Aquatic Enhancement
& Survey, Inc.

Draft 2022 Water Quality Sampling Report
Steuben County Lakes Council
Steuben County, Indiana

December 1, 2022

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Acknowledgements

I would like to thank the following people for making possible the 2021 season sampling and the preparation of this report: Bill Schmidt, Cheryl Silverhart, Cheri Stroh, Pete Hippensteel and the membership of the Steuben County Lakes Council, the Anthony Wayne Council, Keith Chrysler, and Dean Rosener. Laboratory analysis for this work was performed by Sandhill Environmental, Waterloo Indiana. Field work and report preparation was performed by Scott Banfield, Tyler Herrington, and Sue Smith of Aquatic Enhancement & Survey, Inc.

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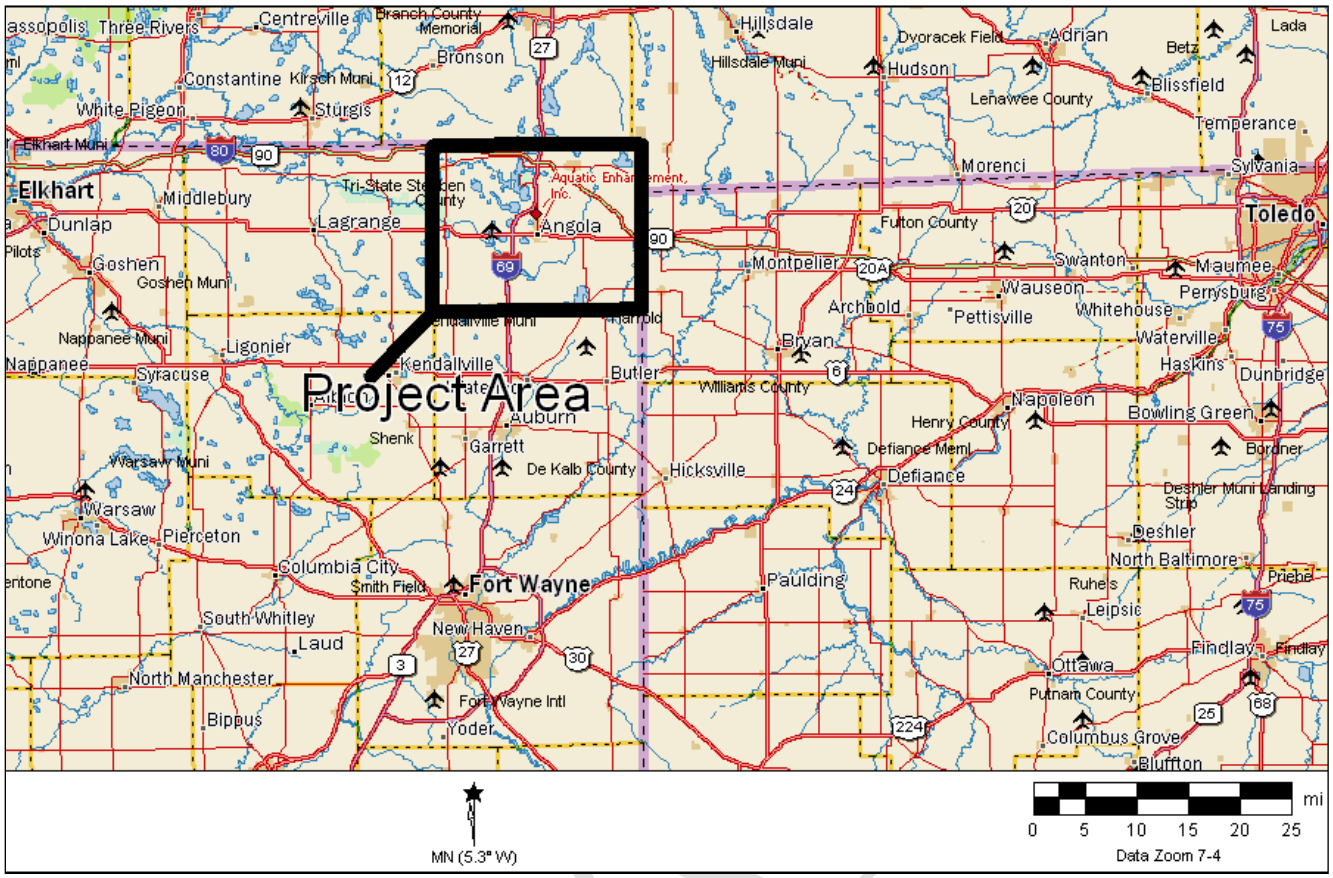

Figure 1 Project location map

1. Project Overview and Purpose:

This project was completed by Aquatic Enhancement & Survey, Inc. under contract with the Steuben County Lakes Council (SCLC) and Angola/Trine MS4. Also partnered with the SCLC in support of this work was the Steuben County Surveyor's Office, and the Clear Lake Township Land Conservancy. Basic water quality data and stream flow (discharge) measurements were collected from 58 sites on several streams and lakes in Steuben County, Indiana, LaGrange County, Indiana, and Branch County, Michigan. Two additional sites were sampled by volunteers and included in the data in this report. Sampling reported in this work was completed in May, July, August and September of 2022. Figure 2 (page 6) displays sampling locations and associated surface water features. For most sites, measured parameters included total phosphorus, total suspended solids, pH, dissolved oxygen, temperature, specific conductance, and E-coli. A basic measurement of stream flow-rate (discharge) at each sampling site was taken when conditions permitted.

Total phosphorus and total suspended solids loading figures were calculated for certain sites at which these measurements were detectible and at which a flow measurement was taken. The purpose of the sampling was to gain a basic understanding of the fate and source of contaminants in these systems with a goal of directing future sampling or directing remediation of watershed point and non-point pollution sources. Table 1 provides a site key showing brief written descriptions of each numbered sampling site. Collected data and calculated loading rates are provided in tables 1-6.

