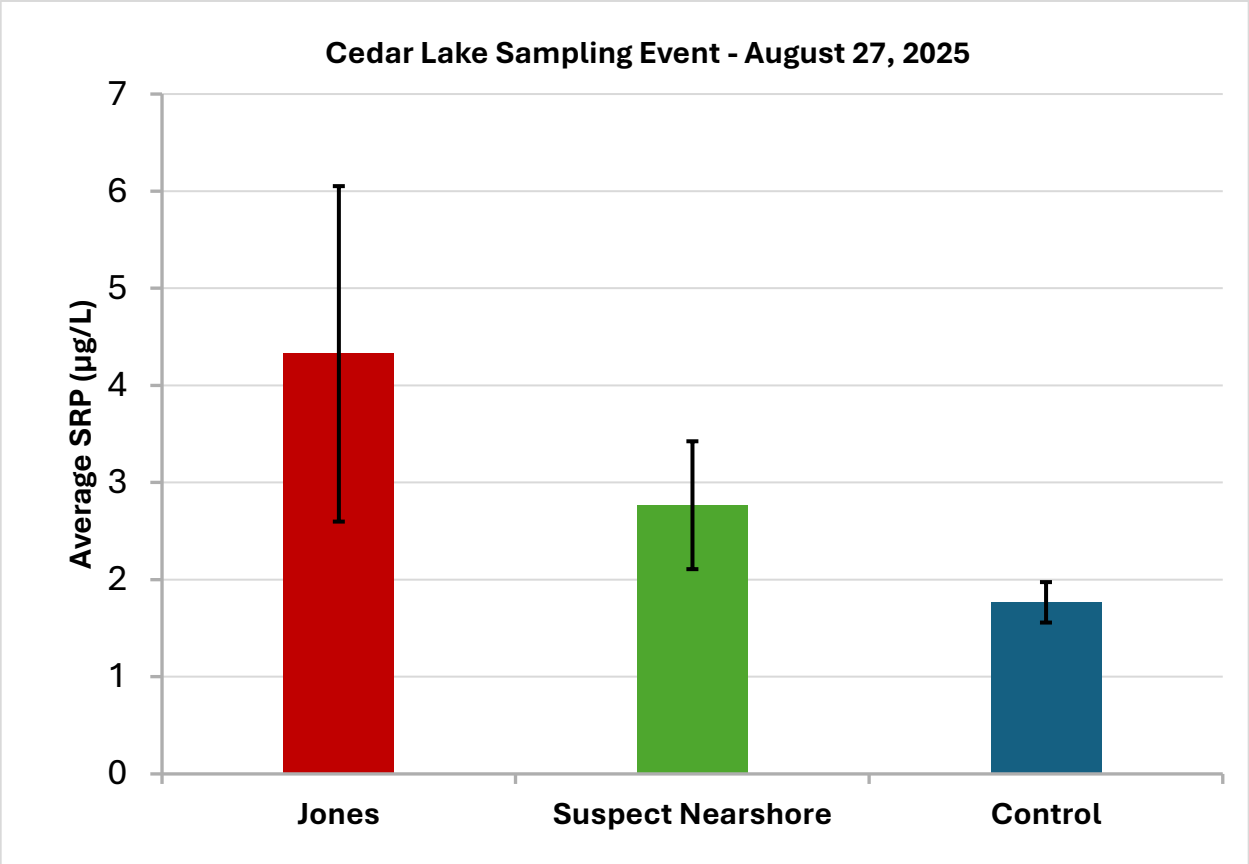

Figure E-1. Mean SRP(µg/L) concentrations at three sampling locations; error bars represent +/- 1standard deviation. Jones Ditch is based on 4 nearshore samples, 12 in the suspect area and three in the Control zone.

The standard deviation around the mean for Jones Ditch exhibits the greatest variability in comparison to the lower standard deviations for the suspect nearshore and control areas. The variability within the data for Jones and the suspect area suggests that the averages for these two

areas may not be significantly different, given the overlap in their standard deviations. The standard deviation for the control area does not overlap with either of the other two, suggesting the average for the control area is significantly different, while the overlap between Jones and nearshore samples does not.

