2019
WATER SAMPLING REPORT FOR SELECTED MS4 SITES

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IN-STREAM SAMPLING PROTOCOLS FOR MS4 SITES

Beginning the first Tuesday of May and ending the last Tuesday of September, the Storm Water Section of the Environmental Health Division conducted surface water testing on a weekly basis throughout the county on ditches, creeks, lakes, the Elkhart River and the St. Joseph River. The sampling provides data to help prioritize sites with a high illicit discharge potential, characterizes water quality problems, helps determine critical areas for improvement, and documents the long term success of the illicit discharge and elimination program.

The sites are selected by storm water representatives from the MS4 Partnership which includes the cities of Elkhart and Goshen, the town of Bristol, and Elkhart County agencies which meet annually to determine if changes need to be made to the locations. The standard procedure is to obtain a minimum of three years of data per site in order to identify any trends. The following is a list of the sites from the 2019 season:

Yellow Creek: Concord High School & County Road 138
Weaver Ditch: County Road 13
Berlin Court Ditch: County Road 15
Turkey Creek: County Road 50
Dausman Ditch: County Road 19
Swoveland Ditch: County Road 19
Rock Run Creek: County Road 34
Pine Creek: Wyland Drive and Roske Drive
Christiana Creek: County Road 4
Heaton Lake: Ideal Beach
Simonton Lake: 51330 State Road 19
Elkhart River: Baintertown & Indiana Avenue
St. Joseph River: Bristol Boat Launch

The sampling form includes whether the sample was considered wet or dry at the time of sample collection. A wet weather event is defined as a rain event with precipitation greater than .1 inches of rain within a twenty-four hour period prior to collection. A dry weather event is defined as a sampling event with no precipitation twenty-four hours prior to collection.

Data gathered for chlorides, dissolved oxygen, pH, temperature, and conductivity are obtained in the field by using a YSI Professional Plus Instrument Probe. Calibration of the instrument probe is done in accordance with the owner's manual. The instrument probe is lowered into the approximate center part of the waterway and placed below the surface of the water to obtain actual real time data. At the sites with piers, the instrument probe is lowered into the water at the end of the piers. According to the technical experts at YSI, this information is to be used for trending purposes only.

Tests for nitrates, phosphorus, total suspended solids, and E. coli are grab samples in which a single volume of water is obtained at a given point in time, placed in a prepared sample bottle, and then analyzed. Water samples were collected using one of two methods. For low flow sampling and sites with piers, a dipper was used. The dipper is rinsed three times at each site prior to collection to prevent cross contamination between samples sites. For high flow streams, a Van Dorn sampler is used. The device is lowered into the approximate center of the waterway and placed below the water surface for a minimum of twenty seconds with the ends open to allow rinsing of the unit between sampling sites. A

weight is then dropped on a line striking a triggering mechanism which tightly closes each end of the tube at the same time. This captures the free flowing water to be sampled. All samples are placed in pre-labeled and prepared sample bottles.

Nitrates and phosphorus samples are collected for analysis in the Elkhart County Health Department Laboratory using a Hach portable spectrophotometer. Chain of custody procedures are required and implemented. These include labeling the bottles with the sample site number and all other information as recorded on the water sampling form. Items on the water sampling form include the sampling site identification, sampling date and time, sampling number, dry or wet event, raining at the time of collection, and "ECHD" as the agency that collected the sample.

All E. coli samples are transported to the Elkhart Public Works and Utilities Laboratory. They provide the bottles and label that are filled out with the site number, location, collection date, who collected the sample, who transported and relinquished the sample. Upon arrival at the Elkhart Public Works and Utilities Laboratory, the relinquished time is also added to the label. The label includes a space to acknowledge who received the sample. The Elkhart County Health Department's water sampling form is also signed by an Elkhart laboratory representative with the time of sample delivery and a copy is made and kept in their laboratory records. This procedure is implemented to verify chain of custody.

The total suspended solid samples are transported to the City of Goshen Waste Water Treatment Plant Laboratory for analysis. The label attached to the sample bottle contains the site number, location, date, and time of collection. Upon delivery, an Elkhart County Health Department representative places the total suspended solids samples into a refrigerated unit to ensure proper temperature requirements before analysis.

All samples collected are immediately placed in a cooler with chill packs as soon as they are obtained in order to maintain proper temperature requirements during transportation per standard methods protocol.

PARAMETER DEFINITIONS AND THEIR IMPORTANCE

CHLORIDES are found in groundwater, streams, and lakes and may be of natural mineral origin or from human or animal sewage, industrial process wastewaters, agricultural fields and roadway deicing salts. It is recommended if very high levels (500 mg/l or more) are found, further investigation should take place to locate the source.

CONDUCTIVITY (SpC) is a measure of how easily electricity flows through water. It is strongly correlated with total dissolved solids. It is useful as a general measure of water quality. Each water body has a fairly constant range of conductivity that can be used for baseline readings. Significant changes in conductivity may be an indicator that a discharge or some other source of pollution has entered the water way. If this occurs, it is recommended that further investigation should take place to locate the source.

DISSOLVED OXYGEN (DO) is considered to be one of the most important parameters of water quality in streams, rivers, and lakes. All aquatic organisms need dissolved oxygen in the water to survive. Stream systems produce and consume oxygen. If more oxygen is consumed than produced, dissolved oxygen levels decline and some organisms move away, weaken, or die. Higher concentrations of dissolved oxygen equate to better water quality. Aquatic life is stressed at levels below 5.0 mg/l and levels below 2 mg/l will not support fish. Dissolved oxygen is very sensitive to temperature. The solubility of oxygen in water decreases as temperature increases. A waste discharge can have a dramatic effect on the oxygen balance of a water body by raising water temperature or introducing pollutants which remove the dissolved oxygen. According to 327 IAC 2-1-6 and the US EPA, the recommended target value is > 6 mg/l and not > 9 mg/l.

E. COLI is a species of fecal coliform bacteria that is specific to fecal matter from humans and other warm-blooded animals. E. coli indicates the possible presence of pathogenic bacteria, viruses, and protozoa that also live in the digestive systems of humans and animals. Their presence in a water body indicate pathogens might be present and that swimming/full body contact recreation can be a health risk. As required by the United States Environmental Protection Agency, total maximum daily load (TMDL) calculations have been established by the Indiana Pollution Control Board (327 IAC 2-1-6 Section 6(d)) for E. coli using membrane filter count and are the following numeric standards:

> "Concentrations shall not exceed 125 cfu/100 ml as a geoemetric mean based on not less than five samples equally spaced over a 30-day period nor exceed 235 cfu/100 ml in any one sample in a 30-day period."

NITRATES (N03) are one of the four forms of nitrogen in the nitrogen cycle. They are essential plant nutrients but in excess amounts they can cause significant water quality problems. Together with phosphorus they can cause increase in plant growth and changes in the types of plants and animals that live in surface water. In turn this affects dissolved oxygen and temperature. Excess nutrients can cause hypoxia which is a condition characterized by low levels of dissolved oxygen when the plants decay. The natural level of nitrates in surface water is typically low, less than 1 mg/l. Sources of nitrates include failing onsite septic systems, runoff from animal manure storage areas, fertilizer runoff from lawns and cropland, wastewater treatment plants and industrial discharges that contain corrosion inhibitors. The US EPA reference level is < 1.5 mg/l.

pH The pH scale measures the logarithmic concentration of hydrogen and hydroxide ions which make up water. Pure water, equal ion concentrations, is neutral with a pH of 7.0. Below 7.0 the water is acidic and above 7.0 the water is alkaline. pH affects many chemical and biological processes in water. The majority of the aquatic organisms survive and thrive at a range of 6.5-8.0. pH outside of this range reduces the diversity of the water way because it stresses the physiological systems of most organisms and can reduce reproduction. Low pH also allows toxic elements and compounds to become soluble and available for uptake by aquatic plants and animals. Some industrial discharges contain very high 12-14 pH or very low 1-3 pH. pH is a good monitoring parameter and significant fluctuations need to be investigated. According to 327 IAC 2-1-6, the target value is > 6 or < 9.