2. Methods:

All samples collected were grab samples. All samples were placed on ice immediately after collection. Measurements for temperature, dissolved oxygen, and specific conductance were taken in the field using a meter. Measurements of pH were taken in the field using a meter or measured in the laboratory. Meters were calibrated at the beginning of each sampling day. Where possible, stream flows were calculated using measurements of the stream cross-sectional area and stream velocity. Stream flow cross-sectional area was calculated by measuring stream width using a tape measure and calculating average stream depth by measuring depth at multiple equidistant points using a measuring staff or tape measure. Quality Assurance Procedures and EPA method codes for laboratory analysis are available upon request.

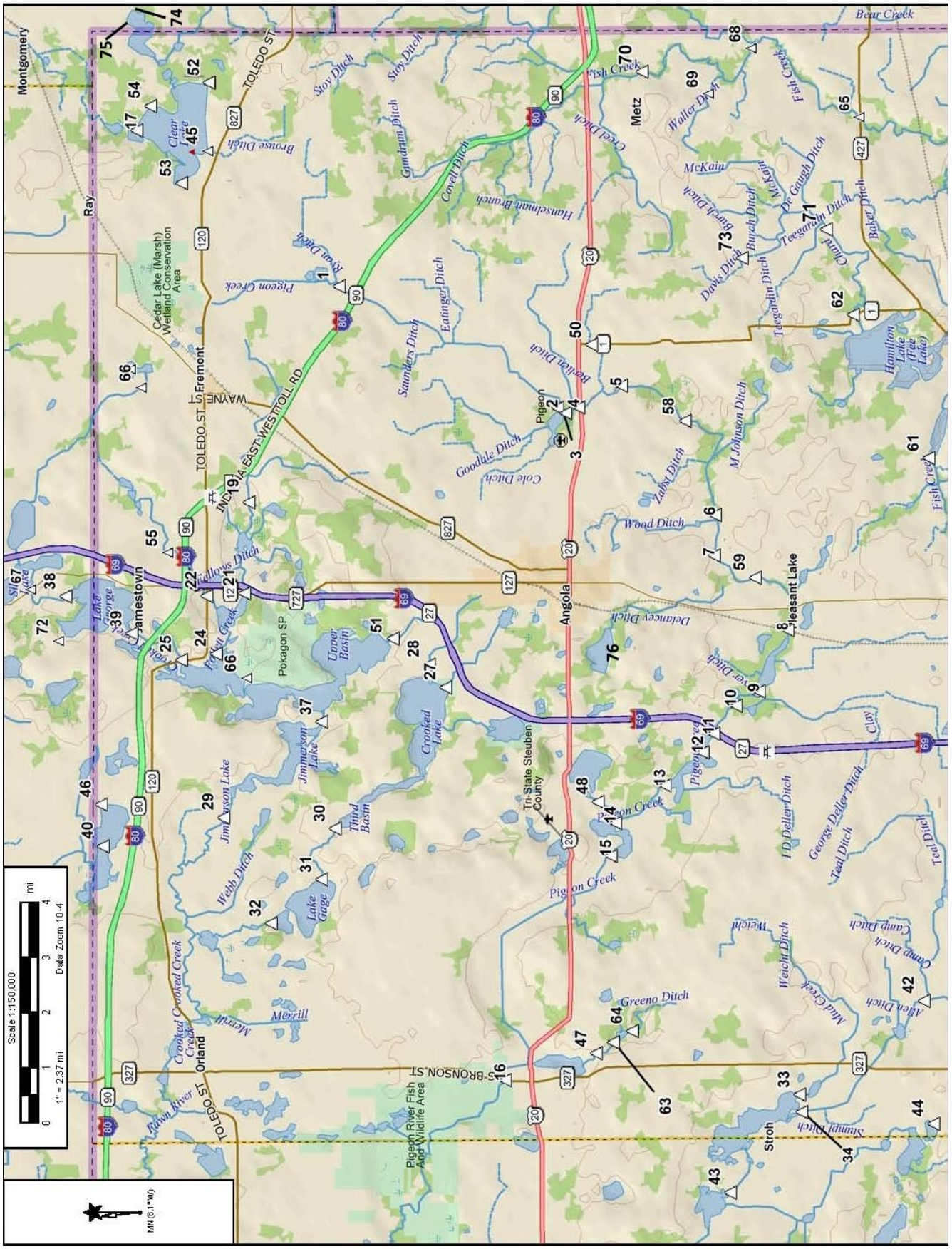

Figure 2 Sampling site map

Samp. Site	SCLC funded	At or near HUC 12 Outlet (10)	At or near HUC14 Outlet Site (13)	Steuben Surveyor Funding (6)	MS4 Funding (4 sites)	Clear Lake funding (2)	Ham Funding (2)	George Funding (2)	Snow Funding (1)	Location Description
1.	yes		yes							Pigeon, East Ray Clark Road at culvert, below juncture with the Ryan Ditch.
2.	yes									Pigeon Creek, Pigeon Lake Inlet.
3.*	yes									Pigeon Creek, Pigeon Lake Outlet. *May only
4.	yes	yes	yes							Pigeon, U.S. 20 Bridge, Below juncture with Berlien Ditch.
5.	yes									Pigeon Creek, Metz Road.
6.		yes	yes		yes					Pigeon Creek, Bill Deller Road.
7.					yes					Pigeon Creek, Meridian Road.
8.	yes									Pigeon Creek, Long Lake Inlet.
9.*	yes									Pigeon Creek, Long Lake Outlet. *May only
10.	yes	yes	yes							Pigeon Creek, Mud Lake Outlet just west of Long Lake, Johnson Ditch from Ashley.
11.*	yes									Pigeon Creek, Big Bower Lake Inlet. *May only
12.	yes									Pigeon Creek, Big Bower Lake Outlet/Golden Lake Inlet.
13.*	yes									Pigeon Creek, Golden Lake Outlet. *May only
14.	yes									Pigeon Creek, Hogback Lake Inlet.
15.	yes	yes	yes							Pigeon Creek, Hogback Lake Outlet.
16.	yes	yes*	yes*							Pigeon Creek at 327.
17.	yes		yes							Clear Lake Outlet.
19.	yes									Crane Marsh Outlet, (tributary to Marsh Lake).
21.	yes									Follet Creek, Little Otter Lake Inlet.
22.	yes									Walter's Lakes Drain (tributary to Big Otter Lake).