Figure E-2 shows the average SRP levels at each nearshore sampling site south of Jones Ditch, along with individual data points at and north of the ditch confluence with the shoreline. For the suspect nearshore zone south of Jones Ditch and the control area, averages represent the three sampling points of each transect. Interestingly, mapped results indicate that the average SRP concentration increases as it gets closer to Jones Ditch (white arrows) from the south and somewhat so for sampling results at, and north of the confluence. This suggests a hot spot or source of SRP originating from the confluence area.

Figure E-2. Average SRP (µg/L) at each sampling site.

T-test Results

Due to statistical uncertainty between locations associated with differing sample sizes, a T-test was used to determine whether the difference between means of two groups is statistically significant considering their variability, standard deviation and sample size. The test will provide T-values that are critical to understand the difference between the mean values of two locations,

as well as a P-value. Simply, if the P-value is greater than 0.05 (a threshold scientists commonly use), then the difference in mean values could easily be due to randomness. However, if the P-value is smaller than 0.05, it means there is less than a 5% chance that the observed difference is due to random chance (i.e., the difference is real and statistically significant).

Table E-1 presents the T-test analysis comparing the suspect nearshore data with the nearshore control location. A comparison between the "T-stat" value and the "T-Critical" value can indicate whether there is a significant difference between the mean values of the two locations. Since the T-stat value (4.45) is larger than the T-Critical value (2.20), there is a statistically significant difference between the two means at the 95% confidence level. Additionally, because the P-value (0.00) is smaller than 0.05, the difference between the means of the two locations is statistically significant despite the difference in sample size between the locations. There is a 0.0% probability that such a difference (or greater) could occur by random chance.

Table E-1. T-test: Two-sample assuming unequal variances between the suspect nearshore area and the control area. The control area is based on three nearshore samples not including the in-lake sample.

Statistical Variable	***Suspect nearshore***	***Control***
Mean	2.77	1.77
Variance	0.43	0.04
Observations	12	3
Hypothesized Mean Difference	0	
Df	11	
t Stat	4.45	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.80	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.20	

Table E-2 presents the T-test analysis comparing the nearshore Jones Ditch sample mean with the suspect nearshore location. The result of the T-stat value (1.76) is smaller than the T-Critical value (3.18) suggesting there is no statistically significant difference between the two means at the 95% confidence level. Additionally, because the P-value (0.18) is larger than 0.05, the difference between the means of the two locations is not statistically significant, and there is approximately an 18% probability that such a difference (or greater) could occur by random chance.

Table E-2. T-test: Two-sample assuming unequal variances between the Jones Ditch area and the suspect nearshore area. Jones area is based on only four samples and does not include the two creek samples.

Statistical Variable	***Jones***	***Suspect nearshore***
Mean	4.33	2.77
Variance	2.98	0.43
Observations	4	12
Hypothesized Mean Difference	0	
df	3	
t Stat	1.76	
P(T<=t) two-tail	0.09	
t Critical two-tail	2.35	

T-test results suggest that the variation and distribution of the SRP values at the suspect nearshore and control locations are not within the expected normal range, despite the differences in sample size. However, the SRP values between Jones Ditch and the suspect nearshore locations are not significantly different, and these differences are attributable to random variation. This further supports the hypothesis that a source (or sources) of SRP near Jones Ditch is influencing the observed results. Based on the T-test analysis and Figure E-2, this sourcing appears to influence the SRP levels at the suspected nearshore area.

Shapiro-Wilk Normality Test

The Shapiro-Wilk normality test was conducted to understand whether the SRP distribution in each location is normal. The results show that all SRP values are normally distributed within their respective locations suggesting that a potential SRP source near Jones Ditch is mainly causing increased nutrient levels around the two sampled areas north and south of the Jones Ditch confluence, but not significantly affecting all three locations.

