

HOSENSACK CREEK
BERKS, LEHIGH AND MONTGOMERY COUNTIES

WATER QUALITY STANDARDS REVIEW
DRAFT STREAM EVALUATION REPORT

Segment: Basin
Stream Code: 01473
Drainage List: F

WATER QUALITY MONITORING SECTION
WATER QUALITY DIVISION
BUREAU OF CLEAN WATER
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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INTRODUCTION

The Department of Environmental Protection (DEP) conducted an evaluation of the Hosensack Creek basin in response to a petition submitted by the Delaware Riverkeeper Network, Perkiomen Valley Trout Unlimited and Lower Milford Township, which was accepted for further study by the Environmental Quality Board (EQB) on April 21, 2015. The petitioner requested that the Hosensack Creek be redesignated to Exceptional Value (EV). The Hosensack Creek basin is currently designated Cold Water Fishes, Migratory Fishes (CWF, MF) from the headwaters to its confluence with Perkiomen Creek.

The stream redesignation process begins with an evaluation of the “existing uses” and the “designated uses” of a stream. “Existing uses” are water uses actually attained in the waterbody. Existing uses are protected through permit or approval actions taken by the DEP. “Designated uses” are water uses identified in regulations that protect a waterbody. Candidates for stream redesignation may be identified by the DEP based on routine waterbody investigations or based on requests initiated by other agencies or from the general public through a rulemaking petition to the EQB.

GENERAL WATERSHED DESCRIPTION

Hosensack Creek is a freestone tributary to Perkiomen Creek in the Delaware River watershed. The drainage area of the Hosensack Creek basin is approximately 18 square miles and contains 31.3 stream miles. The current land cover within the Hosensack Creek basin consists of 53.5% forested, 30.2% agricultural, 13.4% urban and developed areas and 2.9% water/wetlands (Dewitz 2019). There are six National Pollutant Discharge Elimination System (NPDES) permits including three municipal stormwater permits and three sewage treatment permits within the basin.

WATER QUALITY

In response to the petition submitted by the Delaware Riverkeeper Network and copetitioners, DEP collected water quality data in March 2018. Data collected included physical, chemical and biological data from three locations throughout the Hosensack Creek basin (Table 1, Figure 1) as well as one reference station (USC) on an Unnamed Tributary (UNT) to Sixpenny Creek located in Berks County (Table 1).

Discrete Chemistry

Water chemistry data was collected at three locations within the Hosensack Creek basin as well as at the reference station on the UNT to Sixpenny Creek (Table 1, Figure 1). With few exceptions, metals and nutrient concentrations and physical/other parameters were generally more elevated at Hosensack Creek basin stations when compared to the UNT to Sixpenny Creek reference station. Nitrate and nitrite, both total and dissolved parameters, at Hosensack Creek basin locations ranged from 1.34 mg/L to 3.59 mg/L, while USC had concentrations of 0.08 mg/L for both total and dissolved. Phosphorus parameters (ortho, total and dissolved) were mixed with total phosphorus highest at USC, while other phosphorus parameters were fairly consistent across all stations. Alkalinity (75.8 mg/L) and pH (8.61

SU) were highest at the Hosensack Creek 1HC station. All metal and ion parameters were higher at Hosensack Creek basin stations compared to the USC reference station including calcium, chloride

Table 1. Station Locations – Hosensack Creek Basin and Reference (REF).

STATION	DESCRIPTION
1HC	Hosensack Creek at Hosensack Upper Milford Township, Lehigh County Lat: 40.45368 Long: -75.50131
2UHC	Unnamed Tributary 01479 Hosensack Creek at Palm Road Upper Milford Township, Lehigh County Lat: 40.45777 Long: -75.50465
3IC	Indian Creek at Shultz Bridge Road Upper Milford Township, Lehigh County Lat: 40.44901 Long: -75.51498
USC (REF)	Unnamed Tributary to Sixpenny Creek at French Creek State Park Union Township, Berks County Lat: 40.23900 Long: -75.77878