24.	yes									Follet Creek, Snow Lake Inlet.
25.	yes									Crooked Creek at 120 (Tributary to Snow Lake).
27.	yes									Carpenter Ditch (Tributary to Crooked Lake).
28.	yes									Palfreyman Ditch (Tributary to Crooked Lake).
29. *	yes	yes*	yes*							Crooked Ck (Jimm. Outlet Nevada Mills). *May only
30.	yes									Concorde Creek (Outlet from Crooked Lake).
31.	yes									Concorde Creek (Inlet to Lake Gage).
32.	yes	yes*	yes*							Concorde Creek (Outlet from Lime Lake).
33.	yes									Dewitt Ditch (Tributary to Big Turkey Lake).
34.	yes									Turkey Creek (Tributary to Big Turkey Lake).
37.	yes									Crooked Creek (James Outlet, Jimmerson Inlet at 4 corners).
38.	yes									Lake George NE tributary (from Silver Lake).
39.	yes		yes							Crooked Creek (Lake George Outlet).
40.	yes									Lake Pleasant.
42.	yes	yes	yes							Turkey Ck at 700S east of 800W, below Little Turkey and Deetz Ditch juncture.
43.	yes	yes*	yes*							Big Turkey Outlet at 350S on curve north of Stroh or west of Turkey Lake Tavern.
44.	yes									Trib. To McClish Lake (east end).
45.	yes									Trib. To Clear Lake (Cyrus Brouse Ditch).
46.	yes									Trib. To Lake Pleasant (East End).
47.	yes									Trib. To West Otter (Between Arrowhead and Otter).
48.	yes									Trib. Between Silver and Hogback.
50.	yes									William Jack Ditch (at State Rd. 1).
51.	yes									Croxton Ditch (at West 275 North).
52.				yes						Clear Lake Trib. (Harry Teeters Ditch).
53.						yes				Clear Lake Trib. (Peter Smith Ditch).
54.						yes				Clear Lake Trib. (Alvin Patterson Ditch).
58.					yes					Pigeon Creek at Hanselman.
59.					yes					Pigeon Creek at 400 South.
61.				yes						Tributary to Ball Lake.
62.				yes						Black Creek, Tributary to Hamilton Lake.
63.	yes									Tributary just downstream of Arrowhead Lake.
64.				yes						Tributary to Arrowhead Lake at south end of Arrowhead Lake
65.	yes									Fish Creek at 427
68.	yes									Fish Creek at E 400 S
69.	yes									Fish Creek at S 850 E (5/19/17 upstream of S 850 E)
70.	yes									Fish Creek at E Metz Rd.
72.								yes		Trib. to Lake George at 150 W, N. of launch
74 *	yes									East Trib. to Little Long Lake *volunteer sampled
75 *	yes									Trib. To Little Long Lake, Derr Drain *volunteer sampled
76	yes									Fox Lake Beach