Quantile (Q)–Quantile (Q) Plots

Quantile (Q)–Quantile (Q) plots are a graphical comparison used here to determine whether the SRP values in each zone are normally distributed. Figure E-3 shows the Q-Q plots for all three locations, highlighting a normal distribution in each area with Jones Ditch nearshore results being the least normally distributed (lowest R^2 value). This again supports the notion that the SRP distribution within each area is normally distributed, indicating that the factor elevating SRP concentrations at Jones Ditch primarily affects the values in that area.

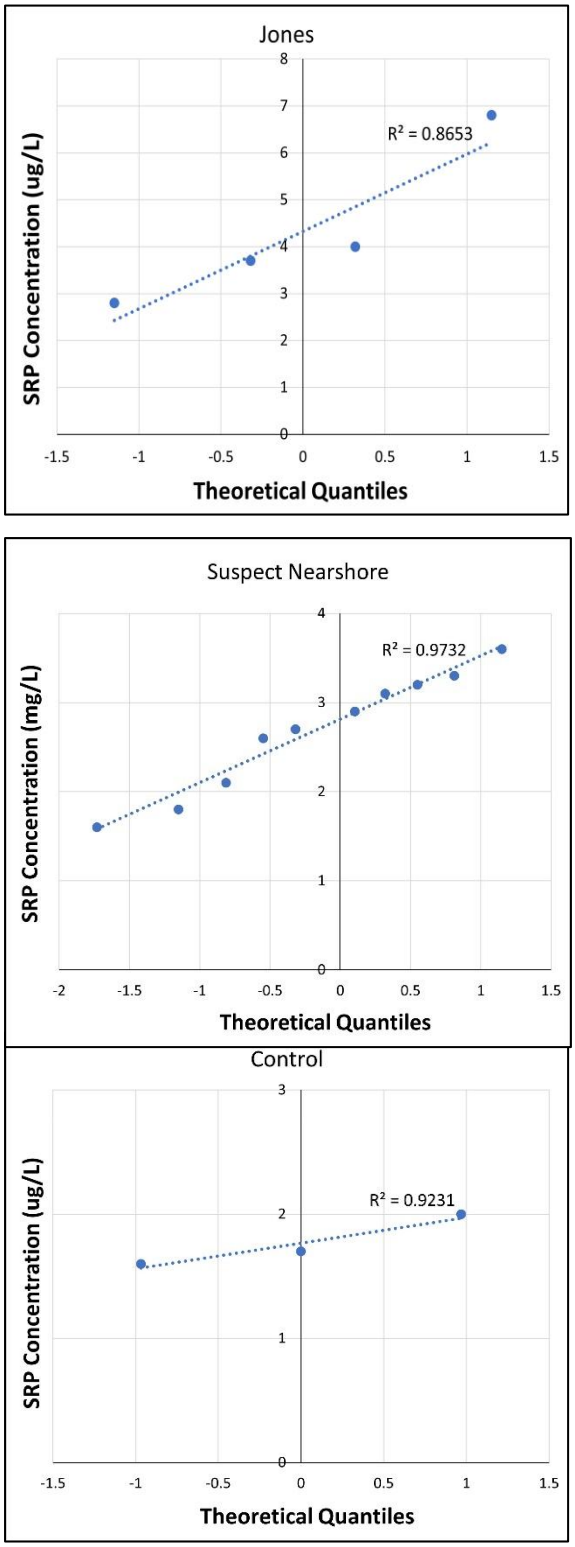

Figure E-3. Q-Q plots for all sample locations showing the normal distribution of SRP values in each area.

Prediction Limit Equation

Finally, the prediction limit equation represented as: prediction limit = mean + (standard deviation * t-value) is used to provide an upper bound for where a future observation might fall based on the available SRP results. Based on these predictions in Table E-3, the Jones Ditch area is expected to have higher results compared to the other locations. This further supports the notion that Jones Ditch shoreline area is experiencing an increasing SRP level due to a nearby source.

Table E-3: Upper Prediction limit of SRP concentration at Cedar Lake.

Sampling Location	SRP Prediction limit (*u*g/L)
Jones Ditch	10.47
Suspect Nearshore	4.27
Control	2.80

Notable are the July 2, 2025 nearshore SRP concentrations collected in front of the suspect nearshore location that ranged from 4-7 *u*g/L. These suggest the corresponding nearshore prediction limit is realistic.