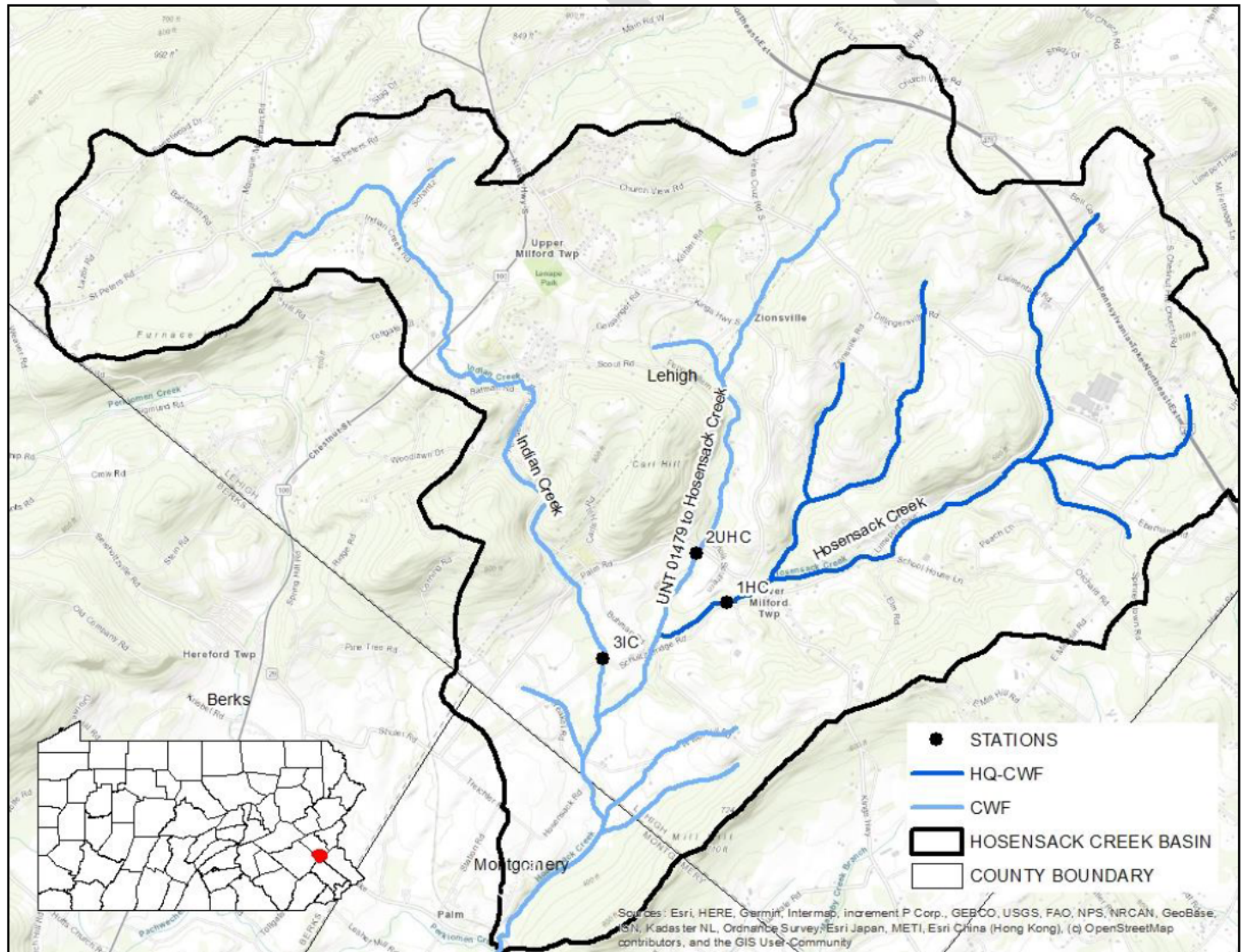


Figure 1. Hosensack Creek Basin Station Locations and Redesignation Recommendation.

and sodium, which are typically an indication of urban development effects. Specific conductance often increases with anthropogenic activity and can be used as an indication of accumulative impacts. Specific conductance ranged from 229 $\mu\text{S}/\text{cm}$ to 344 $\mu\text{S}/\text{cm}$ at Hosensack Creek basin stations compared to 86.4 $\mu\text{S}/\text{cm}$ at USC (Appendix A).