Table 1 Descriptions of numbered sampling sites

	Date	E-coli (CFU or colonies/100 ml)	CFM Discharge	Total Phos. (ppm)	Total Phos. Loading (kg/day)	TSS (ppm)	TSS Loading (kg/day)	D.O.	pH	Temp (F)	Specific Conductance	Post rain event *
1	5/23/22	146.7	428.95	0.029	0.51	2.7	47.23	9.1	7.76	50.9	561	
2	5/23/22	260.3	828.42	0.029	0.98	5.5	185.81	10.4	8.08	53.2	559	
3	5/23/22	8.6	1217.30	0.013	0.65	2.8	139.00	9.0	8.32	62.3	547	
4	5/23/22	65.7	1761.19	0.040	2.87	6.6	474.03	8.5	8.16	62.0	570	
5	5/23/22	60.2	1720.91	<.010	nd	4.1	287.74	8.3	8.06	63.2	585	
6	5/23/22	102.5	1576.19	0.049	3.15	3.2	205.69	8.8	8.06	60.1	550	
7	5/23/22	176.8	2666.25	0.065	7.07	8.8	956.84	8.9	8.04	59.5	627	
8	5/23/22	108.1	5030.05	0.052	10.67	5.7	1169.24	9.4	8.09	58.8	616	
9	5/23/22	3.0	3687.77	0.035	5.26	1.2	180.47	8.4	8.17	65.5	521	
10	5/23/22	17.3	3269.45	0.026	3.47	3.2	426.66	8.8	8.10	64.9	635	
11	5/23/22	41.0	nd	0.030	nd	3.8	nd	8.5	8.10	65.1	625	
12	5/26/22	186.0	5786.59	0.037	8.73	3.6	849.53	8.2	8.16	65.7	634	
13	5/26/22	13.2	nd	0.014	nd	1.8	nd	8.3	8.31	67.1	594	
14	5/26/22	39.5	8342.01	0.015	5.10	1.9	646.37	8.4	8.25	66.9	591	
15	5/26/22	<1	5812.14	0.022	5.21	2.8	663.67	5.7	8.43	67.8	922	
16	5/26/22	79.4	8298.35	0.022	7.45	2.8	947.56	8.4	8.10	65.6	563	
17	5/19/22	3.1	517.06	0.021	0.44	<1	nd	9.5	8.55	63.7	323	
19	5/19/22	78.4	527.57	0.036	0.77	3.8	81.76	9.6	8.12	59.8	757	
21	5/19/22	66.3	2259.91	0.011	1.01	<1	nd	8.6	8.13	64.8	667	
22	5/19/22	69.7	736.49	0.069	2.07	2.6	78.09	7.3	7.69	61.5	865	
24	5/19/22	42.8	nd	0.013	nd	<1	nd	9.3	8.26	65.4	664	
25	5/19/22	75.4	413.27	0.016	0.27	1.2	20.22	8.6	8.16	65.9	383	
27	5/20/22	16.0	157.99	0.064	0.41	14.0	90.20	8.6	8.43	69.6	640	
28	5/20/22	135.4	214.81	0.097	0.85	21.0	183.96	7.8	8.00	65.2	431	
29	5/19/22	43.5	4138.20	0.015	2.53	2.2	371.27	8.6	8.22	69.3	521	
30	5/26/22	131.4	434.22	<.010	nd	2.3	40.73	8.2	8.21	69.9	368	
31	5/26/22	146.7	492.89	0.027	0.54	4.3	86.43	8.3	8.15	68.5	273	
32	5/26/22	124.6	583.93	<.010	nd	3.0	71.44	8.1	8.28	69.0	388	
33	5/20/22	27.9	814.33	0.020	0.66	1.7	56.46	9.2	8.27	68.9	617	
34	5/20/22	75.4	2986.51	0.045	5.48	3.1	377.56	8.2	7.91	66.7	586	
37	5/20/22	3.1	nd	<.01	nd	<1	nd	10.5	8.42	65.5	431	
38	5/19/22	41.0	595.96	0.017	0.41	1.2	29.16	8.3	7.80	67.1	392	
39	5/19/22	8.5	928.94	0.016	0.61	1.2	45.46	9.3	8.42	65.5	378	
40	5/26/22	4.1	nd	0.017	nd	<1	nd	8.9	8.52	68.2	332	

Table 2 May data for sites 1 through 40. The notation "nd" denotes that no data was collected or calculated due to a result below lab detection limits or the constraints of field conditions. Data shaded exceeds certain water quality standards selected from those provided by IDEM (see corresponding shaded standards in table 8). An asterisk (*) in the post rain event column indicated sample collection occurred within 48 hours of .5 inches of rainfall or more.

Site	Date	E-coli (CFU or colonies/100 ml)	CFM Discharge	Total Phos. (ppm)	Total Phos. Loading (kg/day)	TSS (ppm)	TSS Loading (kg/day)	D.O.	pH	Temp (F)	Specific Conductance	Post rain event *
42	5/20/22	122.3	961.81	0.065	2.55	1.9	74.52	8.5	8.00	68.3	478	
43	5/20/22	37.3	4144.47	0.027	4.56	3.9	659.16	9.4	8.44	69.5	542	
44	5/20/22	98.7	48.88	0.010	0.02	1.7	3.39	8.8	7.51	58.1	586	
45	5/19/22	86.0	308.91	0.064	0.81	5.9	74.33	6.9	7.86	56.0	522	
46	5/26/22	107.1	39.94	0.022	0.04	2.2	3.58	8.9	7.61	61.5	551	
47	5/20/22	122.3	243.55	0.037	0.37	1.3	12.91	7.5	8.08	70.7	483	
48	5/20/22	26.6	209.22	0.028	0.24	2.5	21.33	9.1	8.57	72.7	354	
50	5/31/22	186.0	53.45	0.076	0.17	2.9	6.32	4.8	7.57	66.3	348	
51	5/20/22	387.3	90.37	<.01	nd	2.0	7.37	9.4	7.95	59.1	715	
52	5/19/22	727.0	65.35	0.117	0.31	2.9	7.73	8.1	7.86	57.6	549	
53	5/19/22	16.1	3.20	0.050	0.01	2.0	0.26	8.6	7.29	52.0	615	
54	5/19/22	161.6	nd	0.075	nd	1.1	nd	7.0	7.45	56.1	376	
58	5/23/22	201.4	1651.55	0.035	2.36	4.7	316.55	9.1	8.16	62.5	565	
59	5/20/22	105.0	3094.73	0.055	6.94	8.6	1085.37	9.0	8.14	69.4	679	
61	5/31/22	261.3	347.82	1.800	25.53	8.6	121.99	8.5	8.10	66.5	446	
62	5/31/22	488.4	297.20	0.141	1.71	9.1	110.29	7.9	8.06	67.3	284	
63	5/20/22	52.0	nd	0.038	nd	1.6	nd	8.7	8.18	72.2	492	
64	5/20/22	125.0	184.60	0.066	0.50	4.2	31.62	8.4	8.04	68.6	533	
65	5/31/22	1119.9	2577.08	0.167	17.55	15.0	1576.43	7.4	7.98	67.8	485	
68	5/31/22	1119.9	nd	0.130	nd	16.0	nd	7.3	7.91	68.1	492	
69	5/31/22	686.7	2845.04	0.162	18.80	15.0	1740.35	8.4	7.95	68.3	465	
70	5/31/22	492.6	3389.05	0.099	13.68	13.0	1796.71	7.7	7.77	66.3	540	
72	5/19/22	88.4	1.26	0.072	0.00	3.6	0.18	6.5	7.36	60.7	601	
74*	5/25/22	109.2	nd	0.138	nd	11.0	nd	nd	7.61	nd	nd	
75*	5/25/22	128.1	nd	0.230	nd	2.4	nd	nd	7.02	nd	nd	
76	5/20/22	1.0	nd	0.010	nd	1.1	nd	9.01	8.51	73.2	446.0	

Table 3 May data for sites 42 through 76 and June data for sites 74, 75, and 76. The notation "nd" denotes that no data was collected or calculated due to a result below lab detection limits or the constraints of field conditions. Data shaded exceeds certain water quality standards selected from those provided by IDEM (see corresponding shaded standards in table 8). An asterisk (*) in the post rain event column indicated sample collection occurred within 48 hours of .5 inches of rainfall or more.

