

Upper East Branch White Clay Creek Watershed Assessment Report

West Marlborough Township, New Garden Township, London Grove
Township, and Avondale Borough, Chester County,
White Clay Watershed, Pennsylvania

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WHITE CLAY CREEK
National Wild & Scenic River

Ours to Enjoy. Ours to Protect.

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1.0 INTRODUCTION

Since 1965, the White Clay Watershed Association has worked toward the preservation, restoration, and enhancement of natural and cultural resources within the White Clay Creek Watershed. In 2000, the White Clay Creek Watershed was the first entire watershed to be designated a National Wild and Scenic River by the National Park Service. With this designation, the entire White Clay Watershed is to be preserved in its free-flowing state because of its value to the public and the environment. Even with the focused attention that the White Clay Creek has received, issues related to flooding and water quality impairments remain within the watershed. To take the next step in restoring the watershed, this study focuses on the Upper East Branch of White Clay where agricultural siltation and habitat alterations, agricultural nutrients (organic enrichment, low dissolved oxygen [DO]), urban runoff/storm sewers (siltation, water/flow variability), and mercury contamination continue to cause impairment (DEP, 2020). These pollutants not only degrade the water quality in the immediate area where they discharge into the stream, but also contribute to degraded water quality downstream. To address these concerns, the White Clay Wild and Scenic River Program has collaborated with Clauser Environmental, LLC to develop this assessment report and a corresponding restoration plan for the Upper East Branch White Clay Watershed.

2.0 BACKGROUND

The Upper East Branch White Clay Watershed is located in West Marlborough Township, New Garden Township, London Grove Township, and Avondale Borough, Chester County, Pennsylvania. The headwaters are located in an agricultural area that stretches between Doe Run Road and PA-842. The Pennsylvania Department of Environmental Protection (DEP) considers a stream sourced from a spring west of the intersection of Newark Road and PA-842 to be the source of the mainstem of the Upper East Branch White Clay Creek. The mainstem begins within an active farming area. Downslope, the mainstem passes through a forested area and multiple agricultural fields where it meets up with multiple small tributaries sourced from small ponds and springs before meeting up with Trib 00461 which drains from a farm field west of the mainstem. The East Branch White Clay continues downslope where it meets with Trib 00460 that drains from the east across Newark Road. The East Branch White Clay Creek meets with Trib 00460 just south of Street Road (PA Route 926). After the confluence with Trib 00460, the East Branch White Clay drains southward through a matrix of forested and agricultural areas and past the Stroud Water Research Center to its confluence with Trib 00457. The East Branch White Clay meets with Trib 00457 on the newly preserved property that was formerly Loch Nairn Golf Club. This confluence is located just north of the Kennett Oxford Bypass. Trib 00457 originates in a forested area just west of the intersection of East Marlborough, West Marlborough, and New Garden Townships. Trib 00457 flows west through agricultural areas and farmland and picks up one smaller tributary (sourced from a pond located on property that was formerly Loch Nairn Golf Club) before reaching its confluence with East Branch White Clay Creek. The East Branch White Clay Creek continues south underneath the Kennett Oxford Bypass and through a residential area where it meets its confluence with Trib 00454 just upstream

of a large mushroom farm. Trib 00454 originates to the north of PA Route 842 and flows downslope through a forested corridor, agricultural fields, residential areas, and under the Kennett Oxford Bypass before meeting its confluence with the East Branch White Clay Creek. Trib 00454 flows from the west and picks up multiple smaller tributaries and one larger tributary (Trib 00455) before its confluence with the mainstem. After this confluence with Trib 00454, the Upper East Branch White Clay Creek flows south through a forested corridor between agricultural fields and eventually into the town of Avondale. A large section of the Upper East Branch White Clay Creek and its unnamed tributaries are classified by the Pennsylvania Department of Environmental Protection (DEP) as being of exceptional value (EV), the highest level of water quality-based protection afforded to Pennsylvania streams. The DEP states that measures should be taken to preserve or improve the water quality of streams of exceptional value (DEP, 2023). The only section of the watershed within the study area that is not designated as exceptional value is the section of the Upper East Branch White Clay Creek below East 3rd Street in Avondale. This section of stream is classified as a Cold Water Fishery/ Migratory Fishery. The 2020 Pennsylvania Integrated Water Quality Monitoring and Assessment Report specifically identifies agricultural siltation and habitat alterations, agricultural nutrients (organic enrichment, low dissolved oxygen), urban runoff/storm sewers (siltation, water/flow variability), and mercury contamination as impairments to this watershed (DEP).

