

PHYSIOCHEMICAL CHARACTERISTICS OF RUNOFF AND SURFACE WATERS OF LOWER COEYMANS CREEK

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For:
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TABLE OF CONTENTS

INTRODUCTION

A physiochemical surface water sampling effort was conducted along a longitudinal gradient on lower Coeymans Creek in Albany County, New York State, focused within a segment of the creek which flows thorough an industrial park. Publicly available aerial imagery shows numerous points on the landscape surrounding lower Coeymans Creek which appear to be developed for industrial or commercial purposes such as processing or storage of bulk road salt, scrap metal, and electrical transformers. The goal was to collect and analyze physiochemistry data within the mainstem of Coeymans Creek and any incoming tributaries or outfall points between NYS Thruway Route 87 and State route 144 during a heavy precipitation event.

This segment of Coeymans Creek is designated as a Class C (TS) water by DEC, where 'TS' designates trout spawning, as the Coeymans Creek watershed is annually stocked with brown trout (*Salmo trutta*) to provide recreational angling opportunities within Coyemans Creek (https://www.dec.ny.gov/outdoor/23338.html). The trout-spawning designation provides an additional statutory layer of protection for the stream's water quality. According to DEC regulations:

"Trout spawning waters are trout waters in which trout eggs can be deposited and be fertilized by trout inhabiting such waters (or connecting waters) and in which those eggs can develop and hatch, and the trout hatched therefrom could survive and grow to a sufficient size and stage of development to enable them to either remain and grow to adult trout therein, or migrate into and survive in other trout waters." 6 NYCRR 700.1(68)

Furthermore, "trout waters" are defined as:

"Trout waters are waters that provide habitat in which trout can survive and grow within a normal range on a year-round basis, or on a year-round basis excepting periods of time during which almost all of the trout inhabiting such waters could and would temporarily retreat into and survive in adjoining or tributary waters due to natural circumstances." 6 NYCRR 700.1(67).

Natural tributaries entering Coeymans creek require the same level of environmental protection offered to a C(TS) stream, as they are "*connecting waters*" and trout would have the ability to *"temporarily retreat into and survive in adjoining or tributary waters due to natural circumstances."* These tributaries need not be permanent to support these activities, as ephemeral tributaries may be suitable, depending on discharge regimes. 'Natural circumstances' as they relate to brown trout stocked in the Coeymans Creek watershed would commonly refer to fish seeking tributaries for thermal refuge and spawning activities. The latter may be applicable in lower Coeymans Creek during the time of sampling, as brown trout spawn in autumn months, often September-November.

New York State has established water quality standards and guidance values for various classifications of surface waters that include numeric criteria for many analytes and substances (https://www.dec.ny.gov/chemical/23853.html).

METHODS

Surface water grab samples were collected from lower Coeymans Creek on October 7, 2019. Over an inch of rain had fallen over Albany County over the time period between October 6 – 7, 2019 (https://www.usclimatedata.com/climate/albany/new-york/united-states/usny0011/2019/10), providing for adequate runoff event sampling conditions. To access the lower portion of Coeymans Creek, a canoe-float was employed, which began at Old Ravena Rd and ended at Route 144. Water quality parameters and/or grab samples were taken at 12 locations: four above the industrial park zone, seven within the industrial park zone, and one immediately downstream of the industrial park zone (Figures 1 & 2). Specific collection location information and time of collection can be found in Table 1.

In-situ surface water physiochemical measurements of temperature, dissolved oxygen, pH, and conductivity were taken with a YSI Professional Plus handheld Multi-parameter instrument (https://www.ysi.com/proplus). Grab samples taken from discrete outfall locations were collected with appropriate vessels and chemical preservatives as determined by the analyte or substance being tested, and in accordance with standard practices or analytical lab requirements. A full list of measured analytes along with collection requirements, analytical method, and water quality standards can be found in Table 2. For analytes whose toxicity is hardness dependent, Table 3 summarizes the chronic and acute toxicity levels for each collection site based on the hardness at time of collection. Water hardness was calculated from section 2340-B of *Standard Methods for the Examination of Water and Wastewater* (2005). All samples collected for laboratory analyses were kept on ice immediately after collection until delivery to the appropriate analytical laboratory.