PHOSPHORUS Like nitrogen, phosphorus is an essential nutrient for plants and animals that make up the aquatic food chain. Phosphorus in waterways accelerates plant growth and algae blooms and with their decomposition result in low dissolved oxygen and death of some fish, invertebrates and other aquatic species. There are many natural and human sources of phosphorus. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing onsite septic systems, runoff from animal manure storage areas, disturbed land areas and commercial cleaning preparations. Phosphorus is the limiting nutrient in many aquatic environments and very small inputs greatly affect photosynthetic productivity and can initiate a massive bloom of plants and algae in slow moving streams and ponds. These blooms are not desired and have a deleterious effect on the aquatic environments where phosphorus has been enriched. The IDEM 303(d) listing criteria is < 0.3 mg/l.

TEMPERATURE is a very important water quality parameter and influences all biological and chemical reactions. Temperature influences the dissolved oxygen content of the water, the metabolism of all aquatic organisms, the rate of photosynthesis, and the sensitivity of organisms to pollutants such as toxic wastes and parasites. All aquatic organisms have optimal temperatures for their survival. Many factors affect temperature including stream flow, sunlight, shade, water depth, turbidity, bottom color and composition, soil erosion, storm water runoff, and seasonal changes. Temperature is measured in degrees Celsius.

TOTAL SUSPENDED SOLIDS (TSS) are particulates in water and can include many organic and inorganic sources such as silt, decaying plant and animal matter, sewage and industrial wastes. They cause the water to be milky or muddy looking due to the light scattering from very small particles in the water. This is called turbidity. Suspended solids can destroy fish habitat because they can settle to the bottom and smother the eggs of fish and aquatic insects and suffocate newly hatched insect larvae. High levels of suspended solids can clog the gills of fish and reduce their growth rates and reduce dissolved oxygen. Also, pollutants and contaminants adhere to the suspended solids. Total suspended solids are measured in mg/l. There are no numeric standards for total suspended solids however they must meet narrative standards which state in part: "all waters at all times and places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges which are in amounts sufficient to injure, be acutely toxic to, or otherwise produce serious adverse physiological responses in humans, animals, aquatic life or plants."

NOTE: The above information was obtained from the United States Environmental Protection Agency (US EPA), the Indiana Department of Environmental Management (IDEM), The Center for Watershed Protection, and Purdue University Department of Agricultural and Biological Engineering.

SAMPLING RESULTS, CHARTS, AND MISCELLANOUS INFORMATION

The sampling data results are in Appendix 1.

Appendix 2 contains the charts for E. coli and TSS.

Appendix 3 contains the water quality targets.

Appendix 4 contains the Indiana Department of Environmental Management's Policy for Reporting "Too Numerous to Count (TNTC) Data for E. Coli Testing. The TNTC number of 63,000 is the geometric mean between 20,000 (maximum count for a 1.0 mL dilution) and 200,000 (maximum count for a 0.1 mL dilution).

Please Note: Beginning August 20th through September 24th, the Bristol Boat Launch site along the Saint Joseph River was eliminated due to time constraints.

SUMMARY AND CONCLUSIONS

According to the United States Environmental Protection Agency, "a water body is considered impaired when a water quality standard is violated, whether through exceedance of a numeric or narrative criterion, impairment of a designated use or violation of anti-degradation policy." The results of the 2019 sampling season continue to indicate E. coli levels in excess of the total maximum daily load of 235 cfu/100 ml at many of the sample sites except Christiana Creek which is the control site.

All water bodies are capable of assimilating a certain amount of pollution without adverse effects because of the dilution and self-purification capabilities of natural processes. The ability of a water body to mitigate for an organic pollutant, such as E. coli is dependent on many factors such as stream flow, depth, dissolved oxygen, temperature, available sunlight, and time. However, the high levels of E. coli indicate these pathogens are being infused at a rate greater than can be mitigated through natural processes resulting in these higher than acceptable numbers. Results such as these are indicators of illicit discharges entering the water bodies requiring investigation to determine their source and enforce compliance with environmental regulations prohibiting these discharges.

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APPENDIX 1: SAMPLING DATA

YELLOW CREEK - 67 - CONCORD HS

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	8:20	13.4	8.2	523	7.57	75.860	5.83	0.300			n
5/14/2019	8:20	8.7	9.70	472.2	7.87	60.4	5.790	0.520	11	3200	n
5/21/2019	8:25	10.5	13.6	770.0	7.42	69.6	6.260	0.594	15	1300	y
5/28/2019	8:50	16.2	8.11	391.1	7.49	40.71	5.15	1.45	160	63200	y
6/4/2019	8:25	14.3	7.22	372.4	7.68	236.06	1.960	1.35	21	1400	n
6/11/2019	8:30	13.9	6.87	580	7.8	121.59	3.81	0.763	14.3	4800	y
6/18/2019	8:40	15.9	5.7	603	7.78	69.53	4.87	10.00	15	1500	n
6/25/2019	8:10	16.8	6.48	581	7.68	57.72	4.38	0.575	21.7	1012	n
7/2/2019	8:05	19.1	4.27	711	7.78	82.62	3.65	0.512	14.3	1338	n
7/9/2019	8:10	17.5	6.41	648	8.43	100.970	3.58	0.499	18.5	1185	n
7/16/2019	8:05	19.2	4.04	520	7.72	65.990	2.420	0.512	8.83	1450	n
7/23/2019	8:10	19.8	4.24	394.7	8.47	168.440	8.97	1.15	65	6200	n
7/30/2019	8:05	17.8	5.12	531.0	8.57	125.950	3.15	0.502	7.33	3700	y
8/6/2019	8:10	18	5.03	972	8.18	227.800	0.025	0.299	5.13	700	y
8/15/2019	8:10	17.8	4.43	539	8.29	94.210	1.920	0.362	6.25	6000	y
8/20/2019	8:45	18.9	5.28	650	7.96	297.210			8.5	8400	n
8/27/2019	8:20	17.2	72.5	958	8.03	237.15	2.13	0.396	8.75	9500	y
9/3/2019	8:15	16.6	7.73	739	8.14	442.670	1.87	0.322	11.8	3100	n
9/10/2019	8:30	16.5	7.43	4428	8.04	313.43	1.82	0.269	7.33	1175	n
9/17/2019	8:15	16.6	5.92	961	8.33	189.52	1.61	0.338	49.8	860	n
9/24/2019	8:40	15.0	6.77	690	8.28	447.86	1.32	0.372	7.67	950	n