	Date	E-coli (CFU or colonies/100 ml)	CFM Discharge	Total Phos. (ppm)	Total Phos. Loading (kg/day)	TSS (ppm)	TSS Loading (kg/day)	D.O.	pH	Temp (F)	Specific Conductance	Post rain event *
1	7/27/22	378.4	86.06	0.076	0.27	26.0	91.25	6.7	7.84	62.0	687	
2	7/27/22	920.8	651.16	0.037	0.98	5.9	156.67	7.7	8.00	65.4	676	
4	7/27/22	101.4	1943.54	0.046	3.65	6.6	523.11	6.6	8.12	73.0	590	
5	7/27/22	101.7	1538.23	0.055	3.45	5.4	338.74	5.9	7.99	73.0	604	
6	7/27/22	349.0	1391.76	0.057	3.24	2.8	158.92	6.7	8.06	70.9	602	
7	7/27/22	254.8	1874.74	0.074	5.66	7.6	581.05	7.0	8.04	70.8	694	
8	7/27/22	387.3	2423.45	0.061	6.03	4.2	415.09	7.8	8.08	70.2	676	
10	7/27/22	22.3	4634.63	0.063	11.91	6.3	1190.72	8.4	8.31	75.1	620	
12	7/27/22	20.1	6856.96	0.038	10.63	4.0	1118.53	6.6	8.08	75.6	625	
14	7/28/22	24.3	6469.31	0.041	10.82	1.8	474.88	6.6	8.08	75.8	566	
15	7/28/22	1.0	4453.67	0.058	10.53	4.4	799.15	8.2	8.17	77.3	519	
16	7/28/22	65.7	6057.64	0.037	9.14	1.8	444.66	7.0	8.00	72.4	462	
17	7/22/22	13.5	nd	<.01	nd	2.0	nd	6.2	8.18	78.1	293	
19	7/22/22	517.2	11.13	0.076	0.03	13.6	6.17	6.9	8.07	70.7	802	
21	7/22/22	203.5	1676.64	0.023	1.57	<2.0	nd	4.5	7.90	76.6	603	
22	7/22/22	313.0	62.79	0.063	0.16	4.0	10.24	7.3	7.84	71.5	330	
24	7/22/22	56.5	nd	0.015	nd	3.2	nd	6.3	8.09	78.9	415	
25	7/22/22	90.8	684.08	0.012	0.33	2.2	61.37	7.1	8.03	80.1	331	
27	7/22/22	727.0	123.33	0.066	0.33	11.0	55.32	6.1	7.85	80.6	443	
28	7/22/22	980.4	269.91	0.113	1.24	28.0	308.20	8.0	8.09	73.2	465	
30	7/29/22	25.6	441.85	<.01	nd	2.2	39.64	6.5	7.83	75.9	329	
31	7/29/22	110.0	457.78	<.010	nd	5.2	97.08	7.5	7.94	72.6	358	
32	7/29/22	48.0	646.15	<.01	nd	4.0	105.40	7.0	8.23	76.2	369	
33	7/28/22	96.0	nd	0.040	nd	5.8	nd	10.8	8.41	75.5	521	
34	7/28/22	313.0	2252.21	0.103	9.46	7.0	642.93	8.2	7.70	71.2	544	
37	7/22/22	13.4	nd	0.010	nd	3.4	nd	8.8	8.41	80.1	441	
38	7/22/22	1046.2	388.09	0.014	0.22	2.4	37.98	4.9	7.52	80.9	307	
39	7/22/22	45.7	510.40	0.012	0.25	<.02	nd	7.7	8.60	80.1	286	
40	7/28/22	<1.0	nd	0.016	nd	1.9	nd	8.5	8.59	78.9	317	

Table 4 July data for sites 1 through 40. The notation "nd" denotes that no data was collected or calculated due to a result below lab detection limits or the constraints of field conditions. Data shaded exceeds certain water quality standards selected from those provided by IDEM (see corresponding shaded standards in table 8). An asterisk (*) in the post rain event column indicated sample collection occurred within 48 hours of .5 inches of rainfall or more.