Grab-samples for PCBs, Oil/Grease, and Chemical Oxygen Demand (COD) were submitted for analyses to Microbac Laboratories Inc., Cortland NY on October 7, 2019. Grab samples for Chlorides, Mercury, and Total Suspended Solids (TSS) were submitted for analyses to Community Science Institute, Ithaca NY, on October 8, 2019. Grab-samples for metals were submitted to the Cornell Nutrient Analysis Laboratory on October 8, 2019.

RESULTS

Grab sample measurements for all sites can be reviewed in Tables 4 – 6. Within the commercial/industrial zone of lower Coeymans Creek – between NYS thruway Route 87 and State route 144, numerous breaches of C(TS) water quality standards were observed from both incoming natural tributaries and outfalls directly emptying into the Coeymans Creek mainstem.

Tributaries sampled at sites 5,6, and 7 all possessed elevated chloride values. While there is no stand-alone chloride standard or guidance value for Class C or TS waters, there is a total dissolved solids (TDS) standard of 500 mg/L. Chloride is a major contributor to dissolved solids (https://www.usgs.gov/mission-areas/water-resources/science/chloride-salinity-and-dissolved-solids). Therefore, if a sampling site exceeds 500mg/L of chloride, it also violates the TDS standard for Class C or TS waters. Site 6 was the most egregious with a chloride reading of 42,050 mg/L, an exceedance of 83-times the TDS standard. Sites 5 and 7 possessed a chloride value of 1,644mg/L and 1,925mg/L, respectively, exceeding the standard by 2.2 and 2.8 times the TDS standard, respectively. Sodium is also a component of dissolved solids, and sites 5 and 6 possessed sodium values in exceedance of the TDs standard with 23,542mg/L and 699mg/L, respectively. Additionally, tributary Site 6, also violated the dissolved oxygen standard (below 7.0mg/L) with a value of 5.73mg/L. Furthermore, we observed unusually high Chemical Oxygen Demand (COD) within tributary 6 - 3,060mg/L-eight to ten times higher than other grab samples collected.

Outfall 10 within the industrial park area breached the TDS standard with an observed value of 900mg/L. Outfall site 11 showed no unusual analyte values or exceedances. Outfall site 9 measured elevated conductivity values (2,060µS/cm), but other in-situ values of DO, temperature, and pH were within normal bounds. Site 9 flow was limited, and a great deal of sediment was built up in the pipe. All other outfalls had robust flow resulting from the prior and existing precipitation event.

CONCLUSIONS

Within the industrial park, both natural tributaries and man-made outfalls emptying directly into the Coeymans Creek mainstem possessed dissolved solids levels in exceedance of the numeric water quality criterion found in the surface water quality standard for Class-C waters (500 mg/L). Within Tributary Site #6, observable water quality degradation in the form of low dissolved oxygen and high chlorides could impair or disrupt trout behavior.

All of these inputs, cumulatively, likely contribute to the ~18% increase in Coeymans Creek mainstem conductivity values observed between mainstem Site 4 (960 µS/cm) and mainstem Site 12 (1,130 µS/cm). For comparison, this rate of increase over stream distance is 75% higher than observed conductivity increase between Old Ravena Rd and Site 4, prior to entrance into the industrial park area.

Table 1: Collection location information for grab samples collected at Lower Coeymans Creek on October 7, 2019.

Collection Site	Time Collected	Easting UTM	Northing UTM	Sampling Location Description
#1	8:14	597945	4706493	Coeymans Creek downstream of Old Ravena Rd
#2	8:29	598335	4706169	Coeymans Creek at Coeymans WMA
#3	8:58	598088	4705589	Outfall pipe at south drainage of cement plant
#4	9:34	598588	4704911	Coeymans Creek upstream of industrial park
#5	9:59	598585	4704565	Tributary draining the NW portion of industrial park
#6	10:24	598846	4704326	Tributary draining western portion of industrial park
#7	10:46	598792	4704171	Tributary draining western portion of industrial park
#8	10:51	598837	4704046	Outfall: 30” pipe discharging into Coeymans Creek
#9	11:09	598938	4704056	Outfall: 48” pipe discharging into Coeymans Creek
#10	11:25	599042	4703812	Outfall: 30” pipe discharging into Coeymans Creek
#11	11:35	599072	4703747	Outfall: 40” pipe discharging into Coeymans Creek
#12	12:30	599111	4703587	Coeymans Creek upstream of State Route 144

Table 2: Analyte collection information, vessel requirements, and applicable surface water standards.