YELLOW CREEK - 66 - CR 138

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	8:41	13.3	8.95	715	7.73	160.30	11.90	0.889			n
5/14/2019	8:40	8.6	15.69	562	7.8	190.7	10.50	0.944	7	5900	n
5/21/2019	8:50	11	9.06	568	7.5	102.28	12.00	0.982	14	1000	y
5/28/2019	9:10	16.2	7.89	609	7.36	173.05	8.97	1.19	18	63200	y
6/4/2019	8:45	14.7	6.21	680	7.62	268.98	5.120	0.514	29.5	10200	n
6/11/2019	8:50	14.4	6.42	1124	7.59	171.81	8.440	1.57	12	3050	y
6/18/2019	9:00	16.7	5.16	617	7.68	116.43	10.100	1.17	5.75	6500	n
6/25/2019	8:30	17.6	5.30	706	7.62	186.02	9.38	0.74	27.7	1300	n
7/2/2019	8:20	20.6	4.15	848	7.77	277.90	11.200	0.86	13.75	1513	n
7/9/2019	8:30	18.6	5.96	813	7.85	324.87	10.300	1.06	158.5	2737	n
7/16/2019	8:25	21.6	3.23	955	7.67	364.80	2.420	0.512	28	4000	n
7/23/2019	8:30	18.5	4.23	869	7.49	356.50	20.100	1.39	19.25	15200	n
7/30/2019	8:25	20	4.83	1083	8.03	519.96	3.150	0.502	8.83	1200	n
8/6/2019	8:30	20.6	3.98	1113	8.07	586.43	8.550	1.41	42	2050	y
8/15/2019	8:35	19.2	5.47	461	8.19	368.11	7.240	2.85	4.5	4700	y
8/20/2019	9:15	20.8	4.16	650	7.96	297.21			25.75	6200	n
8/27/2019	8:45	19.1	5.86	797	8.10	642.90	5.440	2.67	26.7	12400	y
9/3/2019	8:40	18.3	4.21	1112	8.18	845.29	7.290	1.99	139	1630	n
9/10/2019	8:50	18	4.2	1131	7.92	855.08	7.450	2.3	36	420	n
9/17/2019	8:40	17.7	3.52	890	8.22	740.2	4.050	2.48	74.5	500	n
9/24/2019	9:00	15.9	3.24	1050	8.33	1107.35	3.690	2.26	35.2	530	n

WEAVER DITCH - 45 - CR 13

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	8:54	10.2	6.60	581	7.37	282.64	3.49	3.34			n
5/14/2019	8:55	10.1	5.37	785	7.41	563.80	3.11	7.22	262	117000	n
5/21/2019	9:03	11.5	4.53	811	7.14	291.00	3.98	4.66	154	40000	y
5/28/2019	9:20	14.3	7.12	342.4	7.07	456.37	0.602	1.96	67	63200	y
6/4/2019	9:00	13.8	4.11	888.0	7.20	717.15	1.71	2.53	294.7	40500	n
6/11/2019	9:00	14.6	5.5	1192.0	7.08	1351.91	2.21	3.5	1325	63200	y
6/18/2019	9:10	15	4.42	1193	7.16	1180.94	2.96	6.35	89	51000	n
6/25/2019	8:40	16.1	5.6	2261.0	7.19		1.260	4.25	76	41000	n
7/2/2019	8:30	17.2	4.42	1286.0	7.33	1341.77	1.92	5.69	544	127500	n
7/9/2019	8:40	17.8	5.36	2252.0	7.33	1320.19	1.64	6.07	49	99750	n
7/16/2019	8:40	19.7	4	407.0	7.41	370.1	1.72	5.15	336	820000	n
7/23/2019	8:40	18.4	3.32	1618.0	7.04	1339.71	1.06	9.26	438	880000	n
7/30/2019	8:40	18.7	3.29	2248.0	7.4	+++	1.03	11	348	1070000	y
8/6/2019	8:40	18.5	1.45	3102.0	7.3	+++	0.542	11	81	230000	y
8/15/2019	8:45	19.2	5.47	460.6	8.19	368.11	7.240	2.85	113	680000	y
8/20/2019	9:40	19.8	0.9	2097.0	7.15	++			23	460000	n
8/27/2019	9:00	19.1	3.35	2214.0	7.22	++++	2.26	8.49	37	1400000	y
9/3/2019	9:00	18.6	4.27	2053.0	7.22	+++	2.280	14.4	932	2900000	n
9/10/2019	9:05	18.3	0.88	1465.0	7.08	+++	0.766	8.14	115.5	670000	n
9/17/2019	8:50	18.1	1.10	2381.0	7.12	+++	0.837	9.67	496	2740000	n
9/24/2019	9:15	17.5	3.21	1781.0	7.19	+++	0.608	7.03	1256	680000	n

BERLIN COURT DITCH - 190 - CR 15

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	9:11	13.6	6.96	462.1	7.53	48.88	5.08	0.455			n
5/14/2019	9:15	9.1	10	424.6	7.37	53.2	4.88	0.527	4	550	n
5/21/2019	9:20	10.6	9.44	491.3	7.42	77.39	6.26	0.512	5	430	y
5/28/2019	9:40	17	8.77	341.5	7.31	39.93	3.42	1.26	56	8200	y
6/4/2019	9:15	15.1	7.3	571	7.48	318.52	2.73	1.56	15	350	n
6/11/2019	9:20	14.7	10.5	818	7.51	243.51	4.12	0.571	8	1950	y
6/18/2019	9:25	17.2	5.29	581	7.44	200.63	8.66	1.33	24.3	2400	n
6/25/2019	9:00	17.9	4.97	538	7.52	203.99	5.2	0.418	18.5	1120	n
7/2/2019	8:50	22.2	3.82	807	7.67	378.14	5.63	0.57	10.5	650	n
7/9/2019	9:00	19.6	4.63	610	7.75	277.05	6.34	0.522	7.17	410	n
7/16/2019	8:55	21.7	2.44	811	7.49	410.29	5.37	0.591	21.5	144	n
7/23/2019	9:00	17.6	4.16	762	7.77	298.86	3.92	0.868	4.38	219	n
7/30/2019	9:00	20.4	4.81	997	7.95	983.2	10.8	0.754	5.5	176	y
8/6/2019	9:00	21.2	2.74	976	7.98	788.87	6.64	0.678	4.63	94	y
8/15/2019	9:05	19.9	2.48	591	8.11	608.66	3.1	1.03	49.5	170	y
8/20/2019	10:10	22.8	2.47	124.1	7.75	469.87			1.88	64	n
8/27/2019	9:20	20.1	4.96	716	8.18	716.67	8.69	0.767	2.88	840	y
9/3/2019	9:20	18.1	3.27	1344	8.09	1093.38	11	1.06	39.5	113	n
9/10/2019	9:25	17.9	3.84	1174	7.89	1146.98	17.2	0.826	4.63	48	n
9/17/2019	9:15	17.6	3.19	545	8.25	232.66	4.02	0.799	6	46	n
9/24/2019	9:35	15	4.65	927	8.28	1410.95	15.3	0.683	102	100	n