Summary

Results of statistical analyses confirm that measured SRP levels on August 27, 2025 reflect a localized source of phosphorus at or near the Jones Ditch confluence with the Cedar Lake shoreline. Data are statistically different in the nearshore control area with lower SRP concentrations (to the south of the suspect nearshore area) than concentrations in sampling zones to the north surrounding Jones Ditch. Averaged nearshore zone concentrations and individual data also tend to point to a Jones Ditch localized source.

Statistical analyses of these snap-shot sampling results for a single date in August 2025 provide sufficient indications of external SRP loading to Cedar Lake in the immediate vicinity of the Jones Ditch confluence where luxuriant algal growths have been observed. These tests, however, do not necessarily distinguish whether the source is only Jones Ditch or Jones Ditch and possible localized septic systems discharges.

The potential for septic system discharges is evidenced by bacterial sampling results (reported in the main body of this memorandum) and Attachment F modeling of nearshore P concentrations. Additional testing will be needed to confirm sources of SRP. Such monitoring would include shallow groundwater testing near the shoreline for both SRP and bacterial levels. Bacterial source tracking for Jones Ditch is also recommended. This would require DNA testing to determine whether upstream bacterial detections are human or animal. Limited DNA testing of shallow groundwater along the shoreline would help confirm that the only source in groundwater (if detected) would be upgradient septic system drain fields.

ATTACHMENT F

Nearshore Mass Balance Analysis of Jones Ditch SRP Loading

Attachment F

Jones Ditch Phosphorus Loading Contributions to Nearshore Waters

Overview

Using flow and phosphorus data from Jones Ditch, K&A preliminarily examined the loading of SRP as lbs/day from the Ditch to the lake for August 2025 sampling conditions. This was completed using a propriety K&A nearshore loading model based on a traditional flow net analysis to create a phosphorus mass balance for targeted nearshore areas. The purpose of this exercise was to simulate the resultant nearshore SRP concentrations based solely on Jones Ditch loads. If loading simulations generated the actual nearshore concentrations measured in the suspect areas, Jones Ditch could be considered the sole source of P loading. If loading was not sufficient to generate measured nearshore concentrations, then other sources might be present.

The model used a Jones Ditch flow of 0.056 cfs and an SRP concentration of 4.5 *u*g/L measured just upstream from its confluence at the shoreline on August 27, 2025 (Figure F-1). A background lake concentration of 1.6 *u*g/L was used based on the lowest measured nearshore SRP level at the southern control site. As illustrated in Attachment E, this southern location is statistically different than the sampled areas to the north and south of Jones Ditch. This makes it reasonable to use the 1.6 *u*g/L as a background nearshore concentration.

Algal uptake of SRP was not considered in these simulations, despite the typically high uptake associated with prolific growth. This makes model assumptions more conservative in forecasting Jones Ditch load impacts on nearshore SRP concentrations.

The modeling exercise assumed an area of 10,500 ft^2 (a zone 350 feet along the lakeshore, extending 30 feet into the lake). Using an average depth of 3 feet for this area resulted in a nearshore water volume of 31,500 cubic feet of lake water (or 236,000 gallons) as the mixing zone. Figure E-1 conceptually illustrates the area of mixing considered in this analysis.

The model simulated nearshore concentrations over time, examining how long it would take the volume of nearshore water (at a starting concentration of 1.6 *u*g/L) to reach the observed average SRP concentration of 3.2 *u*g/L based on measured concentrations within this area. Simulations also considered water volume replacement by mixing with other lake water (at 1.6 *u*g/L) under conditions of 0, 10 and 80% daily replacement volumes. These latter assumptions allow for consideration of a range of wind mixing scenarios such as: no wind (0% mixing), light winds (10% mixing) and windy nearshore conditions (80% mixing) for the period of simulation. The 0% mixing condition is never likely to happen in nature because water currents can be generated by winds, temperature differences, tributary inflows, groundwater upwelling and boat traffic. It is used here as an illustration of the most conservative mass balance assumption of no mixing and

no algal uptake to determine whether there is sufficient Jones Ditch loading to minimally reach measured nearshore lake concentrations.