Site	Date	E-coli (CFU or colonies/100 ml)	CFM Discharge	Total Phos. (ppm)	Total Phos. Loading (kg/day)	TSS (ppm)	TSS Loading (kg/day)	D.O.	pH	Temp (F)	Specific Conductance	Post rain event *
42	7/28/22	436.6	736.75	0.106	3.18	3.7	111.17	7.9	7.84	72.7	461	
43	7/28/22	68.9	2928.58	0.042	5.02	8.8	1050.98	8.2	8.45	78.2	415	
44	7/28/22	378.4	27.36	0.031	0.03	5.8	6.47	8.9	7.53	60.4	674	
45	7/22/22	547.5	30.98	0.075	0.09	7.2	9.10	5.2	7.72	69.0	614	
46	7/28/22	23.0	19.15	0.023	0.02	7.8	6.09	4.3	7.40	58.8	607	
47	7/29/22	727.0	46.82	0.087	0.17	5.8	11.07	7.2	7.94	70.2	470	
48	7/28/22	292.4	113.62	0.029	0.13	2.4	11.12	7.8	8.17	78.4	340	
50	7/26/22	228.2	38.10	0.084	0.13	5.1	7.92	5.0	7.63	62.9	650	
51	7/22/22	1299.7	99.22	0.003	0.01	<2	nd	8.0	7.91	70.1	769	
52	7/22/22	547.5	27.75	0.310	0.35	6.8	7.70	5.4	7.76	69.3	603	
53	7/22/22	344.8	6.48	0.246	0.07	216.0	57.08	6.5	7.23	59.4	615	
54	7/22/22	980.4	nd	0.109	nd	6.6	nd	11.1	7.37	69.3	315	
58	7/27/22	228.2	1233.78	0.045	2.26	2.0	100.63	6.8	8.06	72.2	604	
59	7/26/22	311.3	2597.40	0.080	8.47	7.8	826.21	7.3	7.90	68.8	656	
61	7/26/22	980.4	165.49	0.145	0.98	10.0	67.49	8.7	8.00	63.7	582	
62	7/26/22	870.4	112.50	0.158	0.72	12.0	55.05	8.6	8.13	64.9	469	
63	7/22/22	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
64	7/29/22	307.6	116.70	0.074	0.35	3.4	16.18	7.5	7.84	66.3	506	
65	7/26/22	1986.3	603.22	0.149	3.67	12.0	295.20	7.5	8.07	66.9	558	
68	7/26/22	1732.9	nd	0.124	nd	25.0	nd	8.0	8.05	65.7	577	
69	7/26/22	791.5	1112.14	0.127	5.76	7.7	349.23	7.6	8.07	66.7	564	
70	7/26/22	370.7	497.51	0.081	1.64	7.2	146.08	7.3	7.80	64.4	611	
72	7/22/22	8664.5*	4.81	0.121	0.02	31.0	6.08	9.1	7.50	76.2	528	
74*	7/13/22	150.0	nd	0.561	nd	11.5	nd	nd	7.49	nd	nd	
75*	7/13/22	93.3	nd	0.206	nd	2.6	nd	nd	6.86	nd	nd	
76	7/28/22	2.0	nd	0.017	nd	4.8	nd	8.58	8.51	79.9	356.0	

Table 5 July data for sites 42 through 76. The notation "nd" denotes that no data was collected or calculated due to a result below lab detection limits or the constraints of field conditions. Data shaded exceeds certain water quality standards selected from those provided by IDEM (see corresponding shaded standards in table 8). An asterisk (*) in the post rain event column indicated sample collection occurred within 48 hours of .5 inches of rainfall or more. An asterisk (*) after the site number indicates volunteer collected data. An asterisk (*) on data indicates data is suspect, laboratory analysis was performed outside the hold period.

	Date	E-coli (CFU or colonies/100 ml)	CFM Discharge	Total Phos. (ppm)	Total Phos. Loading (kg/day)	TSS (ppm)	TSS Loading (kg/day)	D.O.	pH	Temp (F)	Specific Conductance	Post rain event *
1	8/15/22	1533.1	414.43	0.098	1.66	35.0	591.53	7.7	7.75	60.2	656	*
2	8/15/22	5776.3*	878.27	0.089	3.19	18.0	644.70	7.9	7.89	61.8	588	*
4	8/15/22	73.8	1582.29	0.052	3.36	8.0	516.22	6.9	8.04	69.5	604	*
5	8/15/22	209.8	1169.06	0.058	2.77	7.2	343.26	6.9	7.98	68.4	626	*
6	8/15/22	248.1	1333.40	0.046	2.50	2.8	152.26	7.6	8.07	67.0	632	*
7	8/15/22	770.1	1816.18	0.085	6.30	9.1	673.99	7.4	8.03	66.3	713	*
8	8/15/22	365.4	2330.86	0.059	5.61	4.9	465.77	8.0	8.08	67.2	714	*
10	8/15/22	16.1	2626.39	0.045	4.82	4.9	524.82	7.6	7.67	71.2	684	*
12	8/22/22	146.7	5969.12	0.065	15.82	7.5	1825.69	9.1	7.76	73.5	638	*
14	8/22/22	54.6	6495.91	0.054	14.31	4.8	1271.56	7.6	7.97	73.5	560	*
15	8/22/22	6.3	3934.45	0.109	17.49	14.2	2278.39	8.3	8.29	75.1	521	*
16	8/22/22	125.9	4989.30	0.034	6.92	2.1	427.28	6.6	7.85	69.0	550	*
17	8/2/22	4.1	nd	0.021*	nd	1.9	nd	6.7	8.19	76.5	297	
19	8/2/22	238.2	280.27	0.057	0.65	5.3	60.58	7.6	8.02	66.5	755	
21	8/2/22	214.2	1259.60	0.024	1.23	1.0	51.37	5.4	7.84	72.8	624	
22	8/2/22	88.0	26.97	0.057	0.06	3.1	3.41	7.5	7.76	66.0	627	
24	8/2/22	28.2	nd	0.011*	nd	2.1	nd	5.6	7.98	76.8	556	
25	8/2/22	95.9	430.31	0.017*	0.30	2.8	49.14	6.5	7.81	76.9	385	
27	8/3/22	223.5	29.55	0.039	0.05	2.1	2.53	6.3	7.79	73.9	672	
28	8/3/22	816.4	90.33	0.113	0.42	25.0	92.09	7.6	8.05	70.3	480	
30	8/3/22	61.3	389.35	<.01*	nd	1.9	30.17	6.6	7.83	78.1	360	
31	8/3/22	270.0	236.01	0.015*	0.14	5.7	54.86	7.3	8.09	74.8	378	
32	8/3/22	16.1	120.41	<.01*	nd	2.6	12.77	7.0	8.35	77.8	375	
33	8/3/22	68.3	61.69	0.026	0.07	8.6	21.64	11.8	8.52	80.0	511	
34	8/3/22	436.6	1174.39	0.112	5.36	5.2	249.04	6.2	7.95	77.3	530	
37	8/3/22	18.5	nd	<.01*	nd	2.4	nd	7.5	8.39	78.3	435	
38	8/2/22	547.5	268.77	0.023	0.25	2.6	28.50	5.3	7.48	76.4	316	
39	8/2/22	9.7	149.75	0.014*	0.09	1.2	7.33	7.4	8.46	78.6	273	
40	8/22/22	2.0	nd	<.01*	nd	1.6	nd	7.6	8.48	75.8	328	*