TURKEY CREEK - 83 - CR 50

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	9:24	14.3	9.24	472.9	7.77	35.5	2.58	0.137			n
5/14/2019	9:30	10.7	8.91	433.1	7.78	32.97	0.87	0.137	9	206	n
5/21/2019	9:35	12.9	10.1	474.0	7.68	45.88	2.79	0.172	12	264	y
5/28/2019	9:50	17.6	7.35	443.2	7.47	65.15	3.74	0.707	56	6600	y
6/4/2019	9:30	17.6	5.85	519.0	7.78	45.04	1.19	1.58	15	128	n
6/11/2019	9:30	15.9	6.3	543.0	7.78	128.98	2.360	0.259	11.6	200	y
6/18/2019	9:40	16.7	5.39	600.0	7.71	56.4	2.78	0.281	10.2	200	n
6/25/2019	9:10	18.9	4.27	539.0	7.73	54.00	3.33	0.18	20.3	370	n
7/2/2019	9:00	22.3	4.11	610.0	7.84	75.22	2.07	0.295	12.2	255	n
7/9/2019	9:15	21.6	5.66	559.0	7.64	70.74	1.62	0.154	15.3	402	n
7/16/2019	9:10	24	2.74	477.7	7.58	150.93	1.5	0.189	10.8	390	n
7/23/2019	9:15	18.6	4.24	544.0	7.63	122.73	2.180	0.215	10.5	260	n
7/30/2019	9:10	19.8	4.55	352.1	7.97	132.31	2.600	0.281	3.38	270	y
8/6/2019	9:10	21.5	4.81	771.0	8.14	131.80	0.264	0.2	3.13	124	y
8/15/2019	9:20	19.9	2.48	591.0	8.11	608.66	3.100	1.03	7.5	204	y
8/20/2019	10:35	22.3	4.71	721.0	8.01	229.35			4.13	240	n
8/27/2019	9:40	20.6	4.86	521.0	8.22	230.04	2.230	0.165	51	530	y
9/3/2019	9:35	19.1	6.69	600.0	8.19	269.4	2.200	0.291	4.13	240	n
9/10/2019	9:40	18.4	6.76	934.0	8.04	291.02	2.630	0.124	2.75	218	n
9/17/2019	9:30	19	6.24	568.0	8.35	284.66	2.050	0.193	2.75	240	n
9/24/2019	9:50	17.4	5.78	587.0	8.34	495.84	2.300	0.184	2.63	270	n

DAUSMAN DITCH - 181 - CR 19

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	9:34	12.1	2.74	576	7.53	169.34	6.34	4.310			n
5/14/2019	9:40	9.3	9.73	515	7.71	116.7	4.52	0.940	6	1440	n
5/21/2019	9:40	10.4	8.78	507	7.47	55	10.30	1.380	27	440	y
5/28/2019	10:00	15.7	9.01	491.3	7.34	50.91	7.650	4.9	64	16300	y
6/4/2019	9:40	14.3	6.99	620	7.51	118.14	8.530	1.36	9.75	900	n
6/11/2019	9:40	14.5	6.21	613	7.56	151.35	7.220	1.42	10	9000	y
6/18/2019	9:50	16.2	5.36	659	7.62	145.57	12.100	0.816	11	594	n
6/25/2019	9:20	16.7	4.74	1163.0	7.59	78.42	11.100	0.83	22.5	450	n
7/2/2019	9:10	19.8	6.09	2141.0	7.71	217.01	9.260	0.758	7.25	1350	n
7/9/2019	9:20	18.1	6.41	904	7.4	91.28	12.500	0.957	26	1120	n
7/16/2019	9:20	19.1	3.88	652	7.25	174.30	6.690	0.693	113	3300	n
7/23/2019	9:20	16.1	4.29	587.0	7.45	275.34	5.720	1.05	103	5700	n
7/30/2019	9:20	16.1	5.69	660.0	7.8	243.46	3.650	0.592	19	3200	y
8/6/2019	9:20	15.6	4.59	805.0	8.02	271.34	0.110	0.367	14.5	995	y
8/15/2019	9:20	21.3	5.24	537	8.19	170.78	1.440	0.207	17	1400	y
8/20/2019	10:50	19.6	4.77	579	7.54	282.91			12	6000	n
8/27/2019	9:50	17.2	5.27	734	7.93	501.87	2.720	2.02	74.5	63200	n
9/3/2019	9:45	14.7	5.59	1041.0	8.08	230.26	3.650	0.757	194	2300	n
9/10/2019	9:50	15.2	6.04	518	7.87	241.80	3.650	0.512	92	780	n
9/17/2019	9:35	15.2	4.45	278	8.01	137.18	3.680	0.905	10.5	640	n
9/24/2019	10:00	13.1	5.57	486.7	8.11	325.67	4.110	0.279	35	800	n

SWOVELAND DITCH - 91 - CR 19

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	9:42	11.8	9.67	466.8	7.83	54.8	9.77	0.841			n
5/14/2019	9:50	8.8	13.30	502	7.79	43.40	10.80	0.604	8	570	n
5/21/2019	9:50	9.8	13.13	461.9	7.72	69.38	12.80	0.429	12	500	y
5/28/2019	10:10	16	8.54	431	7.44	126.02	7.2	0.918	33	2100	y
6/4/2019	9:45	14	10.19	555	7.7	54.62	1.31	1.94	12.6	725	n
6/11/2019	9:50	14.5	6.4	839	7.5	280.60	13.700	2.06	9.25	2450	y
6/18/2019	9:55	16.6	5.05	665	7.71	155.61	13.4	0.656	8.3	105	n
6/25/2019	9:30	17	4.65	663	7.66	58.84	13.5	0.651	16	1160	n
7/2/2019	9:15	21.6	6.29	756	7.78	220.73	13.2	0.502	12.3	985	n
7/9/2019	9:30	18.7	8.92	622	7.39	84.54	9.770	0.629	18.5	660	n
7/16/2019	9:30	22.3	3.23	787	7.33	194.93	12.300	0.481	148	1180	n
7/23/2019	9:30	17.7	3.09	78	7.44	277.90	15.2	1.57	10.3	590	n
7/30/2019	9:30	20.1	4.82	852.0	7.78	354.68	10.40	0.769	22	620	y
8/6/2019	9:30	19.2	2.18	793	7.86	298.71	6.83	0.563	12.8	565	y
8/15/2019	9:30	16	4.11	437	8.05	322.63	3.120	0.923	48.5	62000	y
8/20/2019	11:05	21.7	4.73	797	8.04	374.51			12.3	2300	n
8/27/2019	10:00	19.5	5.23	634	8	542.89	7.240	2.5	85.5	63200	y
9/3/2019	10:00	18.2	9.04	903	8	672.08	9.66	1	73	1200	n
9/10/2019	10:00	16.2	1.23	8	7.68	299.97	4.040	1.15	6.17	680	n
9/17/2019	9:50	18.1	2.46	793	8.24	529.46	4.810	1.09	5.63	440	n
9/24/2019	10:10	16.4	5.03	655.0	8.17	709.91	0.426	0.924	7.67	263	n