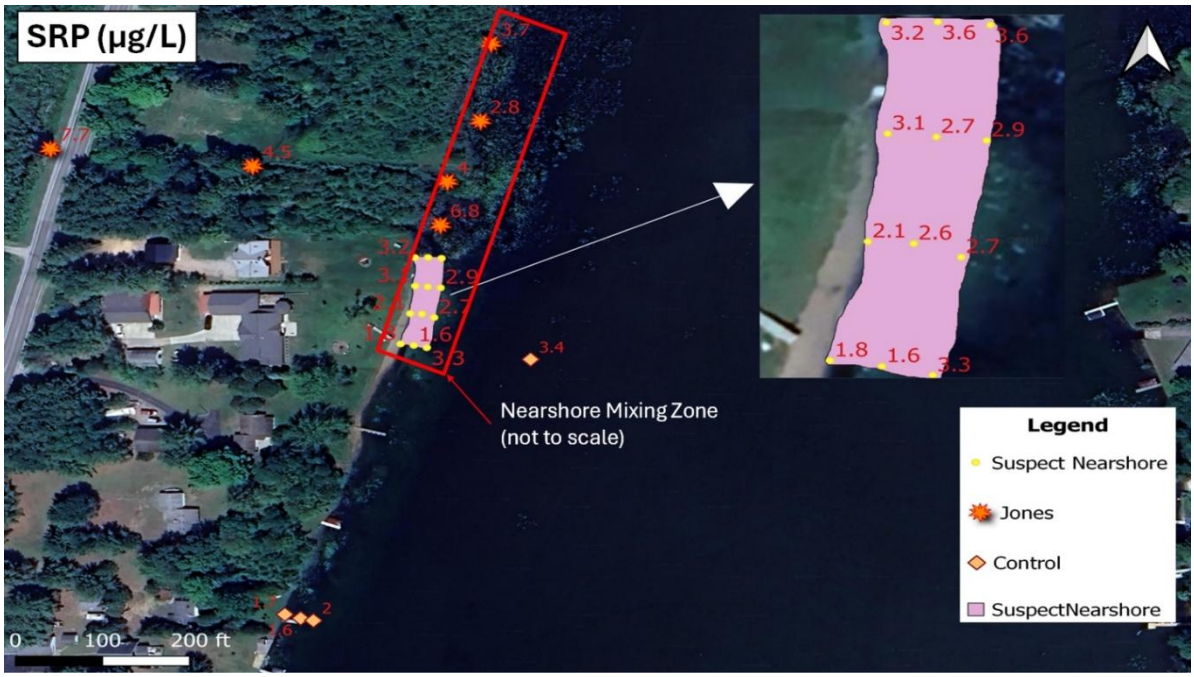

Figure F-1. Hypothetical mixing zone overlaying the suspected nearshore area and the Jones Ditch Shoreline.

Simulation Results

Figure F-2 shows a hypothetical SRP accrual in the nearshore zone over a 5-day period starting at a lakeshore concentration of 1.6 *u*g/L. With no mixing, the 3.2 *u*g/L average measured nearshore concentration of SRP is reached in five days. With some mixing (10%), simulated concentrations only reach 2.2 *u*g/L within five days. If windy conditions prevailed over this 5-day timeframe, nearshore concentrations would peak at 2 *u*g/L in one day, then diminish by continuous dilution.

To illustrate hypothetical nearshore phosphorus concentrations over a 30-day period, Figure F-3 shows results for this longer simulation period. Though rather unrealistic, no lake water mixing in the nearshore area would result in an equilibrium concentration of 4.5 *u*g/L after one month of only Jones Discharge P discharges. With 10% mixing, the measured nearshore average concentration of 3.2 *u*g/L would be reached after 14 days with just Jones Ditch inputs. The 80% mixing scenario would suggest that nearshore conditions would bounce back to a lake-wide average SRP concentration of 1.6 *u*g/L after 7 days. Again, these scenarios focus only on Jones Ditch loading and no algal uptake.