2.1 Agricultural Siltation, Habitat Alterations

Excessive siltation within streams smothers critical benthic habitat. As sediment fills in around the gravels, cobbles, and boulders on the stream bottom, the bottom becomes more uniform and loses its diversity of microhabitats. As the diversity of available niches (positions or jobs within the ecosystem) decreases, the diversity and stability of the macroinvertebrate community is reduced. Excessive siltation within stream systems also increases maintenance costs for structures (i.e. culverts, bridges, and dams) within and around the stream.

Within the Upper East Branch White Clay Watershed, the stream corridor contains substantial sediment deposits that have accumulated during decades of farming within the watershed. These accumulated “legacy” sediments continue to impact the stream system as the streambanks erode. The accelerated erosion and siltation of the streambanks may be minimized through streambank restoration, native plantings, and floodplain restoration projects. While soil loss from the upland areas has decreased with a decrease in farming within the watershed and from implementation of conservation farming techniques, siltation from the uplands still reaches the stream corridor and more opportunities for conservation exist. In this assessment, relative siltation levels within the stream channels are analyzed as part of the habitat assessment protocol.

2.2 Agricultural Nutrients (Organic Enrichment/ Low DO)

Within the Upper East Branch White Clay Watershed, agricultural nutrients likely contribute to the impaired biology of the stream. When nitrogen and phosphorus are added to stream systems, algal blooms often occur. The algal blooms typically are unsustainable and result in a massive algal die-off when resources become limited. The dying algae are consumed by bacteria that take up oxygen. The bacteria populations boom within the decaying algae and take up much of the dissolved oxygen within the stream. With depressed dissolved oxygen conditions, fish and macroinvertebrate kills may result.

Within the Upper East Branch White Clay Watershed, dominant sources of nutrient enrichment likely include residential and commercial application of fertilizers to lawns, agricultural runoff, livestock, and erosion of soil particles that contain high levels of nutrients from legacy impacts. Within the historically agrarian Upper East Branch White Clay Watershed, nutrient inputs to the landscape have been occurring for decades. Over time, excessive nutrients become bound to soil particles that provide an ongoing source of nutrients to the stream system for some time after current discharges are minimized. In this study, nitrogen and phosphorus levels were determined through laboratory analysis on the day of instream sampling and are compared to established thresholds for watershed impairment. Nutrient inputs to a stream vary seasonally and in accordance with precipitation events. So, multiple samplings over an extended time period are often needed to gain a more complete picture of nutrient inputs within a watershed.

Reduction of ongoing nutrient inputs to the stream system is possible with improved management of fertilizer application, riparian buffer enhancements, and installation of agricultural best management practices (BMPs). Soil particle bound nutrient inputs to the stream can be minimized through reductions in streambank and upland erosion.

2.3 Urban Runoff/Storm Sewers (Siltation, Water/Flow Variability)

A review of recent and historic aerial photography indicates that the Upper East Branch White Clay Watershed has become increasingly urbanized during the last 85 years (Appendices A and B). With increased urbanization and corresponding increases in impervious cover, stream flows have likely been impacted. As impervious cover increases, streams become much more variable in flow and have more pronounced peaks in runoff. With greater fluctuations in runoff, stream channels become less stable and erosion of legacy sediment is exacerbated. The Stroud Water Research Center (Stroud) office is located within the watershed. Stroud has been a leader in stormwater management in Pennsylvania for many years and has worked with landowners to ensure that current stormwater management regulations are being upheld and to develop and install innovative stormwater management techniques. When coupled with the increased scrutiny development within exceptional value watersheds receives during permit reviews, the Upper East Branch White Clay Watershed has received substantially more protection from development than many other Pennsylvania watersheds. While older developments may lack stormwater management BMPs, most of the existing developments within the watershed have stormwater rate controls in place. New

developments are required to design stormwater systems that account for both stormwater rate and volume. Point sources of pollutant discharges within the Christina River Watershed are subject to existing total maximum daily load (TMDL) limitations (EPA 2006 [a, b], 2007).

2.4 Mercury Contamination

While a specific source of mercury contamination has not been identified in the Upper East Branch White Clay Watershed, the possibility of contaminated American eels migrating through the watershed exists. Segments of White Clay Creek are currently listed as impaired for mercury by the DEP (DEP 2022). While mercury in its ambient form in bodies of freshwater do not pose a risk for humans or wildlife, the bioaccumulation of the metal through aquatic food chains is a risk to those who consume fish from contaminated bodies of water. Currently, American eel are under a consumption advisory for the entire White Clay Creek with a meal frequency limit of two meals per month. (PFBC)

Common sources of mercury pollution from humans include inappropriate disposal of household goods, industrial manufacturing plants, and water treatment plants. Coal-fired power plants are the biggest source of mercury contamination in the U.S., accounting for over a third of all human-related mercury emissions (Driscoll et al, 2007). Mercury emissions and other forms of mercury pollution are regulated under multiple environmental laws and regulations including The Clean Water Act, the Resource Conservation and Recovery Act, and Safe Drinking Water Act. On-going monitoring by the Pennsylvania Fish and Boat Commission (PFBC) will determine when the mercury in the watershed is at safe levels to remove all fish consumption advisories.