Analyte or Substance	Units of Measure	Collection Vessel	Analytical Method	Numeric Standard or Guidance Value for C(TS) Water[1]	Sites Collected
pH	-	Probe	In-Field	6.50<pH<8.5	1-12
Dissolved Oxygen	mg/L	Probe	In-Field	7.0	1-12
Conductivity	µS/cm	Probe	In-Field	none	1-12
H_20 Temperature	C	Probe	In-Field	>50F	1-12
COD	mg/L	500lm LDPE[2] w/ H_2SO_4	HACH 8000	none	4,5,6,8,10,11
PCBs	µg/L	1L amber glass	EPA 608.3	0.505	4,8,10,11
Oil/Grease	mg/L	1L glass w/ H_2SO_4	EPA 1664A	5.0	4-7,9-11
Total Suspended Solids	mg/L	500ml LDPE	Std Methods 2540-D	none	4,5,6,8,10,11
Chloride (Cl)	mg/L	250ml LDPE	Std Methods 2122:4500-Cl	none	4-8,10,11
Hardness	mg/L	calculated	Std. Methods 2340-B	none	1-12
METALS					
Aluminum (Al)	mg/L	500ml LDPE	EPA 3015-6010	0.100, ionic	4-8,10,11
Arsenic (As)	µg/L	“	"	0.150 chronic, 0.340 acute	4-8,10,11
Barium (Ba)	mg/L	“	"	1.00	4-8,10,11
Beryllium (Be)	mg/L	“	"	1.10	4-8,10,11
Boron (B)	mg/L	“	"	1.00	4-8,10,11
Cadmium (Cd)	mg/L	“	"	*hardness dependent	4-8,10,11
Calcium (Ca)	mg/L	“	"	none	4-8,10,11
Chromium (Cr)	mg/L	“	"	*hardness dependent	4-8,10,11
Copper (Cu)	mg/L	“	"	*hardness dependent	4-8,10,11
Iron (Fe)	mg/L	“	"	none	4-8,10,11
Lead (Pb)	mg/L	“	"	*hardness dependent	4-8,10,11
Magnesium (Mg)	mg/L	“	"	none	4-8,10,11
Manganese (Mn)	mg/L	“	"	none	4-8,10,11
Mercury (Hg)	µg/L	500ml LDPE w/ HNO_3	EPA 245.2	0.77 chronic, 1.4 acute	4,6,8,10,11
Nickle (Ni)	mg/L	500ml LDPE	EPA 3015-6010	*hardness dependent	4-8,10,11
Phosphorus (P)	mg/L	“	"	none	4-8,10,11
Selenium (Se)	mg/L	“	"	0.01	4-8,10,11
Silver (Ag)	µg/L	“	"	0.1, ionic	4-8,10,11
Sodium (Na)	mg/L	“	"	none	4-8,10,11
Zinc (Zn)	mg/L	“	"	*hardness dependent	4-8,10,11

[1]: http://www.dec.ny.gov/docs/water_pdf/togs1112.pdf

[2]: Low-density polyethylene

Table 3: Toxicity standards for analytes which are hardness dependent. Hardness was calculated from section 2340-B in Standard Methods for the Examination of Water and Wastewater (2005) as follows:

Hardness = 2.497*(Ca,mg/L) + 4.118*(Mg,mg/L). Abbreviations 'A(C)' and 'A(A}' refer to chronic and acute toxicities, respectively, where chronic impairs biological propagation and acute impairs life.