Biological

The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. DEP staff collected benthic macroinvertebrate data from the three stations throughout the Hosensack Creek basin and from the reference station on the UNT to Sixpenny Creek in 2018. In addition, the Pennsylvania Fish and Boat Commission (PFBC) collected trout biomass data from two stations on Hosensack Creek in 2014.

Benthos

Benthic macroinvertebrate samples were collected at three stations in the Hosensack Creek basin and at one reference station located on the UNT to Sixpenny Creek in Berks County in March 2018 (Appendix B) using DEP benthic macroinvertebrate data collection protocols, which is a modification of the U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (Barbour et al. 1999, Plafkin et al. 1989, Shull 2017b).

Macroinvertebrate data from Hosensack Creek basin candidate stations were consistent with water quality conditions that are affected by anthropogenic activities. Taxa richness was lower and ranged from 19 to 24 at Hosensack Creek basin stations compared to a taxa richness of 28 at the UNT to Sixpenny Creek reference station. The intolerant Ephemeroptera, Plecoptera, Trichoptera (EPT) metric (EPT Richness (PTV 0-4)) range (9 – 13) was also lower for Hosensack Creek basin stations compared to the UNT to Sixpenny Creek station (15). The index of biotic integrity (IBI) score for the UNT to Sixpenny Creek (87.6) was much higher than IBI scores for Hosensack Creek basin stations (58.7 – 60.2, Table 2).

Table 2. Benthic Macroinvertebrate Metrics and IBI Scores.

METRICS	STATIONS ¹			REF ¹
	1HC	2UHC	3IC	USC
TAXA RICHNESS	19	22	24	28
EPT RICHNESS (PTV 0-4)	9	13	10	15
BECKS INDEX V. 3	14	7	11	32.0
HILSENHOFF INDEX	3.15	3.70	4.35	2.10
SHANNON DIVERSITY	2.13	2.41	2.46	2.65
% SENSITIVE INDIV. (PTV 0-3)	50.9	44.2	39.7	73.8
IBI²	60.2	58.7	59.5	87.6

¹ Refer to Figure 1 and/or Table 1 for station locations

² Index of Biotic Integrity (Shull 2017a)

Fishes

Trout biomass data was collected by PFBC according to PFBC protocols (Miko et al. 2011) at two stations on Hosensack Creek in 2014. Trout biomass data is evaluated later in the 'Class A Wild Trout – High Quality Qualification' section.

Physical

Instream habitat was evaluated at each station where benthic macroinvertebrates were collected using DEP's *Stream Habitat Data Collection Protocol* (Lookenbill 2017) and *Physical Habitat Assessment Method* (Walters 2017). The habitat evaluation consists of rating twelve parameters to derive a total habitat score. Total habitat scores for candidate stations ranged from 149 to 205 with suboptimal scores at stations 1HC (149) and 3IC (184) and an optimal score at station 2UHC (205). The UNT to Sixpenny Creek reference station had an optimal total habitat score of 216. Total scores across all stations exceeded the total habitat impairment threshold (140); however, couplet summations for embeddedness + sediment deposition and condition of banks + bank vegetative protection were below impairment thresholds (24) indicating siltation and habitat modification causes of impairment (Table 3).

Table 3. Habitat Evaluation Data.

PARAMETER	STATIONS ¹			REF ¹
	1HC	2UHC	3IC	USC
1. INSTREAM COVER	9	19	16	18
2. EPIFAUNAL SUBSTRATE	14	16	16	19
3. EMBEDDEDNESS	10	15	16	16
4. VELOCITY/DEPTH	11	15	13	12
5. CHANNEL ALTERATIONS	12	16	13	20
6. SEDIMENT DEPOSITION	13	16	16	18
7. RIFFLE FREQUENCY	16	18	18	18
8. CHANNEL FLOW STATUS	18	18	19	19
9. BANK CONDITION	11	18	15	17
10. BANK VEGETATIVE PROTECTION	13	18	15	19
11. GRAZING/DISRUPTIVE PRESSURE	11	18	15	20
12. RIPARIAN VEG. ZONE WIDTH	11	18	12	20
Total Score	149	205	184	216
Rating ²	SUB	OPT	SUB	OPT
EMBEDDEDNESS + SEDIMENT DEPOSITION ³	23	31	32	34
CONDITION OF BANKS + BANK VEG. PROTECTION ³	24	36	30	36