2.5 Watershed Geology

The Upper East Branch White Clay Watershed is located within the Piedmont Upland Physiographic Section. It consists of broad, gently rolling hills and valleys. The rock formations, as described by the Pennsylvania Topographic and Geologic Survey, starting at the top of the sub-watersheds within the area of investigation are mafic gneiss, Cockeysville Marble, felsic and intermediate gneiss, Setters Quartzite, and pegmatite (DCNR, 2022).

Mafic gneiss is composed mainly of dark-colored minerals and typically formed in the lower Paleozoic period. Cockeysville Marble formed during the late Precambrian period and is best known for its historic use as dimensional stone in structures such as the Washington Monument. Felsic and intermediate gneiss are largely made of quartz, feldspar, and mica. They formed during the Precambrian period. Setters Quartzite formed during the lower Paleozoic period, as well. It includes white feldspathic quartzite, gray mica gneiss, and mica schist. Pegmatite is coarse-grained consisting of quartz and other minerals, typically formed in the lower Paleozoic. It is typically formed in dikes.

The uplands of the Piedmont Upland Section appear to be made of the remnants of a formerly continuous sloping surface that is now dissected by the valleys eroded into it. Elevations in the Upper East Branch White Clay Watershed range from 260 to 595 feet above mean sea level. As noted, many of the rocks are metamorphic in nature. These rocks

tend to have a very well-developed plane or “schistosity” that was formed during metamorphism. This plane dips to form moderately steep angles to the south and stream erosion is usually parallel to or normal to the plane of schistosity (DCNR 2022). The drainage patterns tend to be dendritic, however in some locations it has a rectangular orientation.

3.0 METHODOLOGY

Clauser Environmental, LLC conducted upland sub-watershed analysis and in-stream sampling within the Upper East Branch White Clay Watershed.

3.1 Sub-watershed Analysis

The Upper East Branch White Clay Watershed was divided into 8 sub-watersheds based on land use and the location of major unnamed tributaries (Appendix A). For each sub-watershed, land use was analyzed through the use of USGS Streamstats version 4.3.11 (USGS, 2022). The resulting data was compiled to prepare an estimate of percentage of urban and forested cover classes for each sub-watershed. To provide greater depth in understanding of the potential impacts of the impervious cover within each sub-watershed, stormwater best management practices (BMPs) were identified. By combining a review of high-resolution aerial photography and ground-truthing, structural stormwater BMPs were identified and included in watershed mapping. In order to gain a greater understanding of historical land use, aerial photography from 1937, 1957-58, and 1971 was compiled, georeferenced, and reviewed (Appendix B).

3.2 Sample Locations

Twelve (12) sample locations are located within the Upper East Branch White Clay Watershed (Appendix A). Sample Site 1 is located on the edge of a small public park in Avondale. This section of the East Branch White Clay Creek is located within a forested riparian zone that receives drainage from several residential areas and a large agricultural area just upstream. Sample Site 2 is located just downstream of the Kennett Oxford Bypass. This section of the East Branch White Clay Creek runs through a residential area and is just upstream of a mushroom farm. Sample Site 3 is located in a field on a tributary to East Branch White Clay Creek just upstream of Loch Nairn Golf Club. This tributary drains a mixture of residential, agricultural, and commercial areas. Site 4 is located along the western boundary of the Loch Nairn Golf Club and just upstream of the Kennett Oxford Bypass. Sample Site 5 is located near the top of the watershed, just south of Street Road. Sample Site 5, which is on the mainstem of East Branch White Clay Creek, is located in a forested area that is surrounded by agricultural and residential parcels. Sample Site 6 is located just west of Sample Site 5 along a tributary to East Branch White Clay Creek. Sample Site 6 is also located just south of Street Road. Sample Site 7 is located where an unnamed tributary to East Branch White Clay Creek crosses under Glen Willow Road. It drains residential, agricultural, and forested areas. Sample Site 8, on the same tributary as Sample Site 7, is located just north of Woodview Road, in an open field. Sample Site 9

is located along East London Grove Road in an area that is mainly agricultural and residential. Sample Site 9 is located on a tributary to East Branch White Clay Creek. Sample Site 10 is located just northeast of the intersection of Street Road and Big Springs Road in a forested patch. The surrounding area is mainly residential and agricultural although the stream corridor is principally forested. Sample Site 11 is located just north of Glen Willow Road in an open field surrounded by residential areas. Sample Site 11 is on an unnamed tributary to East Branch White Clay Creek. Sample Site 12 is located just north of Street Road alongside a horse farm. The surrounding area is mostly agricultural, residential, and open area.