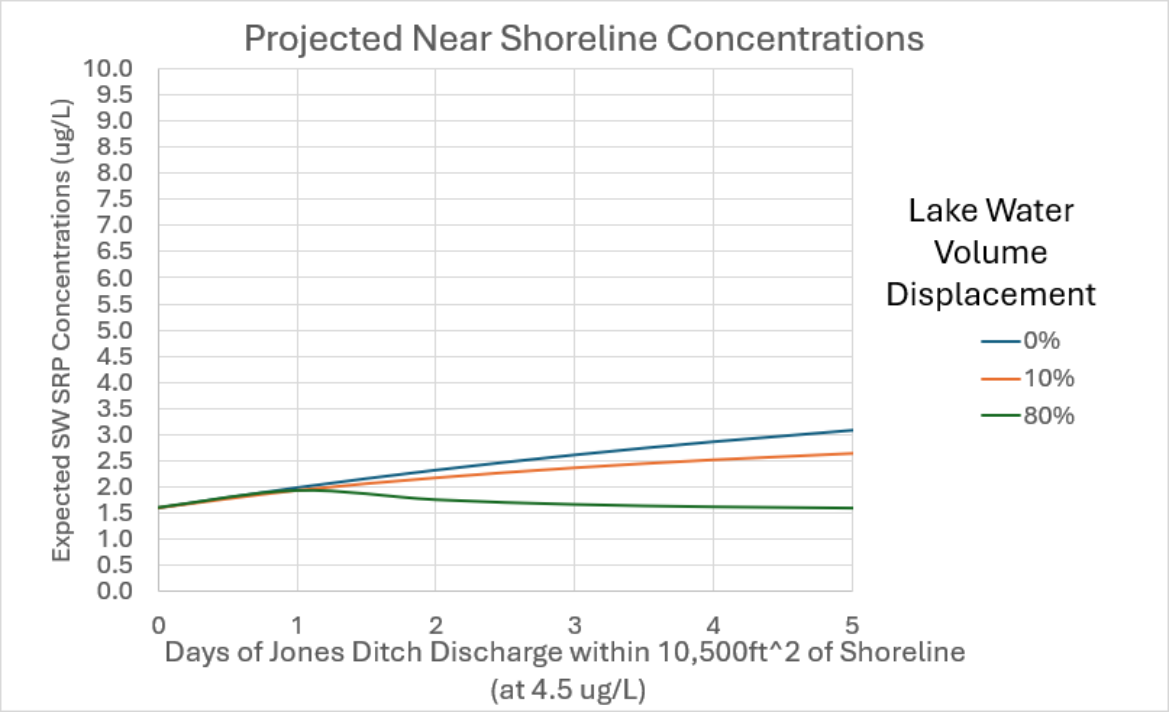

Figure F-2. Hypothetical 5-day nearshore concentrations with Jones Ditch loading to the nearshore mixing zone.