ELKHART RIVER -24 - BAINTERTOWN

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	9:52	15.6	4.53	475.6	7.80	27.47	1.82	0.115			n
5/14/2019	10:00	11.0	9.5	414.9	7.93	23.4	2.33	0.166	2	149	n
5/21/2019	10:00	13.0	9.47	425.2	7.8	35.4	1.89	0.192	10	92	y
5/28/2019	10:20	19.4	7.18	517	7.75	48.34	1.81	0.247	4	762	y
6/4/2019	9:55						8.84	1.24	10.5	82	n
6/11/2019	10:00	18	5.08	510.0	7.91	44.44	1.67	0.391	9.75	460	y
6/18/2019	10:05	18.5	4.7	484.2	7.86	41.55	2	0.349	6.7	167	n
6/25/2019	9:40	19.9	3.83	522.0	7.62	42.75	1.81	0.333	6	465	n
7/2/2019	9:30	24.5	4.36	568.0	7.84	102.49	1.340	0.334	5.83	440	n
7/9/2019	9:40	21.3	5.06	412.7	7.5	19.03	2.350	0.372	12.75	210	n
7/16/2019	9:40	24.4	3.01	643.0	7.42	34.62	1.56	0.397	9.67	180	n
7/23/2019	9:40	21.2	3.4	544.0	7.64	41.47	1.96	0.523	11.5	1100	n
7/30/2019	9:40	22.3	4.63	566.0	8	75.8	1.48	0.4	16.5	212	y
8/6/2019	9:40	22.9	4.24	602.0	8.21	96.34	0.189	0.33	24	162	y
8/15/2019	9:50	22.1	4.67	549.0	8.29	72.12	1.67	0.334	11.5	320	y
8/20/2019	11:15	23.4	4.84	538.0	8.28	131.56			27.75	470	n
8/27/2019									8.67	120	y
9/3/2019							1.51	0.25	6.13	224	n
9/10/2019	10:15	19	6.05	531.0	8.1	103.41	1.38	0.21	408	290	n
9/17/2019	10:05	20	0.74	575.0	8.26	119.78	1.42	0.269	7.83	262	n
9/24/2019	10:25	18.3	4.55	732	8.35	208.33	1.21	0.258	15.75	250	n

ROCK RUN CREEK - 20 - CR 34

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	10:10	11.8	9.18	564	7.78	61.21	5.69	0.253			n
5/14/2019	10:20	8.9	14.09	424.5	7.95	30.93	Sample Spilled		3	480	n
5/21/2019	10:20	9.8	22.83	516	7.78	103.26	6.3	0.243	4	360	y
5/28/2019	10:40	16.6	9.06	497.8	7.64	41.62	3.81	1.06	35	6300	n
6/4/2019	10:30	13.6	8.52	505	7.62	106.72	2.64	3.19	17.66	1543	n
6/11/2019	10:30	13.3	7.33	487.7	7.77	116.26	5.65	0.421	11.5	600	y
6/18/2019	10:30	15.1	5.6	992	7.71	108.5	5.56	0.388	12.2	535	n
6/25/2019	10:00	15.9	5.17	562	7.76	73.22	5.25	0.733	16.5	1520	n
7/2/2019	9:50	18.3	7.64	622	7.85	200.5	6.44	0.24	8.6	740	n
7/9/2019	10:05	16.2	7.16	654	7.61	95.14	6.6	0.193	5.38	1195	n
7/16/2019	10:05	18.8	8.49	660	7.64	155.44	6.7	0.27	8.5	620	n
7/23/2019	10:05	15.5	4.62	589	7.98	59.91	6.41	0.324	10.83	760	n
7/30/2019	10:00	17.4	5.47	648	7.97	219.87	6.64	0.25	9.5	650	y
8/6/2019	10:00	17.8	5.77	531	8.12	149.39	7.18	0.22	8.5	1120	y
8/15/2019	10:15	17.4	6.38	661	8.23	243.82	7.36	0.258	4.33	1415	y
8/20/2019	11:40	19.4	7.69	658	8.19	235.11			5.625	1120	n
8/27/2019	10:40	17.8	7.04	294.3	8.17	103.58	6.53	0.309	6.33	1400	y
9/3/2019											
9/10/2019	10:40	16.7	8.21	637	8.04	208.85	7.49	0.185	86.5	840	n
9/17/2019	10:25	16	7.55	674	8.28	125.99	7.26	0.257	5	540	n
9/24/2019	10:50	14.1	7.51	588	8.34	306.26	7.29	0.224	9.5	425	n

ELKHART RIVER - 22 - INDIANA AVE

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	10:30	16.1	8.68	470.7	7.97	98.87	2.14	0.164			n
5/14/2019	10:35	11.1	15.5	425.1	8.09	37.96	1.71	0.188	4	82	n
5/21/2019	10:30	14.1	10.81	481.5	7.87	43.52	2.37	0.229	6	90	y
5/28/2019	10:50	19.1	8.13	546	7.78	150.05	2.32	0.27	7	170	y
6/4/2019	10:45	18.1	8.29	463	7.89	131.76	0.974	0.951	7.5	130	n
6/11/2019	10:45	18.4	5.30	476.9	7.93	175.5	1.7	0.358	7.75	480	y
6/18/2019	10:45	18.3	4.52	535	7.91	124.86	2.590	0.726	7	2900	n
6/25/2019	10:15	20.1	4.31	478.5	7.86	86.03	2.25	0.314	11.5	1020	n
7/2/2019	10:00	24.4	4.78	595	7.92	190.72	1.47	0.364	7	150	n
7/9/2019	10:15	22.4	5.5	549	7.62	86.32	2.570	0.362	9.6	125	n
7/16/2019	10:15	24.7	3.51	598	7.81	138.32	1.430	0.358	7.5	96	n
7/23/2019	10:20	21.7	2.8	642	7.8	148.78	2.23	0.555	11	600	n
7/30/2019	10:15	22.6	4.2	726	8.04	203.38	1.61	0.423	6.17	64	y
8/6/2019	10:20	23.1	4.74	508	8.71	236.3	1.54	0.318	4.25	56	y
8/15/2019	10:30	22.7	5.08	559	8.13	177.27	1.86	0.296	4.33	224	y
8/20/2019											
8/27/2019	11:05	20	5.84	430.2	8.24	174.3	1.270	0.256	4.38	98	n
9/3/2019											
9/10/2019	10:50	18.6	7.28	495.4	8.12	261.79	1.33	0.187	3.13	80	n
9/17/2019	10:40	20.0	6.02	557	8.32	231.19	1.380	0.258	2.25	61	n
9/24/2019	11:10	19.9	5.55	525	8.32	364.48	1.24	0.24	3.13	34	n

SAINT JOSEPH RIVER - 210 - BRISTOL BOAT LAUNCH

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	10:53	15.4	8.09	487.6	8.06	32.82	2.19	0.118			n
5/14/2019	11:00	10.6	13.08	459.8	8.11	25.85	2.63	0.171	7	188	n
5/21/2019	11:00	12.4	16.02	511	8.02	39.43	2.67	0.157	9	290	y
5/28/2019	11:20	20.3	6.79	458.7	7.91	36.32	1.45	0.104	6	248	y
6/4/2019	11:20	15.9	13.1	288.6	8.02	32.91	2.88	2.82	10	600	n
6/11/2019	11:05	16.2	5.61	533	8.06	43.9	2.57	0.387	11.8	500	y
6/18/2019	11:25	16.8	4.74	556	7.97	35.1	2.77	0.28	10.8	300	n
6/25/2019	10:55	18.6	4.64	546.0	7.97	44.91	2.3	0.291	11.5	640	n
7/2/2019	10:30	21.7	5.53	530.0	8.04	71.91	3.59	0.248	12.2	250	n
7/9/2019	10:50	19.9	6.03	525	7.69	74.360	2.69	0.248	10.8	252	n
7/16/2019	11:00	22.3	5.04	540	7.76	47.13	2.49	0.23	6	212	n
7/23/2019	10:55	19.7	3.34	512	7.8	81.32	2.62	0.411	13.8	2200	n
7/30/2019	11:00	20.9	5.21	629	8.06	82.9	2.52	0.24	83.5	480	y
8/6/2019	10:55	21.2	5.08	507	8.29	88.58	2.27	0.239	12	2800	y
8/15/2019	11:10	20.4	5.31	562	8.36	35.21	2.440	0.20	1.38	169	y
8/20/2019											
8/27/2019											
9/3/2019											
9/10/2019											
9/17/2019											
9/24/2019											