3.3 Macroinvertebrate Sampling

The Pennsylvania Department of Environmental Protection (DEP) Instream Comprehensive Evaluation Survey (ICE) protocol (DEP 2013) was utilized to collect benthic macroinvertebrates at each of the sample locations. Field sampling occurred on May 19, 2022. The 6 D-frame method of sample collection was utilized in accordance with the DEP Standardized Biological Field Collection and Laboratory Methods (DEP “Methods”, Section V.C.). Samples were processed, sub-sampled, and identified in the lab following DEP protocols. Identification of collected organisms was conducted with the aid of established taxonomic keys (Merritt and Cummins 1996).

Data analysis included the evaluation of six metrics for the macroinvertebrate community at each site. The six metrics were combined via an established DEP weighting function to determine the more robust Index of Biological Integrity (IBI) value for each site. The IBI value allows for comparison with the established DEP threshold for biological impairment. During the sampling period, an IBI value of 50 or less indicates impaired biological conditions for streams designated as cold water fisheries (Site 1). An IBI value of 63 or less indicates impaired biological conditions for exceptional value designated streams during the sampling period (Sites 2-12). Sites with an IBI value above the threshold for macroinvertebrates are considered unimpaired. The six metrics that comprise the IBI value include:

3.3.1 Total Taxa Richness

The total taxa richness of a site is a count of the total number of taxa within the sub-sample and is a measure of the diversity of the macroinvertebrate community at the site. In general, the more impaired a stream segment is, the lower the total taxa richness will be. As water quality and habitat improve, the stream segment will be less impaired. As a stream segment becomes less impaired, the total taxa richness and corresponding community diversity typically increase.

3.3.2 Ephemeroptera + Plecoptera + Trichoptera Taxa Richness

The Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa richness metric is a count of the total number of pollution sensitive taxa (Pollution Tolerance Value 0-4) within the mayflies, stoneflies, and caddisflies. In general, impaired stream segments will have a lower EPT taxa richness while unimpaired stream segments will have a higher EPT taxa richness.

3.3.3 Beck's Index

This version of the Beck's Index evaluates taxonomic richness and tolerance as a weighted count of pollution sensitive taxa with Pollution Tolerance Values of 0, 1, or 2. Within the analysis, the more pollution sensitive an organism is, the greater weight it receives within the metric. As such, a higher Beck's Index score generally indicates a less impaired stream segment.

3.3.4 Shannon Diversity Index

This metric measures community composition by evaluating both taxonomic richness and evenness of individuals across taxa of the sub-sample. In general, this metric decreases in a more impaired stream segment as fewer pollution-tolerant taxa dominate. The Shannon Diversity Index typically increases in less impaired stream segments.

3.3.5 Hilsenhoff Biotic Index

This metric evaluates community composition by determining an average pollution tolerance value for the individuals in a sub-sample. As pollution tolerance value is higher in tolerant taxa, the Hilsenhoff Biotic Index typically is higher in an impaired stream segment than in an unimpaired stream segment.

3.3.6 Percent Sensitive Individuals

Percent Sensitive Individuals is a determination of the percentage of individuals within a sub-sample with Pollution Tolerance Values of 0-3. This metric typically decreases in a more impaired stream segment and increases in a less impaired stream segment.

3.4 Habitat Analysis

Twelve parameters including instream cover (fish), epifaunal substrate, embeddedness, velocity/depth regimes, channel alteration, sediment deposition, frequency of riffles, channel flow status, condition of banks, bank vegetative protection, grazing or other disruptive pressure, and riparian vegetative zone width were assessed at each sample location. Each parameter was given a score of 1 to 20 in accordance with the DEP Instream Comprehensive Evaluation Survey protocol and DEP “Methods” (DEP 2013). The sum of all scores at each sample location gives a cumulative score for habitat impairment. Forested, cold-water, high-gradient stream segments having a total habitat score above 140 are considered unimpaired while those scoring a 140 or less are considered impaired. Additional impairment thresholds exist. Cold water streams are considered impaired for habitat if either riffle/run embeddedness plus sediment deposition or condition of banks plus bank vegetation metrics total score is 24 or less. A cumulative score of 240-192 is considered “optimal”; “suboptimal” 180-132; “marginal” 120-72; and, “poor” 60 or less. The decision gaps between categories allows for the discretion of the field investigator (DEP 2013).