¹ Refer to Figure 1 and/or Table 1 for station locations

² OPT = Optimal (≥ 192); SUB = Suboptimal (132-192)

³ ≤ 24 = Impaired

CLASS A WILD TROUT – HIGH QUALITY QUALIFICATION

The DEP is required by regulation, 25 Pa. Code § 93.4b(a)(2)(ii), to consider streams for High Quality (HQ) designation when the PFBC provides information that indicates a stream is a Class A Wild Trout stream based on wild trout biomass and the PFBC, after public notice and comment, classifies the stream as a Class A Wild Trout Water. The PFBC approved the addition of the Class A listing for a portion of Hosensack Creek in January 2015. (Murphy et al. 2015). DEP staff conducted an independent review of the trout biomass data along with a review of the surface water quality.

PFBC staff collected trout biomass data from two locations throughout the Hosensack Creek basin in 2014. One PFBC station location was generally consistent with the 1HC DEP station location. A second PFBC station was located approximately 1.5 miles upstream of 1HC. Brown trout biomass (128.60 kg/ha and 87.65 kg/ha) from both stations independently, as well as the mean biomass reported (108.12

kg/ha) exceeded the biomass threshold (40 kg/ha; Detar et al. 2011) for Class A Brown Trout (Murphy et al. 2015).

Based on applicable regulatory definitions and requirements of 25 Pa. Code § 93.4b(a)(2)(ii) the Hosensack Creek basin from the source to UNT 01479 (approximately 12.2 stream miles) qualifies as HQ-CWF based on PFBC Class A Wild Trout classifications.

INTEGRATED BENTHIC MACROINVERTBRATE SCORING TEST

The DEP applied its integrated benthic macroinvertebrate scoring test described at 25 Pa. Code § 93.4b(b)(1)(v) to Hosensack Creek basin candidate stations. Selected benthic macroinvertebrate community metrics calculated for the basin stations evaluated were compared to the station on the UNT to Sixpenny Creek in Berks County. The UNT to Sixpenny Creek was chosen as an Exceptional Value (EV) reference because it has comparable drainage area, is found in similar geologic settings as the candidate stations, it has demonstrated an existing use of EV based on biological measures, and the macroinvertebrate community has demonstrated best attainable biological communities by scoring well above the top 25th percentile of Pennsylvania EV reference streams. In addition, the UNT to Sixpenny Creek reference has optimal habitat and similar gradient, drainage area, pH and alkalinity to the candidate stream stations (DEP 2013). The comparisons were done using the following metrics that were selected as being indicative of community health: taxa richness, modified EPT index, modified Hilsenhoff Biotic Index (HBI), percent dominant taxon, and percent modified mayflies (Table 4).

Based on these five metrics, none of the candidate stations within the Hosensack Creek basin exceeded the EV qualifying criterion of 92%.

Table 4. Benthic Macroinvertebrate Metric Comparison.

METRIC	STATIONS ¹			REF ²
	1HC	2UHC	3IC	USC
TAXA RICHNESS	19	22	24	28
Cand/Ref (%)	68	79	86	
Biol. Cond. Score	3	7	8	8
MOD. EPT INDEX	9	10	10	15
Cand/Ref (%)	60	67	67	
Biol. Cond. Score	3	4	4	8
MOD. HBI	3.15	3.70	4.35	2.10
Cand-Ref	1.05	1.60	2.25	
Biol. Cond. Score	3	0	0	8
% DOMINANT TAXA	39.5	28.1	28.5	20.1
Cand-Ref	19.4	8	8.4	
Biol. Cond. Score	2	8	8	8
% MOD. MAYFLIES	42.7	32.7	27.1	34.6
Ref-Cand	-8.1	1.9	7.5	
Biol. Cond. Score	8	8	8	8
TOTAL BIOLOGICAL CONDITION SCORE	19	27	28	40
% COMPARABILITY TO REFERENCE	48	68	70	