PINE CREEK - 30 - WYLAND AND ROSKE

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	11:05	12.6	11.05	522	8.17	85.02	3.27	0.139			n
5/14/2019	11:10	10.4	11.12	502	8.04	39.66	3.11	0.124	16	210	n
5/21/2019	11:10	10.5	10.58	507	7.95	55.58	3.59	0.125	11	370	y
5/28/2019	11:35	16.8	8.23	456.0	7.76	41.92	2.21	0.446	92	8400	y
6/4/2019	11:35	13.5	13.21	371.8	7.93	129.65	1.29	0.702	20.3	655	n
6/11/2019	11:25	14.1	6.37	602.0	8.03	100.57	3.210	0.383	17.8	1050	y
6/18/2019	11:10	15.5	5.51	560.0	7.95	82.91	3.24	0.412	23.3	420	n
6/25/2019	10:40	15.6	5.55	215.5	7.97	77.22	3.11	0.308	32	720	n
7/2/2019	10:20	17.4	6.74	762.0	7.99	203.49	2.49	0.288	32	955	n
7/9/2019	10:30	15.9	7.69	507.0	7.62	95.08	3.64	0.204	17.3	925	n
7/16/2019	10:45	17.7	4.83	584.0	7.95	79.23	3.81	0.224	43	800	n
7/23/2019	10:40	16.1	4.03	580.0	7.84	110.17	3.1	0.357	25	2800	n
7/30/2019	10:35	16.8	5.42	606.0	8.05	206.9	3.42	0.251	15.7	3700	y
8/6/2019	10:40	17.3	5.63	358.0	8.23	193.52	0.051	0.251	41	2900	y
8/15/2019	10:50	17	6.51	537.0	8.3	113.02	3.49	0.202	12.3	1610	y
8/20/2019											
8/27/2019	11:25	17	8.03	561.0	8.22	367.56	3.47	0.235	15.7	1600	y
9/3/2019										2900	n
9/10/2019	11:15	16.8	7.63	481.0	8.09	164.9	3.790	0.156	15.3	440	n
9/17/2019	11:00	16.0	7.52	497.4	8.34	172.19	3.370	0.218	14.2	1015	n
9/24/2019	11:35	15.3	7.42	394.7	8.42	368.7	3.260	0.209	9.5	760	n

HEATON LAKE - 4 - IDEAL BEACH

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	11:21	16.3	8.62	226.1	8.14	31.88	0.261	0.047			n
5/14/2019	11:25	14.1	10.56	309.3	8.16	14.65	0.366	0.079	1	14	n
5/21/2019	11:30	15.6	10.97	323.9	8.22	22.81	0.295	0.121	2	7	y
5/28/2019	11:50	21.2	7.22	352.4	8.15	23.95	0.367	0.093	13	5100	y
6/4/2019	11:50	21.5	7.78	330.8	8.5	29.3	0.426	1.85	1.63	72	n
6/11/2019	11:35	21.2	4.37	313.3	8.07	20.56	0.421	0.192	2.14	390	y
6/18/2019	11:40	21.2	4.12	319.4	7.97	13.850	0.623	0.288		2000	n
6/25/2019	11:10	23.5	3.51	306.7	8.28	24.450	0.555	0.011		64	n
7/2/2019	10:50	29.6	3.95	322.9	8.58	33.62	0.408	0.137		344	n
7/9/2019	11:10	27	4.49	292	8.25	12.2	0.399	0.082		960	n
7/16/2019	11:20	28.2	2.42	360.6	7.34	23.11	0.405	0.155		32	n
7/23/2019	11:10	25.9	2.36	337	7.81	16.5	0.408	0.132		1600	n
7/30/2019	11:20	26.4	3.63	303.6	8.24	26.41	0.436	0.145		64	y
8/6/2019	11:10	26.7	3.65	307.4	8.32	30.65	0.394	0.12		131	y
8/15/2019	11:30	25.2	4.48	336.8	8.54	74.51	0.418	0.129		11	y
8/20/2019											
8/27/2019	11:45	22.2	5.78	295.9	8.53	64.59	0.374	0.142		1300	y
9/3/2019										131	n
9/10/2019	11:30	21.7	6.14	302.2	8.38	54.61	0.263	0.079		73	n
9/17/2019	11:30	22	6.08	256	8.74	69.41	0.238	0.212		80	n
9/24/2019											