Site Number	Hardness mg/L	Cadmium (Cd) µg/L		Chromium (Cr) µg/L		Copper (Cu) µg/L		Lead (Pb) µg/L		Nickel (Ni) µg/L		Zinc (Zn) µg/L	
		A(C)	A(A)	A(C)	A(A)	A(C)	A(A)	A(C)	A(A)	A(C)	A(A)	A(C)	A(A)
1	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	787	10.6	39.3	401	3085	52.1	93.8	93	2409	819	7386	464	646
4	408	6.3	18.7	234	1800	29.7	50.4	36	939	422	3830	266	370
5	564	8.1	27.0	305	2349	39.2	68.5	58	1498	584	5297	350	487
6	879	11.5	44.6	439	3370	57.3	104	109	2816	909	8243	509	709
7	729	9.9	36.0	376	2896	48.8	87.2	84	2157	754	6837	435	605
8	491	7.3	23.1	272	2096	34.8	60.1	47	1227	509	4612	311	433
9	-	-	-	-	-	-	-	-	-	-	-	-	-
10	299	4.9	13.2	181	1393	22.7	37.6	23	598	309	2804	204	284
11	315	5.2	14.0	189	1458	23.8	39.6	25	648	327	2963	214	297
12	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4: Grab sample analyte results for non-metals, plus mercury collected from lower Coeymans Creek on October 7, 2019. A dash indicates no sample was collected or measured from that site number and 'ND' indicates a sample was collected, but the measurement was a non-detect or below an accepted detection threshold.

Site Number	Temp. C	Cond. µS/cm	DO mg/L	pH	COD mg/L	PCBs µg/L	Oil/Grease mg/L	TSS mg/L	Chloride mg/L	Mercury µg/L
1	13.2	750	9.43	7.76	-	-	-	-	-	-
2	13.0	760	9.58	7.89	-	-	-	-	-	-
3	14.4	1,360	9.33	8.14	-	-	-	-	-	-
4	13.4	960	9.33	8.07	ND	ND	ND	8.5	63.3	ND
5	14.7	5,240	8.90	8.13	49.2	-	ND	18.0	1,644	-
6	15.1	10,320	5.73	7.56	3,060	-	ND	177	42,050	ND
7	14.4	6,870	8.66	7.97	-	-	-	-	1,925	-
8	14.4	1,900	9.28	8.12	30.8	ND	ND	34.0	301	ND
9	14.3	2,060	7.99	7.56	-	-	ND	-	-	-
10	14.9	3,420	9.18	8.02	56.0	ND	ND	176	900	ND
11	15.6	1,100	9.93	8.09	24.9	ND	ND	18.5	143	ND
12	13.3	1,130	10.42	8.13	-	-	-	-	-	-

Table 5: Grab sample analyte results for metals which don't require a hardness-dependent water quality standard collected from lower Coeymans Creek on October 7, 2019. A dash indicates no sample was collected or measured from that site number and 'ND' indicates a sample was collected, but the measurement was a non-detect or below an accepted detection threshold.

Site Number	Aluminum (Al) mg/L	Arsenic (As) µg/L	Beryllium (Be) mg/L	Calcium (Ca) mg/L	Iron (Fe) µg/L	Magnesium (Mg) mg/L	Manganese (Mn) µg/L	Selenium (Se) mg/L	Silver (Ag) µg/L	Sodium (Na) mg/L
1	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-
3	0.13	0	0	192	3	74	14	0	0	22
4	0.15	0	0	114	23	29	0	0	0	33
5	0.19	0	0	144	44	49	13	0	0	699
6	0.10	0	0	176	332	106	1,096	0	0	23,542
7	0.15	0	0	203	42	53	25	0	0	880
8	0.16	0	0	120	65	46	3	0	0	192
9	-	-	-	-	-	-	-	-	-	-
10	0.30	0	0	93	132	16	300	0	0	129
11	0.20	0	0	77	48	29	28	0	0	54
12	-	-	-	-	-	-	-	-	-	-

Table 6: Grab sample analyte results for metals which require a hardness-dependent water quality standard collected from lower Coeymans Creek on October 7, 2019. A dash indicates no sample was collected or measured from that site number and 'ND' indicates a sample was collected, but the measurement was a non-detect or below an accepted detection threshold