3.5 Water Quality Analysis

Water quality analysis was conducted at all sample sites on May 19, 2022. Chemical and physical water quality analyses were conducted in accordance with the Department of Environmental Protection Instream Comprehensive Evaluation Survey protocol (DEP 2013). Field measurements of dissolved oxygen and temperature were taken in-situ with a YSI Pro20 portable dissolved oxygen meter. Conductivity and pH were measured in the field with a YSI-63 portable handheld meter. All meters were calibrated in accordance with the manufacturer’s recommendations. A two-point (4.00 and 7.00) slope calibration was utilized to calibrate the pH meter. Total dissolved solids (TDS) was measured using a YSI Professional Plus meter with TDS Pro 10102030 cable.

CWM Environmental, a certified water quality laboratory, completed laboratory analysis. Water quality site sampling laboratory analysis parameters included Phosphorus, Total Kjeldahl Nitrogen (TKN), Nitrite as N, Nitrate as N, and Alkalinity (total to pH 4.5). Total Nitrogen was calculated as the sum of the TKN, Nitrite, and Nitrate at each sample site.

4.0 RESULTS

4.1 Sub-watershed Analysis Results

The 8 sub-watersheds of the Upper East Branch White Clay Watershed ranged from 0.02 to 24.73 percent in approximate percent of urban development (Table 1). Sub-watershed F, which is south of the Kennett Oxford Bypass and includes a significant portion of the Borough of Avondale, has the highest approximate percent urban development at 24.73 percent. Sub-watershed G, which includes the area that drains to Sample Sites 11 and 12 has the lowest approximate percent urban development at 0.02 percent. The sub-watersheds of Upper East Branch White Clay Watershed ranged from 23.32 to 33.84 percent in approximate percent of forested area (Table 1). Sub-watershed E, which has the lowest approximate percent forested area, includes primarily agricultural and residential areas. The sub-watershed with the highest percentage of forested area was Sub-watershed B, which is in the northeastern corner of the overall watershed.

Table 1
Upper East Branch White Clay Watershed
Percent Impervious Cover Data

Sub-watershed	Approx. Total Square Miles	Approx. % Urban Development	Approx. % Forested Area
A	1.18	0.09	29.38
B	0.77	0.04	33.84
C	1.44	4.26	26.42
D	1.51	3.58	31.54
E	1.33	4.09	23.32
F	1.20	24.73	32.81
G	1.88	0.02	31.08
H	2.29	2.21	29.24
Total	11.6	4.47	29.50

4.2 Macroinvertebrate Sampling Results

Macroinvertebrates that were sampled within the Upper East Branch White Clay Watershed comprised at least 78 taxa (Appendix C). Data collected by Clauser Environmental, LLC indicates that the benthic macroinvertebrate population was unimpaired at Site 10 and impaired at the other 11 sample sites (Table 2).

Table 2
Upper East Branch White Clay Watershed
Benthic Macroinvertebrate Data

	Modified Becks Index	EPT Taxa Richness (TV 0-4)	Total Taxa Richness	Shannon Diversity Index	HBI Index	% Sensitive Individuals (TV 3 or less)	IBI Value
Site 1	3	4	17	1.09	5.66	7.8	30.2
Site 2	10	6	19	1.51	6.21	3.8	36.6
Site 3	1	0	13	1.64	6.67	0.5	23.5
Site 4	5	5	18	1.86	5.40	10.1	37.9
Site 5	9	8	22	2.12	5.22	21.3	48.5
Site 6	11	9	21	2.00	5.92	17.6	46.8
Site 7	9	7	23	2.25	6.11	7.8	44.3
Site 8	7	6	23	0.95	4.72	27.0	41.7
Site 9	4	3	16	1.54	5.39	10.1	32.91
Site 10	33	22	38	3.07	3.47	37.85	91.71
Site 11	4	5	21	1.89	2.88	14.57	45.28
Site 12	14	6	17	1.28	1.55	8.21	46.45

Table 3
Upper East Branch White Clay Watershed
Impairment Determination Values

Site	Macroinvertebrate IBI Value	Total Habitat Value	Riffle/Run Habitat	Condition of Banks
1	30.2	151	13	21
2	36.6	155	21	21
3	23.5	150	16	27
4	37.9	138	18	22
5	48.5	196	31	29
6	46.8	190	28	35
7	44.3	159	18	22
8	41.7	178	29	24
9	32.9	170	30	21
10	91.7	215	36	36
11	45.3	148	23	17
12	46.5	170	16	29

Macroinvertebrate and habitat impairment is based upon the DEP ICE protocol (2013). Blue values indicate unimpaired; red values indicate impaired. During the sampling period, an IBI value of 50 or less indicates impaired biological conditions for cold water fisheries (Site 1). An IBI value of 63 or less indicates impaired biological conditions for exceptional value streams during the sampling period (Sites 2-12).