¹ Refer to Figure 1 & Table 1 for station locations

² Refer to Table 1 for station location

SURFACE WATERS OF EXCEPTIONAL ECOLOGICAL SIGNIFICANCE

The DEP also evaluated the surface waters of exceptional ecological significance described at 25 Pa. Code § 93.4b(b)(2) in response to the petition. Information gathered for the Pennsylvania Natural Heritage Program and reported in *Natural Heritage Inventory of Lehigh and Northampton Counties, Pennsylvania – Update 2013* (Western Pennsylvania Conservancy 2013) describes Hosensack Creek as a landscape dominated by agricultural activities with associated wetlands and riparian zones that support a sensitive species of concern. However, no surface waters with statewide or local ecological significance or areas that tie the petitioned surface waters to rare or endemic ecological communities were identified. The petition references *Results of Phase I and II Bog Turtle and Redbelly Turtle Surveys at the Geryville Materials in Lower Milford Township, Lehigh County, Pennsylvania* (Torocco et al. 2007), which indicates that bog turtle habitat is present, and that bog turtles have been identified within the Hosensack Creek basin. The bog turtle is listed as a Pennsylvania endangered and a federal threatened species and the redbelly turtle is a Pennsylvania threatened species. Although threatened and endangered species status alone, is not an Exceptional Value qualification, such species are provided protection through the DEP's permitting process (See implementation of antidegradation regulations at 25 Pa. Code § 93.4c(a)(2)).

PROTECTED USE ASSESSMENT

The Hosensack Creek basin, which is currently designated CWF, MF, is currently supporting this Aquatic Life Use (ALU). Benthic macroinvertebrate IBI scores from Hosensack Creek basin stations all exceed the assessment threshold (50) for first through third order streams, where samples were collected from November through May (Table 2, Shull 2017a). Hosensack Creek basin samples were collected in March 2018.

Based on the regulations at 25 Pa. Code § 93.4b(a)(2)(ii) (the Class A Wild Trout HQ qualifier), the Hosensack Creek basin from the source to UNT 01479 to Hosensack Creek qualifies for redesignation to HQ-CWF. The benthic macroinvertebrate assessment threshold for HQ and EV surface waters is 63.

- The IBI score from the sample collected at Hosensack Creek station 1HC is 60.2, which falls below the assessment threshold for HQ and EV waters and otherwise indicates impairment of the HQ protected use (Table 2).
- Couplet summations for embeddedness + sediment deposition and condition of banks + bank vegetative protection were below impairment thresholds (24) at 1HC indicating siltation and habitat modification causes of impairment (Table 3).
- The 30.2% agricultural land cover along with elevated alkalinity, pH, phosphorus and nitrogen concentrations support the Agriculture source of impairment.
- The 13.4% urban land cover along with elevated levels of pollutants including chlorides and other anions support the Urban Runoff/Storm Sewers source of impairment.

PUBLIC NOTICE AND REQUEST FOR TECHNICAL DATA

The DEP provided public notice of this redesignation evaluation and requested any technical data from the general public through publication in the *Pennsylvania Bulletin* on January 23, 2016 (46 Pa.B. 503). The Lehigh Conservation District, Lehigh County, Lower Milford Township, Montgomery County, Upper Hanover Township, Upper Milford Township, Trout Unlimited and the Delaware Riverkeeper Network were notified of the evaluation in a letter dated January 5, 2016. In addition, a notification was posted on the DEP's website. In response to this public notice, the DEP received technical data and information including *Hosensack Creek Conservation Action Plan* (Perkiomen Watershed Conservancy 2009) and *Lower Milford Township Fishery Survey* (Princeton Hydro, LLC 2016). In addition, to a letter of support from Lower Milford Township.