Table 6 August data for sites 1 through 40. The notation "nd" denotes that no data was collected or calculated due to a result below lab detection limits or the constraints of field conditions. Data shaded exceeds certain water quality standards selected from those provided by IDEM (see corresponding shaded standards in table 8). An asterisk (*) in the post rain event column indicated sample collection occurred within 48 hours of .5 inches of rainfall or more.

Site	Date	E-coli (CFU or colonies/100 ml)	CFM Discharge	Total Phos. (ppm)	Total Phos. Loading (kg/day)	TSS (ppm)	TSS Loading (kg/day)	D.O.	pH	Temp (F)	Specific Conductance	Post rain event *
42	8/4/22	648.8	588.69	0.110	2.64	3.1	74.42	5.8	7.80	71.8	535	
43	8/3/22	69.7	1829.34	0.041	3.06	9.8	731.10	8.5	8.44	82.8	409	
44	8/4/22	456.9	27.17	0.024	0.03	5.2	5.76	6.9	7.54	59.5	675	
45	8/2/22	nd	no flow	nd	nd	nd	nd	nd	nd	nd	nd	
46	8/3/22	60.2	23.34	<.01*	nd	<1	nd	6.4	7.47	59.6	612	
47	8/3/22	410.6	37.69	0.090	0.14	2.1	3.23	6.4	8.14	76.2	457	
48	8/3/22	172.3	77.61	<.01*	nd	2.9	9.18	6.9	8.15	79.6	350	
50	8/4/22	1986.3	13.92	0.152	0.09	17.0	9.65	5.1	7.81	72.6	672	
51	8/2/22	579.4	77.09	<.01*	nd	<1	nd	9.4	8.06	65.9	802	
52	8/2/22	872.0	4.68	0.279	0.05	18.0	3.44	6.2	7.80	67.2	616	
53	8/2/22	11.0	6.22	0.093	0.02	68.0	17.25	7.2	7.14	57.8	571	
54	8/2/22	344.8	nd	0.102	nd	2.4	nd	4.8	7.38	67.0	364	
58	8/4/22	307.6	1008.10	0.032	1.32	2.0	82.22	7.0	8.15	74.5	642	
59	8/4/22	456.4	2054.62	0.061	5.11	4.8	402.19	6.4	8.02	73.5	840	
61	8/4/22	1119.9	57.81	0.081	0.19	7.8	18.39	7.7	8.16	69.8	492	
62	8/4/22	1413.6	46.47	0.090	0.17	5.4	10.23	7.5	8.14	70.3	601	
63	8/3/22	365.4	nd	0.095	nd	11.0	nd	5.8	7.91	78.6	484	
64	8/3/22	275.5	73.34	0.080	0.24	3.7	11.07	7.4	8.11	72.1	575	
65	8/4/22	2419.6	573.40	0.136	3.18	5.9	137.96	7.0	8.23	74.7	597	
68	8/4/22	686.7	nd	0.080	nd	5.0	nd	7.4	8.25	74.6	609	
69	8/4/22	686.7	723.52	0.115	3.39	4.2	123.92	7.2	8.24	75.2	596	
70	8/4/22	522.6	400.63	0.070	1.14	12.0	196.06	7.0	7.96	70.6	635	
72	8/2/22	2423.3*	3.57	0.050	0.01	8.8	1.28	9.3	7.81	74.7	578	
74*	9/12/22	689.3	nd	0.102	nd	4.0	nd	nd	7.57	nd	nd	*
75*	9/12/22	574.8	nd	0.258	nd	15.0	nd	nd	6.81	nd	nd	*
76	8/4/22	2.0	nd	<.01*	nd	1.8	nd	7.73	8.64	79.7	391.0	

Table 7 August data for sites 47 through 76. The notation "nd" denotes that no data was collected or calculated due to a result below lab detection limits or the constraints of field conditions. Data shaded exceeds certain water quality standards selected from those provided by IDEM (see corresponding shaded standards in table 8). An asterisk (*) in the post rain event column indicated sample collection occurred within 48 hours of .5 inches of rainfall or more. An asterisk (*) after the site number indicates volunteer collected data. An asterisk (*) after E-coli data indicates data is suspect, laboratory analysis was performed outside the hold period. An asterisk (*) after T-phos. data indicates result below quantification limit, data is suspect.