Site Number	Cadmium (Cd) µg/L	Chromium (Cr) µg/L	Copper (Cu) µg/L	Lead (Pb) µg/L	Nickel (Ni) µg/L	Zinc (Zn) µg/L
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	0	0	2.0	0	0	0
4	0	0	2.0	0	0	0
5	0	0	12.0	0	4.0	0
6	1.0	0	7.0	0	0	8.0
7	0	0	4.0	0	0	0
8	0	0	4.0	0	0	0
9	-	-	-	-	-	-
10	0	0	10.0	0	0	2.0
11	0	0	3.0	0	0	0
12	-	-	-	-	-	-

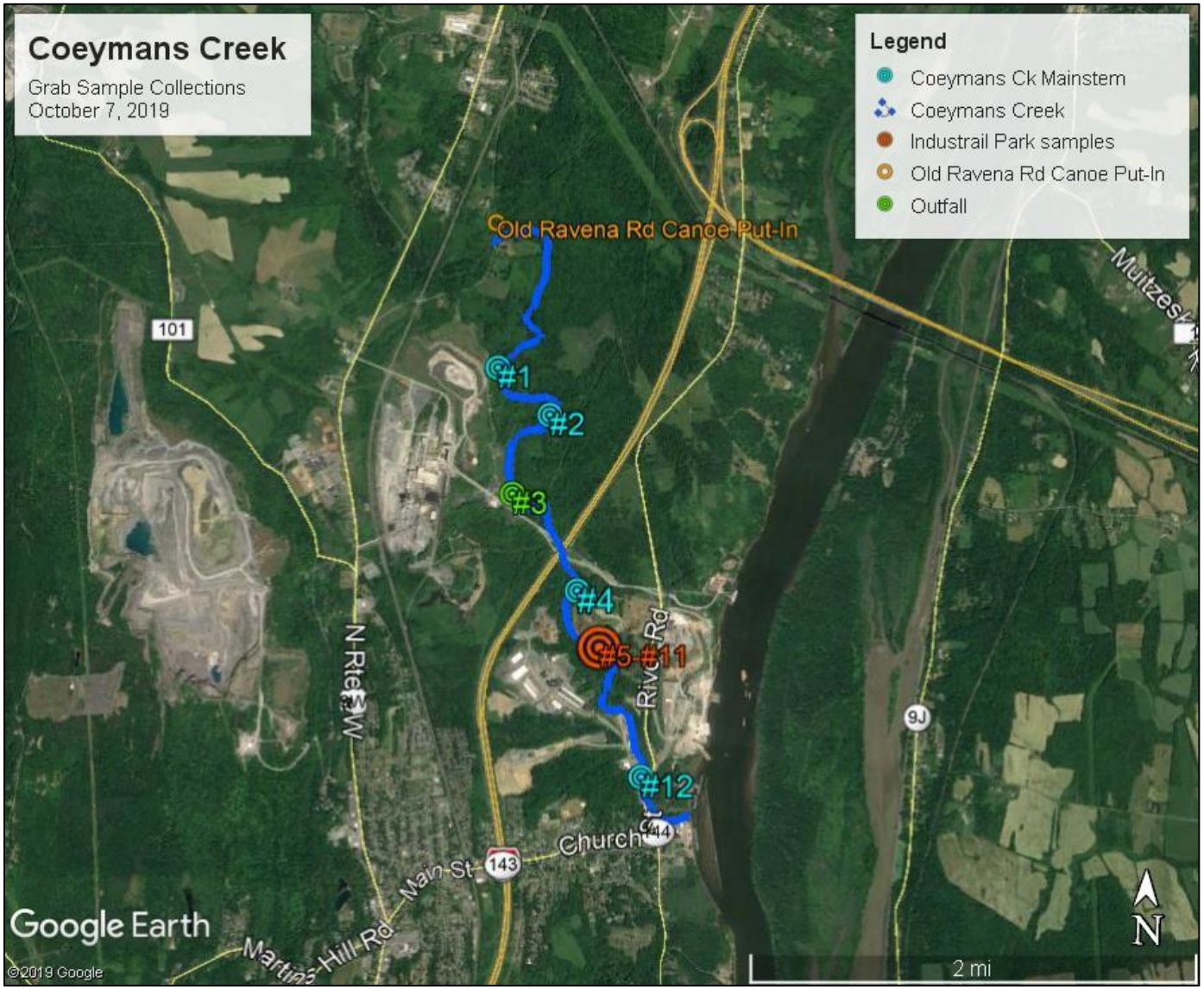

Figure 1: Location of lower Coeymans creek grab-sample collection effort in Albany County, New York State, conducted on October 7, 2019.