RECOMMENDATION

The Hosensack Creek basin is currently designated CWF, MF. Based on applicable regulatory definitions and requirements of 25 Pa. Code § 93.4b(a)(2)(ii) (the Class A Wild Trout HQ qualifier), the DEP's independent review of the trout biomass data along with a review of surface water quality, the DEP recommends that the Hosensack Creek basin from the source to UNT 01479 to Hosensack Creek be redesignated from CWF, MF to HQ-CWF, MF.

This recommendation adds **12.2** stream miles of HQ waters to Chapter 93.

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APPENDIX A – WATER CHEMISTRY DATA

Table A1. March 29, 2018 Water Chemistry.

	PARAMETER	UNITS	STATIONS			REF ¹
			1HC	2UHC	3IC	USC
METALS AND IONS	ALUMINUM D	ug/L	<10	<10	<10	20.3
	ALUMINUM T	ug/L	21.7	41.3	40.6	49.1
	BARIUM T	ug/L	48	31	26	32
	BORON T	ug/L	<200	<200	<200	<200
	BROMIDE	ug/L	<25.0	33.69	<25.0	<25.0
	CADMIUM D	ug/L	<.20	<.20	<.20	<.20
	CALCIUM T	mg/L	34.28	25.13	17.91	5.157
	CHLORIDE T	mg/L	45.14	45.44	34.53	15.08
	COPPER D	ug/L	<4	<4	<4	<4
	COPPER T	ug/L	<4	<4	<4	<4
	IRON D	ug/L	37	57	49	<20
	IRON T	ug/L	70	141	125	65
	LEAD D	ug/L	<1.0	<1.0	<1.0	<1.0
	LEAD T	ug/L	<1.0	<1.0	<1.0	<1.0
	LITHIUM D	ug/L	<25	<25	<25	<25
	LITHIUM T	ug/L	<25	<25	<25	<25
	MAGNESIUM T	mg/L	7.044	8.823	6.055	2.311
	MANGANESE D	ug/L	<10	<10	<10	<10
	MANGANESE T	ug/L	11	12	<10.00	<10.00
	NICKEL D	ug/L	<50	<50	<50	<50
	NICKEL T	ug/L	<50	<50	<50	<50
	POTASSIUM T	mg/L	1.658	1.519	1.327	<1.00
	SELENIUM T	ug/L	<7	<7	<7	<7
SODIUM T	mg/L	20.43	19.18	16.17	6.789	
STRONTIUM T	ug/L	93	138	84	20	
SULFATE T	mg/L	14.4	20.98	12.96	6.62	
ZINC D	ug/L	18	<10.0	<10.0	19	
ZINC T	ug/L	11	10	10	<10.0	
NUTRIENTS	AMMONIA D	mg/L	<.02	0.026	<.02	<.02
	AMMONIA T	mg/L	<.02	0.03	<.02	<.02
	NITRATE & NITRITE D	mg/L	3.58	3.02	1.38	0.08
	NITRATE & NITRITE T	mg/L	3.59	3.01	1.34	0.08
	NITROGEN D	mg/L	3.98	3.38	1.63	<0.25
	NITROGEN T	mg/L	0.012	0.011	<.01	0.011
	ORTHO PHOSPHORUS D	mg/L	0.011	0.01	0.01	<0.01
	ORTHO PHOSPHORUS T	mg/L	0.021	0.011	<0.01	0.012
	PHOSPHORUS D	mg/L	0.019	0.015	0.01	0.019
PHOSPHORUS T	mg/L	<0.01	0.028	0.02	0.32	
PHYSICAL/OTHER	ALKALINITY	mg/L	75.8	49.4	42.8	11
	DISSOLVED OXYGEN	mg/L	14.01	12.69	12.88	12.19
	HARDNESS T	mg/L	115	99	70	22
	pH	SU	8.61	8.02	8.4	7.07
	SPECIFIC COND	µS/cm ^c	344	308	229	86.4
	TDS	mg/L	214	188	134	66
	TSS	mg/L	<5	<5	<5	<5
	TOC	mg/L	1.68	1.78	1.94	2.08

¹ Refer to Figure 1 and/or Table 1 for station locations

^c indicate concentrations below the reporting limit.