At sample sites 1, 2, 3, 4, 5, 6, 7, 9, and 12, the total of midges (Chironimidae), segmented worms (Oligochaeta), and roundworms (Nematoda) comprise more than half of the individuals collected (Appendix C). Midge and worm species are often dominant in habitats that are impaired by sediment and high nutrient concentrations. Some macroinvertebrate populations throughout the watershed are severely impaired and indicative of stream conditions that are degraded by sedimentation. Sample site 10 was an outlier, scoring an IBI score characteristic of that of an exceptional value stream (Table 3).

4.3 Habitat Analysis Results

The ICE protocol habitat analysis data for the Upper East Branch White Clay Watershed indicates that all Sample Sites except Site 4 are “Blue” (un-impaired) for total habitat score (DEP 2013). Sample Sites 5, 6, and 10 have “optimal” habitat conditions at the sample site. Sites 1, 2, 3, 4, 7, 8, 9, 11, and 12 are considered “sub-optimal” for total habitat score. Sample Sites 1, 2, 4, and 7, were impaired for both riffle/run habitat and condition of banks and vegetation. Sample Sites 3 and 12 were impaired for riffle/run habitat. Sample Sites 8, 9, and 11 were impaired for condition of banks and vegetation (Table 3).

4.4 Water Quality Analysis Results

Water temperatures throughout the Upper East Branch White Clay Watershed ranged from 14.4 to 17.1°C throughout the study (Table 4). Dissolved oxygen (DO) levels ranged from 8.24 to 11.48 mg/L and were near saturation values for all of the sample sites (Table 4). Throughout the watershed, pH values were near neutral. The pH values ranged from 6.80 to 7.44 (Table 4). Specific conductance ranged from 157.0 – 479.0 umhos throughout the watershed. Alkalinity was sufficient to buffer the pH throughout the watershed and ranged from 41 to 136 mg CaCO₃/L.

Table 4
Upper East Branch White Clay Watershed
Water Quality Sampling Data

Site	Temp (°C)	DO (mg/L)	DO (% sat.)	pH	Specific Cond. (umhos)	Alkalinity (mg CaCO ₃ /L)
1	15.2	8.24	81.8	7.00	373.4	97
2	14.8	9.34	92.2	7.03	329.7	95
3	16.1	8.27	84.0	7.22	479.0	136
4	15.7	11.01	110.4	7.44	238.3	74
5	16.1	11.48	116.2	7.42	167.1	42
6	16.3	9.98	100.3	7.06	242.5	86
7	14.9	9.27	91.4	7.08	283.0	69
8	14.4	9.57	93.6	6.80	219.3	53
9	15.6	10.33	103.3	6.81	242.9	67
10	15.2	10.06	100	6.94	231.2	72
11	16.0	10.69	108.1	7.14	157.0	41
12	17.1	10.38	107.1	7.13	157.2	43

Total kjehldahl nitrogen (TKN) concentration was 1.01 mg/L or less across all 12 sample sites. TKN measures ammonia and organic forms of nitrogen. Nitrite levels were less than 0.10 mg/L at all sample sites (Table 5). Concentrations of nitrate values ranging from 1.44 to 4.19 mg/L were measured throughout the watershed. Total nitrogen concentrations were greater than at least 1.44 mg/L at all 12 sample sites (Table 5). At all sample sites except 11 and 12, the calculated total nitrogen concentration exceeds the threshold of 2.01 mg/L for impaired streams (Sheeder and Evans 2004).

Total phosphorus levels within the Upper East Branch White Clay Watershed were below the limit of the laboratory testing performed and were less than 0.10 mg/L across the watershed (Table 5). Sheeder and Evans found that impaired streams typically exceed a total phosphorus concentration of 0.07 mg/L (2004).

Table 5
Upper East Branch White Clay Watershed
Nutrient Sampling Data

Site	TKN (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (PO₄) (mg/L)
1	<1.00	<0.10	4.19	>4.19	<0.10
2	<1.00	<0.10	3.33	>3.33	<0.10
3	1.01	<0.10	4.05	>5.06	<0.10
4	<1.00	<0.10	2.78	>2.78	<0.10
5	<1.00	<0.10	3.23	>3.23	<0.10
6	<1.00	<0.10	2.30	>2.30	<0.10
7	<1.00	<0.10	3.95	>3.95	<0.10
8	<1.00	<0.10	3.12	>3.12	<0.10
9	<1.00	<0.10	3.04	>3.04	<0.10
10	<1.00	<0.10	2.92	>2.92	<0.10
11	<1.00	<0.10	1.59	>1.59	<0.10
12	<1.00	<0.10	1.44	>1.44	<0.10

5.0 DISCUSSION

Within the Upper East Branch White Clay Watershed, eleven of the twelve sample sites had impaired biology as determined during the macroinvertebrate sampling. Sample Site 10 had a macroinvertebrate community that shows this section is unimpaired and attains the exceptional value designation. Sample Site 10 demonstrates the potential aquatic community for this watershed. The dominant impairments throughout the watershed are related to sediment and nutrient legacy impacts being exacerbated by increased stormwater discharges that are related to deforestation, development and climate change throughout the watershed.