Parameter	Target	Reference/other information
Temperature	Dependent on time of year and whether stream is designated as a coldwater fishery	Indiana Administrative Code (IAC)
Dissolved Oxygen (DO)	Min: 4.0 mg/L Max: 12.0 mg/L	Indiana Administrative Code (IAC)
	Min: 6.0 mg/L in cold water fishery streams	Indiana Administrative Code (IAC)
	Min: 7.0 mg/L in spawning areas of cold water fishery streams	Indiana Administrative Code (IAC)
E. coli	Max: 235 CFU/ 100mL in a single sample,	Indiana Administrative Code (IAC)
	Max: Geometric Mean of 125 CFU/ 100mL from 5 equally spaced samples over a 30-day period	
Total Phosphorus	Max: 0.076 mg/L	U.S. EPA recommendation
	0.07 mg/L	Dividing line between mesotrophic and eutrophic streams (Dodd et al. 1998)
	Max: 0.08 mg/L	Ohio EPA recommendation to protect aquatic biotic integrity in WWH
	Max: 0.3 mg/L	IDEM draft TMDL target
Total Suspended Solids (TSS)	Max: 80.0 mg/L	Wawasee Area Conservancy Foundation recommendation to protect aquatic life in lake systems
	Max: 30.0 mg/L	IDEM draft TMDL target
	Range: 25.0-80.0 mg/L	Concentrations within this range reduce fish concentrations (Waters, 1995)
	Max: 40.0 mg/L	New Jersey criteria for warm water streams
	Max: 46.0 mg/L	Minnesota TMDL criteria for protection of fish/macroinvertebrate health
Turbidity	Max: 10.4 NTU	U.S. EPA recommendation

Table 8 Indiana Department of Environmental Quality Table of Water Quality Targets. Standards shaded on results tables correspond to standards shaded in this table.

3. Results: May Sampling

May sampling occurred at 60 sites. May sampling results are listed in tables 2 and 3. Samples collected represented baseline-flow conditions at all sites. Table 8 contains a variety of stream water quality targets provided by the Indiana Department of Environmental Management (IDEM) for comparison with the 2022 season data. Also provided for comparison is table 9 containing averages of stream data from the IDEM probabilistic data set. The data used to calculate these averages was collected from Indiana Streams within the St. Joseph River watershed from year 2000 to 2005. Most of the collection sites included in the 2022 data are also within the St. Joseph River watershed and therefore represent somewhat similar soil types, topography, and land uses. This allows some amount of judgment to be made as to whether the 2022 samples were "below average", "average" or "above average" in terms of northern Indiana stream water quality. In May nine sites exceeded the E-coli standard of 235 MPN/100 ml and 10 sites exceeded the total phosphorus standard of .076 ppm.

Parameter	IDEM Mean Stream Data
	St. Joseph Watershed 2000-2005
pH	n/d
D.O. (ppm)	7.14
Temp. (deg C)	19.91
Specific conductance umho/cm	764.19
Total Suspended Solids (ppm)	36
Total Phosphorus (ppm)	0.382
E-coli (CFU/100ml)/(MPN)	1895.58

Table 9 Average of IDEM-collected probabilistic Indiana stream data for the St Joseph River Watershed 2000-2005

4. Results: July Sampling

July sampling was scheduled to include 55 sampling sites, but only 54 sites were sampled. Site 63 was not sampled because the property owner could not be reached to gain permission to access the site. Samples collected represented baseline-flow conditions at all sites in July. Sampling results are listed in tables 4 and 5. E-coli standards were exceeded at 29 sites. Total phosphorus standards were exceeded at 18 sites.

5. Results: August Sampling

August sampling was scheduled to include 55 sampling sites. Samples were collected at 54 sites. Site 45 was omitted due to "no flow" conditions. Sampling results are listed in tables 6 and 7. Samplings at 15 sites represented "rain event" conditions, while the remaining 39 sites represented "baseline" flow conditions. E-coli standards were exceeded at 30 sites while total phosphorus standards were exceeded at 21 sites.

6. Conclusions

A number of notable observations were made during the 2021 season sampling. The standard typically used for maximum E-coli is 235 CFU. Ideally waters are not to exceed this count. A

notable number of sites returned E-coli measurements of over 10,000 CFU back in May of 2018. Five of these were from various Fish Creek and Black Creek sites in the Fish Creek watershed in southeastern Steuben County. The highest measurement recorded was 48,392 from a sample from Fish Creek at 427. Since then, members of the SCLC water quality committee have taken steps toward ongoing watershed improvements in this region, working with landowners and regulators. In 2019 E-coli measurements from this region were considerably lower. The highest measurement in this region in 2019 was 3635 from an August sample collected from site 71, Black Creek at South 600 East. In 2020 the highest measurement among these sites was lower again with a maximum measurement of 2827.2 from a May sample collected from Black Creek at S 600 E. In 2021 August rainfall produced a peak measurement from these sites of 4082 in August at site 73, Davis Ditch, a tributary to Black Creek, and in 2022 the highest in this region was 2419.6 in a sample collected August 4 from Fish Creek at 427. Measurements have remained significantly lower than those noted in this region back in 2018, although it should be noted that two sites in the Black Creek watershed were discontinued in 2022.

In the last five years the number of sampling sites on Pigeon Creek exceeding the 235 E-coli standard has varied between 17% and 56%. In 2022 a total of 14 samples were above the 235 standard (30%). The is closely aligned with the five-year average of 36.8%.

The number of sites on the upper Pigeon, another area with measurements often exceeding the E-coli standard, 41% of sites were above 235 in 2022. This was in alignment with the previous three years. In the last three years an average of 42% of sites in that area have exceeded 235. The highest overall E-coli count recorded on the upper Pigeon reach in 2022 was 5776.3 from rain event sample collected at the Pigeon Lake inlet on August 15.

With regard to total phosphorus on the upper Pigeon, 2022 only three samples (11%) exceeded the total phosphorus standard of .076 ppm. It should be noted that the three samples exceeding the standard were rain event samples. This was identical to the result of 2021 when three samples also exceeded the standard.

Over several years the SCLC has built an extensive body of local water quality data. There are many ways to examine the statistical content of the data and glean information to assist in meeting the needs of local lake residents, government agencies, and land users. The SCLC is encouraged to continue to convey the water quality information through its website, meetings, and other outlets, fostering cooperative community water-quality improvement efforts and encouraging new input and ideas to direct future sampling and steps toward water quality improvement.