APPENDIX B – BENTHIC MACROINVERTEBRATE DATA

Table B1. March 29, 2018 Benthic Macroinvertebrate Data.

TAXA		STATIONS ¹			REF ¹
		1HC	2UHC	3IC	USC
Ephemeroptera (Mayflies)					
Baetidae	<i>Baetis</i>	12	20	17	7
Isonychiidae	<i>Isonychia</i>	-	1	30	-
Heptageniidae	<i>Epeorus</i>	-	-	-	19
	<i>Maccaffertium</i>	7	7	11	1
	<i>Cinygmula</i>	-	-	-	10
Ephemeridae	<i>Ephemerella</i>	-	-	-	1
	<i>Ephemerella</i>	87	61	17	43
	<i>Eurylophella</i>	-	1	-	-
	<i>Teloganopsis</i>	-	1	-	-
Plecoptera (Stoneflies)					
Pteronarcyidae	<i>Pteronarcys</i>	-	-	-	6
Peltoperlidae	<i>Tallaperla</i>	-	-	-	1
Nemouridae	<i>Amphinemura</i>	-	4	2	-
	<i>Prostoia</i>	2	9	-	-
Perlidae	<i>Agnetina</i>	1	-	-	-
	<i>Acroneuria</i>	2	-	1	10
	<i>Paragnetina</i>	-	-	1	-
Perlodidae	<i>Malirekus</i>	-	-	-	-
	<i>Isoperla</i>	4	4	1	4
Chloroperlidae	<i>Haploperla</i>	1	-	-	-
	<i>Sweltsa</i>	-	-	-	1
Capniidae	<i>Allocapnia</i>	-	-	9	-
Trichoptera (Caddisflies)					
Philopotamidae	<i>Dolophilodes</i>	-	-	-	-
	<i>Chimarra</i>	6	9	4	1
Polycentropidae	<i>Polycentropus</i>	-	-	-	-
Hydropsychidae	<i>Diplectrona</i>	-	-	-	21
	<i>Cheumatopsyche</i>	16	25	12	-
	<i>Hydropsyche</i>	17	17	17	-
Rhyacophilidae	<i>Rhyacophila</i>	1	-	-	3
Limnephilidae	<i>Pycnopsyche</i>	-	-	-	3
Thremmatidae	<i>Neophylax</i>	-	5	1	1

¹ Refer to Figure 1 and/or Table 1 for station locations

"-" indicate taxa was not identified at a particular station

Table B1 (cont.). March 19, 2018 Benthic Macroinvertebrate Data.

TAXA	STATIONS ¹			REF ¹
	1HC	2UHC	3IC	USC
Diptera (True Flies)				
Ceratopogonidae	<i>Bezzia</i>	-	-	2
Empididae	<i>Clinocera</i>	-	1	3
Tipulidae	<i>Antocha</i>	2	2	4
	<i>Dicranota</i>	-	-	-
	<i>Hexatoma</i>	-	-	-
	<i>Tipula</i>	-	-	-
Limoniidae	<i>Pseudolimnophila</i>	-	-	-
Simuliidae	<i>Prosimulium</i>	5	1	6
Chironomidae		7	26	61
Megaloptera (Fishflies)				
Corydalidae	<i>Nigronia</i>	-	-	-
Sialidae	<i>Sialis</i>	1	-	-
Odonata (Dragon/Damselflies)				
Gomphidae	<i>Stylogomphus</i>	-	-	2
Cordulegasteridae	<i>Cordulegaster</i>	-	-	-
Coleoptera (Aquatic Beetles)				
Psephenidae	<i>Psephenus</i>	4	1	1
Elmidae	<i>Macronychus</i>	-	-	1
	<i>Optioservus</i>	12	14	9
	<i>Oulimnius</i>	-	2	-
	<i>Promoesia</i>	-	1	1
	<i>Stenelmis</i>	33	5	2
Non-Insect Taxa				
Oligochaeta		-	-	-
Planorbidae	<i>Ancylidae</i>	-	-	1
Total		220	217	214

¹ Refer to Figure 1 and/or Table 1 for station locations
 "-" indicate taxa was not identified at a particular station