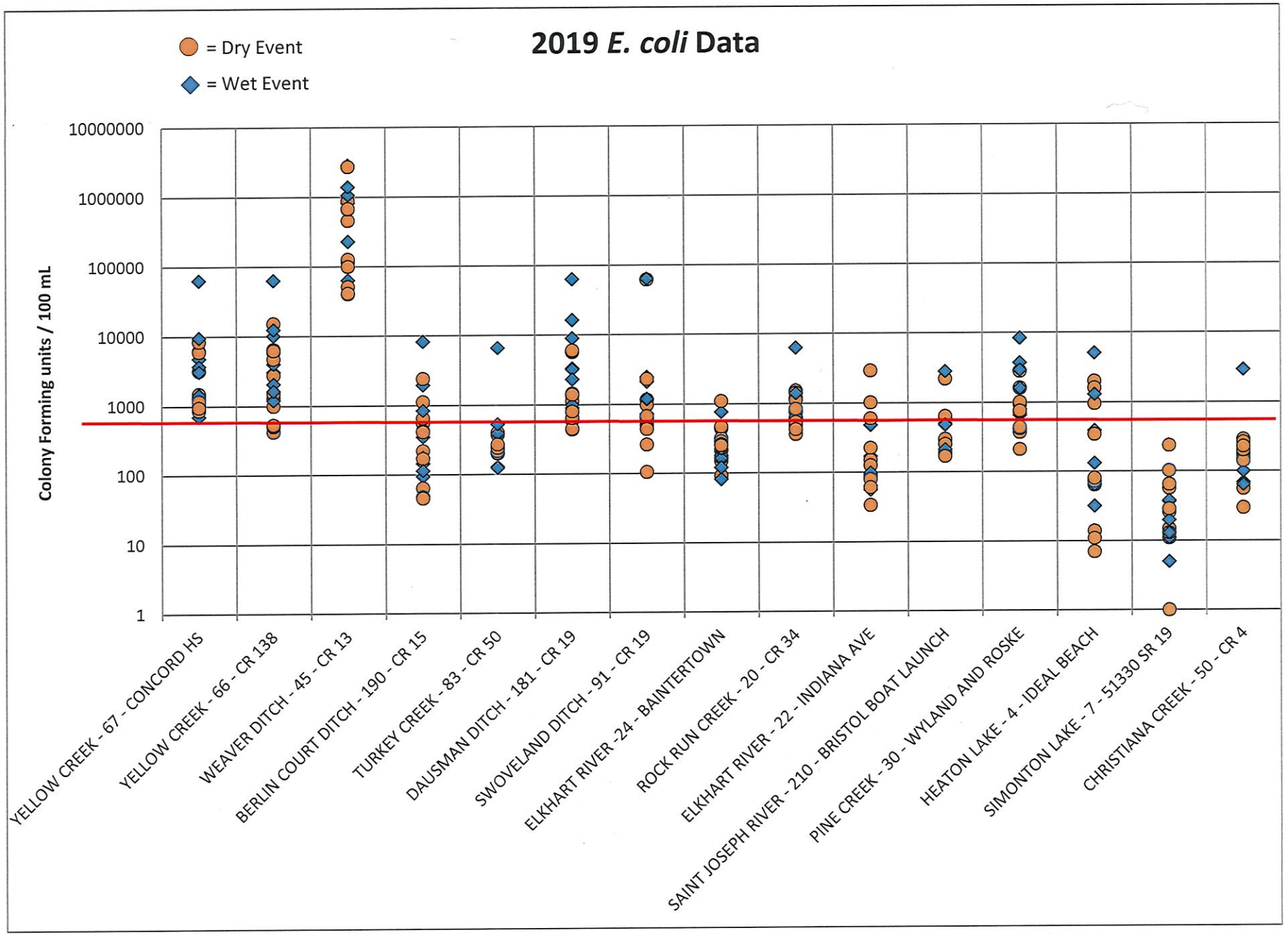
SIMONTON LAKE - 7 - 51330 SR 19

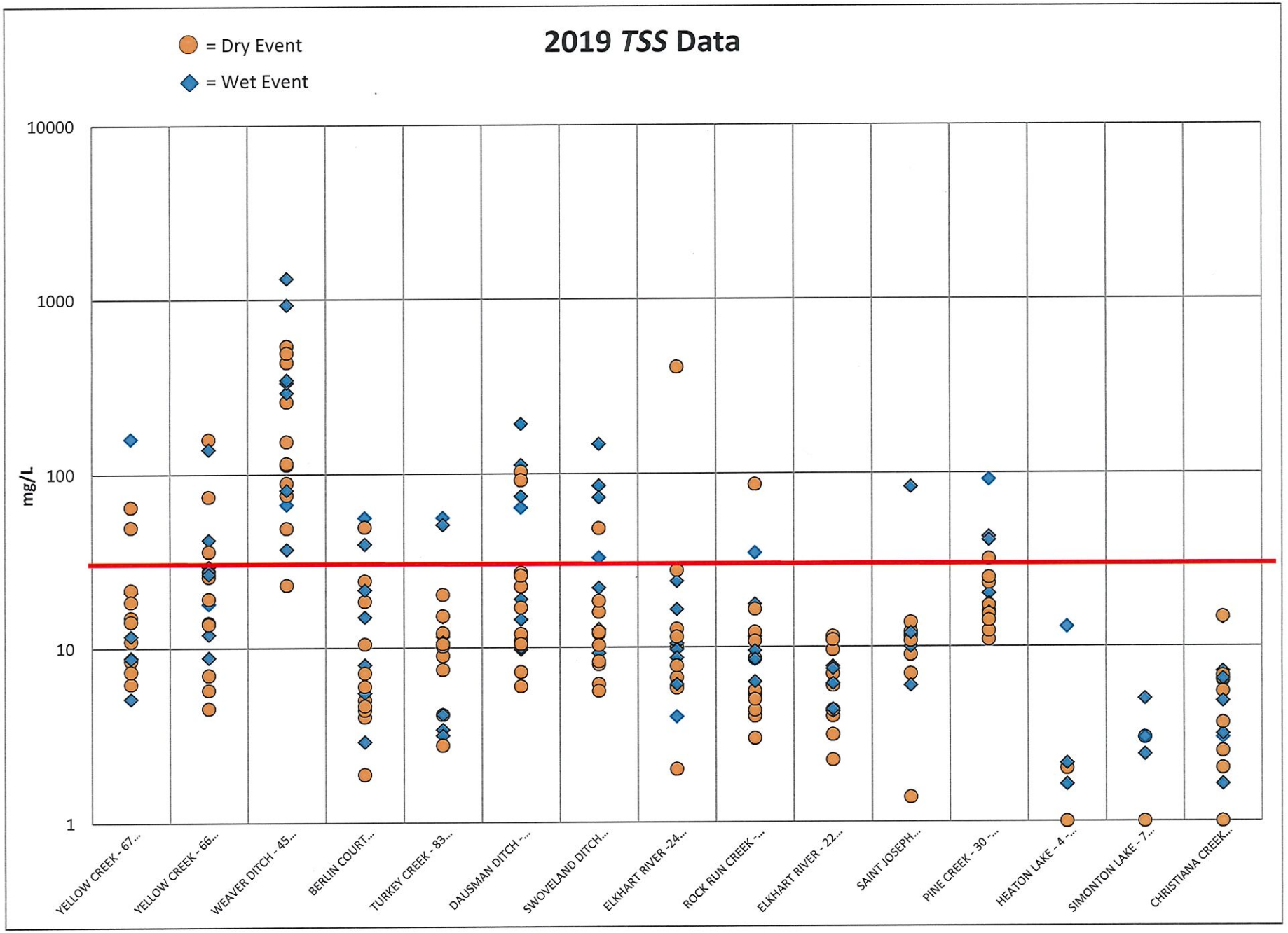
DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	11:35	15.2	8.77	305.7	8.21	33.68	0.914	0.037			n
5/14/2019	11:40	14.6	8.44	330.6	8.09	24.86	0.41	0.036	3	1	n
5/21/2019	11:45	15.8	11.72	342	8.14	38.05	0.905	0.059	1	11	y
5/28/2019	12:00	20.6	7.06	388.6	8.1	35.09	0.746	0.10	3	101	y
6/4/2019	12:05	21.4	7.51	411.3	8.28	58.99	0.984	1.68	2.4	5	n
6/11/2019	11:55	21.8	4.25	380.6	8.36	43.52	0.559	0.218	5	11	y
6/18/2019	12:00	21.5	4.15	394.9	8.04	58.860	0.731	0.134		57	n
6/25/2019	11:30	23.3	3.71	221.3	8.19	71.47	0.577	0.34		26	n
7/2/2019	11:10	28.3	3.4	441.5	8.21	92	0.553	0.113		15	n
7/9/2019	11:25	27.2	4.1	404.6	7.94	26.24	0.471	0.079		13	n
7/16/2019	11:30	27.7	3.44	428.9	7.89	86.270	0.460	0.093		13	n
7/23/2019	11:30	25.8	2.52	385.6	8.05	42.47	0.372	0.152		26	n
7/30/2019	11:35	26.1	3.65	491.5	8.24	62.15	0.42	0.123		20	y
8/6/2019	11:25	25.6	4.21	147.9	8.47	160.21	0.26	0.16		37	y
8/15/2019	11:45	25.1	4.57	374.8	8.65	87.03	0.266	0.065		65	y
8/20/2019											
8/27/2019	12:05	22.9	5.05	360.7	8.5	80.18	0.307	0.079		38	y
9/3/2019											
9/10/2019	11:45	22.1	7.03	351.3	8.39	98.32	0.226	0.064		102	n
9/17/2019	11:45	22.3	5.3	343.1	8.66	109.99	0.136	0.098		236	n
9/24/2019	12:00	21.8	5.46	355.8	8.72	168.51	0.183	0.085		29	n