The mainstem of the Upper East Branch White Clay originates just southwest of the intersection between Upland Road (842) and Newark Road. All of the drainage area from the origin of the stream to its confluence with Trib 00460 is within Sub-watershed A. The water quality of the stream within this sub-watershed is encapsulated by Sample Site 6. This sample site was impaired for macroinvertebrate life, but had optimal habitat conditions at the sample site. Sub-watershed A consists of primarily open areas, agricultural fields, forests and corridors of buffer, as well as some residences. The water quality analysis data on the day of sampling indicates that nitrogen levels in the stream were at levels high enough to contribute to the biological impairment of this stream reach. Restoration of this stream section should focus on reducing nutrient runoff from the agricultural and residential areas within the watershed and extending the riparian buffers.

Sub-watershed B consists of Trib 00460 and the area that drains to it. The water quality of Sub-watershed B is captured by Sample Site 5. Like Sample Site 6, this sample site was impaired for macroinvertebrate life and has optimal habitat near the sample site. The nitrogen levels were slightly higher in this sub-watershed than Sub-watershed A on the day of sampling. Sub-watershed B consists primarily of agricultural fields, open areas, and patches of forest. Despite the lack of urban development within this sub-watershed, Trib 00460 is still impaired. The impairments are primarily tied to impacts from agriculture. Restoration of this tributary should focus on reduction of nutrient inputs and stormwater discharges to the stream in the headwaters of the tributary to the east of Newark Road.

Sub-watershed C is drained by Trib 00457 and the smaller unnamed tributaries, Tribs 00458 and 00459, that drain into it. A large portion of this sub-watershed is the former Loch Nairn Golf Club, which has recently been purchased by New Garden Township to create a 106-acre passive recreation park. Sub-watershed C consists of approximately 4% urban development which is primarily roadways and residential areas. Approximately 26% of this sub watershed is forested area. Sample Site 3 was taken just upstream of the golf club and had the lowest macroinvertebrate score and highest nutrient pollution levels within the watershed. This sub-watershed should be a target for restoration. Recommended BMPs include agricultural practices to reduce nutrient discharges to the

stream, planting native riparian buffers, wetland creation, and reconnecting stream sections to the active floodplain.

Sub-watershed D includes the mainstem of the East Branch White Clay Creek and has similar percentages of forested and urban areas as Sub-watersheds A, B, and C. This sub-watershed receives water from those three sub-watersheds. This sub-watershed has a high concentration of installed best management practices that target agricultural runoff in the upstream section of the sub-watershed surrounding the Stroud Water Research Center. Stormwater from roadways, residences, and farm fields appears to still be contributing to the impairment of this stretch of stream. The water quality of Sub-watershed D is represented above the Kennett Oxford Bypass by Sample Site 4, and below the Kennett Oxford Bypass by Sample Site 2. Both of these sample sites were impaired for habitat and macroinvertebrate life, with Sample Site 4 being the only site that scored as impaired for all impairment determination values (Table 4). Sample Sites 2 and 4 are impacted by legacy, post-colonial sediment in the valley floor that has restricted the stream channel's access to the active floodplain, contributed to streambank erosion, and provides a source of nutrient rich soil that is released into the stream channel when the streambanks erode. Future work in this section of the watershed should focus on installing additional agricultural runoff focused best management practices and planting forested riparian buffers. In the portion of the sub-watershed that is adjacent to Sample Site 4, restoration of the active floodplain, streambank restoration with bank grading and native plantings, and wetland creation should be considered.

Sub-watershed G stretches from the very top of the overall watershed where Trib 00454 originates to the confluence of Trib 00454 with Trib 00455 just south of E. London Grove Road. The water quality of Sub-watershed G is identified in Sample Sites 11 and 12. This sub-watershed has less than 1% urban development, and approximately 31% forested area. Much of the land within Sub-watershed G is open space or agricultural fields. The nutrient concentrations on the day of testing were the lowest in the overall watershed within Sub-watershed G and fell below the impairment thresholds. Of the parameters investigated, sediment within the stream channel from legacy farming impacts and riparian forest width appear to be the main source of impairment to this stream section. BMPs within this stream section should focus on extending the riparian forested buffers and the creation of floodplain wetlands that are connected to the active floodplain of the stream. Appropriately sited wetlands could have the potential to provide a location for legacy sediment that is moving within the channel a place to deposit during storm events and absorb some of the flooding flows that impact downstream communities. Additionally, focused agricultural stormwater best management practices would aid in mitigating future degradation of this sub-watershed.