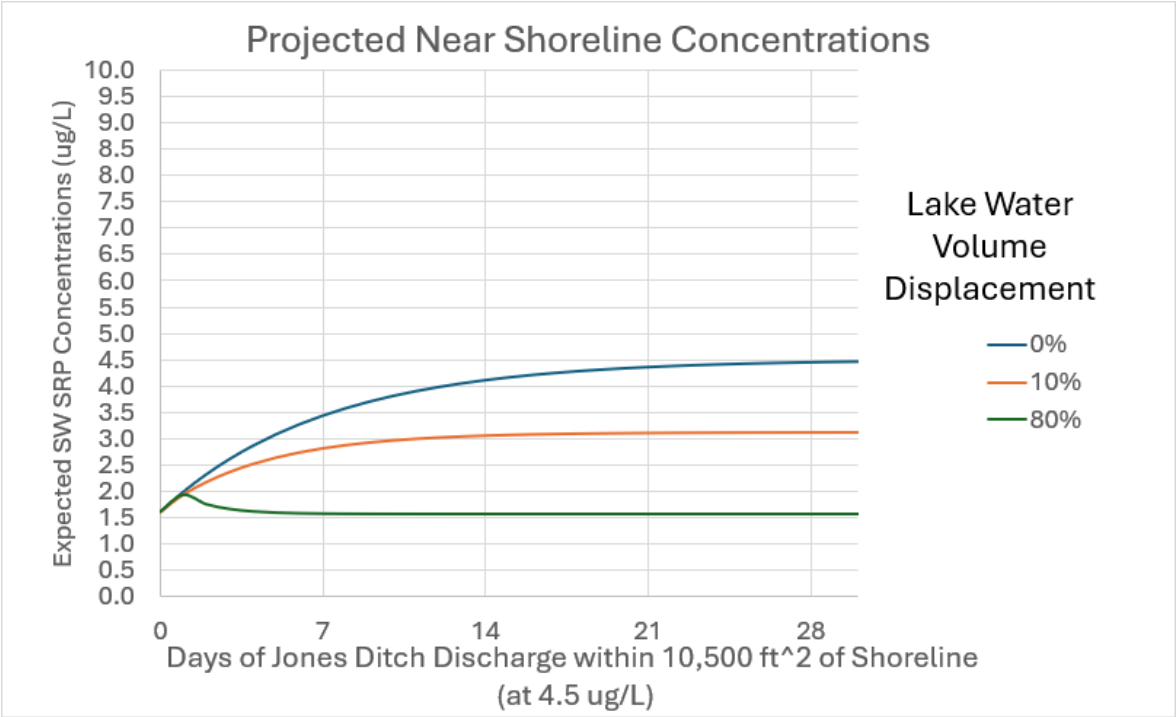

Figure F-3. Hypothetical 30-day nearshore concentrations with Jones Ditch loading to the nearshore mixing zone.

Summary

The short-term (5-day) hypothetical loading conditions (Figure F-2) could be considered representative of likely episodic mixing conditions typically experienced along the lakeshore, ranging from light wind to heavy wind mixing. For five days leading up to the August 27, 2025 sampling, winds were predominantly from the west. As reported in the main body of this memorandum, a wind shadow effect from the treed shoreline likely diminished substantial nearshore mixing before and during the sampling event. If hypothetically, there was 0% mixing under these conditions at the time of sampling, then Jones Ditch loading could have resulted in the 3.2 *u*g/L average mixing zone SRP concentration. This would suggest Jones Ditch could be the sole source of phosphorus, if negating uptake of soluble phosphorus by luxuriant algal growths in the suspect nearshore area, as well as any mixing.

With 10% light mixing under the 5-day scenario, the measured average nearshore concentration does not appear achievable with the ditch as the sole source of phosphorus. Given the high level of expected algal uptake in the suspect nearshore area, it could be postulated that SRP concentrations would be higher in the absence of these growths. This would further suggest other P sources to the nearshore, given that simulated P loading from only Jones Ditch falls short of generating the measured average nearshore mixing zone P levels.

The 30-day simulations might also suggest that Jones Ditch is not the sole source of P to nearshore waters. Lake water circulation over this length of time likely falls between the 10-80% mixing zone conditions such that Jones Ditch loads at this time of the year might not be sufficient to generate measured nearshore phosphorus concentrations.

Jones Ditch flow logger data established as part of the ongoing CLIB lake level monitoring program have not yet been retrieved for 2025. Nearshore SRP concentrations in the targeted nearshore zone ranged from 4-7 *u*g/L, averaging 5.5 *u*g/L on July 2, 2025. These are higher levels than noted on August 27th. Higher ditch flows could have been occurring during the July sampling; thus, these will be checked when logger data are retrieved by late November, 2025 to similarly consider Jones as the possible sole source of P to these nearshore areas.

Overall, this hypothetical modeling of Jones Ditch SRP loading impacts suggests there may be other sources of nearshore phosphorus. Sediment phosphorus release is not considered as one of these, leaving open the possibility of septic system discharges. Shallow groundwater sampling along the shoreline at the nearshore suspect location would confirm or refute the notion septic system discharges to the lake. Such sampling should include both SRP and bacteria.