CHRISTIANA CREEK - 50 - CR 4

DATE	TIME	TEMP	DO	SPC	PH	CHLORIDES	NITRATES	PHOSPHORUS	TSS	E. COLI	WET
5/7/2019	11:40	14.7	10.68	347.1	8.19	23.67	1.24	0.037			n
5/14/2019	11:50	13.4	12.07	330.7	8.3	17.13	1.2	0.025	1	30	n
5/21/2019	11:50	14.8	11.64	363.1	8.09	22.58	1.25	0.067	2	56	y
5/28/2019	12:05	20.1	7.88	410	8.09	25.28	1.200	0.077	3	69	y
6/4/2019	12:10	19.8	8.05	331.4	8.07	17.45	0.969	1.84	1.5	64	n
6/11/2019	12:05	20.4	4.2	407.2	8.14	33.13	0.891	0.215	14.5	100	y
6/18/2019	12:05	20.3	4.26	403.7	8.07	17.6	1.050	0.177	6.38	171	n
6/25/2019	11:35	21.8	4.48	428.9	8.05	60.23	0.906	0.042	14.75	180	n
7/2/2019	11:15	26.4	4.77	466.8	8.04	33.66	0.905	0.128	5.5	146	n
7/9/2019	11:40	24.9	4.73	495	7.94	19.12	0.985	0.119	6.5	147	n
7/16/2019	11:40	25.3	4.33	428.4	8.01	41.28	1.19	0.012	7.17	226	n
7/23/2019	11:35	23.4	2.74	449.8	7.98	21.56	1.08	0.157	6.75	288	n
7/30/2019	11:40	23.7	3.86	491.5	8.21	48.01	1.27	0.143	4.83	176	y
8/6/2019	11:30	23.4	4.75	386.2	8.28	47.64	1.15	0.136	6.5	2900	y
8/15/2019	11:55	23.2	4.84	432.6	8.42	41.84	1.65	0.103	2	264	y
8/20/2019											
8/27/2019	12:10	22.7	9.1	434.1	8.33	51.14	1.070	0.132	1.63	176	y
9/3/2019											
9/10/2019	12:00	20.7	8.67	437.5	8.23	61.4	1.1	0.09	2.5	140	n
9/17/2019	11:50	21.1	6.23	440.7	8.43	68.64	0.872	0.115	3.63	200	n
9/24/2019	12:10	19.7	6.54	202	8.50	101.97	0.988	0.101	3	228	n

APPENDIX 2: CHARTS FOR E.COLI & TSS


2019 E. coli Data
= Dry Event
= Wet Event
Colony Forming units / 100 mL
10000000
1000000
100000
10000
1000
100
10
1
YELLOW CREEK - 67 - CONCORD HS
YELLOW CREEK - 66 - CR 138
WEAVER DITCH - 45 - CR 13
BERLIN COURT DITCH - 190 - CR 15
TURKEY CREEK - 83 - CR 50
DAUSMAN DITCH - 181 - CR 19
SWOVELAND DITCH - 91 - CR 19
ELKHART RIVER -24 - BAINTERTOWN
ROCK RUN CREEK - 20 - CR 34
ELKHART RIVER - 22 - INDIANA AVE
SAINT JOSEPH RIVER - 210 - BRISTOL BOAT LAUNCH
PINE CREEK - 30 - WYLAND AND ROSKE
HEATON LAKE - 4 - IDEAL BEACH
SIMONTON LAKE - 7 - 51330 SR 19
CHRISTIANA CREEK - 50 - CR 4


= Dry Event
= Wet Event
2019 TSS Data
10000
1000
100
10
1
mg/L
YELLOW CREEK - 67...
YELLOW CREEK - 66...
WEAVER DITCH - 45...
BERLIN COURT...
TURKEY CREEK - 83...
DAUSMAN DITCH -...
SWOVELAND DITCH...
ELKHART RIVER -24...
ROCK RUN CREEK -...
ELKHART RIVER - 22...
SAINT JOSEPH...
PINE CREEK - 30 -...
HEATON LAKE - 4 -...
SIMONTON LAKE - 7...
CHRISTIANA CREEK...

APPENDIX 3: WATER QUALITY TARGETS

Water Quality Targets

Parameter	Target	Source
Dissolved Oxygen	> 6 mg/L and not > 9 mg/L	327 IAC 2-1-6/US EPA recommendation
Temperature	40-85 degrees F (4.4 – 29.4 C)	MI – R.323.1075
Escherichia coli	< 235 CFU/100 ml per single sample and < 125 CFU/100 ml per the geometric mean of 5 equally spaced samples over a 30 day period	327 IAC 2-1.5-8
Turbidity	< 10.4 NTU	US EPA recommendation (2000)
Total Dissolved Solids	< 750 mg/L	MI – R.323.1051 / 327 IAC 2-1-6
Total Suspended Solids	< 25 mg/L	US EPA recommendation
Total Phosphorus	< 0.3 mg/L	IDEM 303d listing criteria
Nitrate	< 1.5 mg/L	US EPA reference level (2000)
Nitrate-Nitrite	< 1.5 mg/L	Dodds et al. (1998)
TKN	<0.076 mg/L	Dodds et al. (1998)
Biological Oxygen Demand	< 50%	Hoosier Riverwatch Protocol
pH	> 6 or < 9	327 IAC 2-1-6
macroinvertebrate Index of Biotic Integrity (mIBI)	>23 points / >36 points	Hoosier Riverwatch Protocol / IDEM (2008)
Qualitative Habitat Evaluation Index (QHEI)	> 51 pts	IDEM (2008)
Index of Biotic Integrity (IBI) (fish)	$\geq$ 36 points	IDEM (2006)

APPENDIX 4: TNTC REPORTING POLICY

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We make Indiana a cleaner, healthier place to live.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
(800) 451-6027
www.IN.gov/idem

MEMORANDUM

To: **All NPDES Permittees Who Must Perform *E.coli* Testing**

From: **Martha Clark Mettler, Acting Assistant Commissioner, Office of Water Quality**

Subject: **Policy for Reporting "Too Numerous to Count" (TNTC) Data for *E. coli* Testing**

Date: **July 1, 2005**

Utilization of this TNTC policy should not become necessary in any but the rarest of situations. Any questions regarding this policy should be directed to Barbara McDowell at 317-233-6464 or bmcdowel@idem.IN.gov

For Testing Methods Utilizing a Membrane Filter:

NPDES permits require that the monthly average of *E. coli* be less than 125 colonies per 100 milliliters (mL) of filtered sample. *Standard Methods for the Examination of Water and Wastewater* 20th Edition – pages 9-59, indicate that the allowable maximum number of colonies per plate (filter) is 200. The optimum count is in the range of 20 to 80 colonies, with an ideal sample yielding about 50 colonies. (If no filter has a count falling in the optimum range, meaning in the range of 20 to 80 colonies, total the colonies on all filters and report as number per 100 mL) (See 20th Edition – pages 9-61 for detailed examples.)

Even though filtration of 100 milliliters (or lesser volumes) normally produces an acceptable colony count for disinfected effluent, occasionally the count for these normally acceptable dilutions may exceed 200 colonies per plate.

To prevent such an occurrence we are strongly recommending that laboratory personnel *routinely* run a 1.0 milliliter dilution *along with* the normally acceptable dilutions for each test.

If all dilutions for that test, including the 1.0 mL dilution, result in plates (filters) that are deemed TNTC, the number reported for the 1.0 mL test should be 63,200. This number should be reported on the Monthly Report of Operations (MRO) as the *E.coli* result for that day and should be included in the monthly average calculation.

Justification: If the 1.0 mL plate is deemed TNTC, then the actual count is likely to be somewhere between 20,000 (maximum count for a 1.0 mL dilution) and 200,000 (maximum count for a 0.1 mL dilution). **The TNTC number of 63,200 is the geometric mean of those two numbers.**