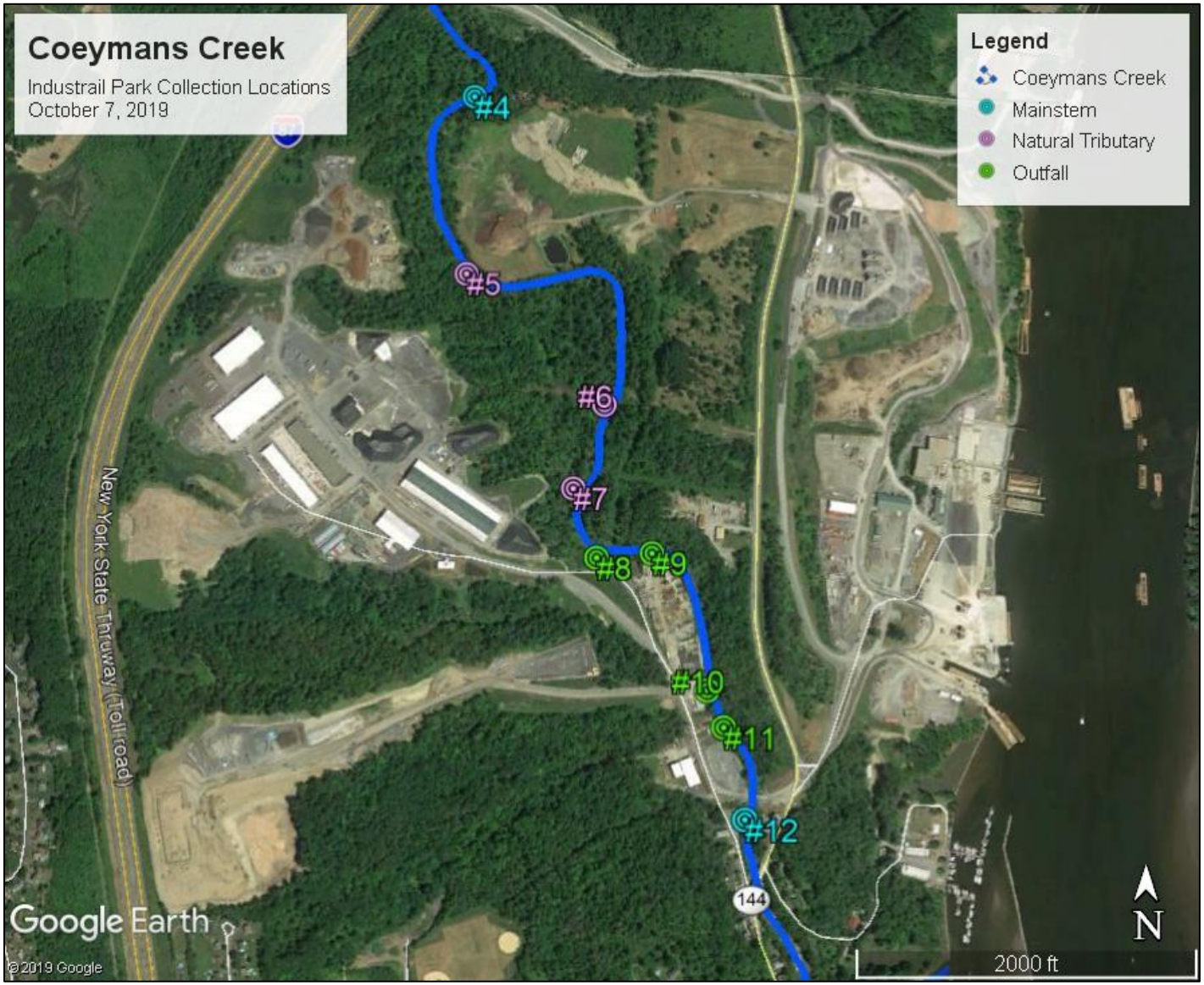

Figure 2: ***Location grab-samples collected within the Industrial area of lower Coeymans Creek on October 7, 2019.***