Sub-watershed H is located in the northwest corner of the watershed and includes the area draining to Trib 00455 upstream of its confluence with Trib 00454. This sub-watershed is represented by Sample Sites 10 and 9. The headwaters of Trib 00454 flows through a forested area. Sample Site 10 was the only unimpaired sample site within the Upper East Branch White Clay Creek Watershed. The Sample Site 10 aquatic and riparian

zone habitat was considered optimal, and the macroinvertebrate study identified 38 different taxa within the sample. Since 1937, the forested cover upstream of Sample Site 10 has continually increased (Appendix B). Preservation of the water quality and habitat conditions of this headwater area that provides a refuge for sensitive species within the watershed should be a high priority for conservation organizations within the watershed. Downstream of Sample Site 10, Trib 00455 runs through mostly forested corridors that are surrounded primarily by agricultural fields. Historically, the lower portion of this sub-watershed was cleared for agricultural. Since 1971, substantial regrowth of trees within the riparian zone has occurred. But, the legacy impact of sediment within the riparian zone disconnects the stream channel from an active floodplain. The legacy sediment is actively eroding into the stream channel and continues to impair this stream section (Sample Site 9 in Table 3). Restoration of the section of Sub-watershed H downstream of Sample Site 10 should focus on reconnecting the stream channel to the active floodplain by removing legacy sediment within the riparian zone, installing floodplain wetlands, expanding the riparian forested buffer, and stream restoration that incorporates the removal of legacy sediment to achieve a stable, vegetated slope.

The stretch of Trib 00454 that flows downstream of the confluence with Trib 00455 to the confluence with the Upper East Branch White Clay is identified as Sub-watershed E. Sub-watershed E is dominated by open agricultural areas and is only 23.3% forested. This sub-watershed, represented by Sample Sites 7 and 8, is impaired for both macroinvertebrates and habitat at both sample sites. As the water flows through this sub-watershed, measured nitrogen levels increased on the day of sampling (Table 5). At both sample sites, the streambanks were moderately unstable with up to 60% of the banks in the reach having areas of erosion. Streambank erosion of legacy soils from past farming operations is likely the major source of sediment within the stream channel. The sediment carried by the channel results in increased embeddedness of the stream bottom in downstream areas with lower gradients such as at Sample Site 7 (Appendix D). Restoration of this sub-watershed should focus on expanding the riparian forested buffer, reconnecting the stream channel to the active floodplain by removing legacy sediment within the riparian zone, installing floodplain wetlands, and stream restoration that incorporates the removal of legacy sediment to achieve a stable, vegetated slope of the streambank. Agricultural BMPs that reduce sediment and nutrient inputs to the stream system should be installed where necessary.

The stretch of the Upper East Branch White Clay that flows from the confluence with Trib 00454 to the bottom of the overall area of investigation is identified as Sub-watershed F. Sub-watershed F flows through the heart of the Borough of Avondale. The borough, surrounding developments, and businesses contribute to 24% of the land usage in this sub-watershed being urban development. Sub-watershed F also contains some agricultural areas and is approximately 32.8% forested. Downstream of the East 3rd Street bridge, the East Branch White Clay Creek loses its exceptional value designation and is considered a cold-water fishery. Sample Site 1 is located just downstream of that bridge crossing. The stream exhibited both impaired biology and habitat conditions that are likely due to the high levels of sediment and nutrients in the stream channel. Restoration of this

sub-watershed should focus on restoring the floodplain, stabilizing streambanks by removing legacy sediment and planting native vegetation, and increasing the extent of forested riparian buffers.

Improving the water quality and habitat within the Upper East Branch White Clay Watershed should lead to biological improvements within the stream community. The primary focus of restoration within this watershed should be on addressing the legacy impacts of agriculture, managing stormwater and nutrient discharges to the stream from agricultural areas and new developments, restoring floodplains, creating wetlands, and expanding the riparian buffers. Additionally, the area of Sub-watershed H that is upstream of Sample Site 10 should be preserved to maintain the diversity of aquatic life within the watershed. In this study, the legacy impacts of past practices within the watershed were determined to still be contributing to impairments to habitat and the aquatic community in most of the watershed. The full effects of decreased pollutant inputs to the stream from current conservation farming practices and already implemented best management practices are not yet realized. As the newly planted riparian buffers mature and additional conservation practices are implemented, the aquatic community within the watershed should continue to build diversity and resiliency to both local and global change.

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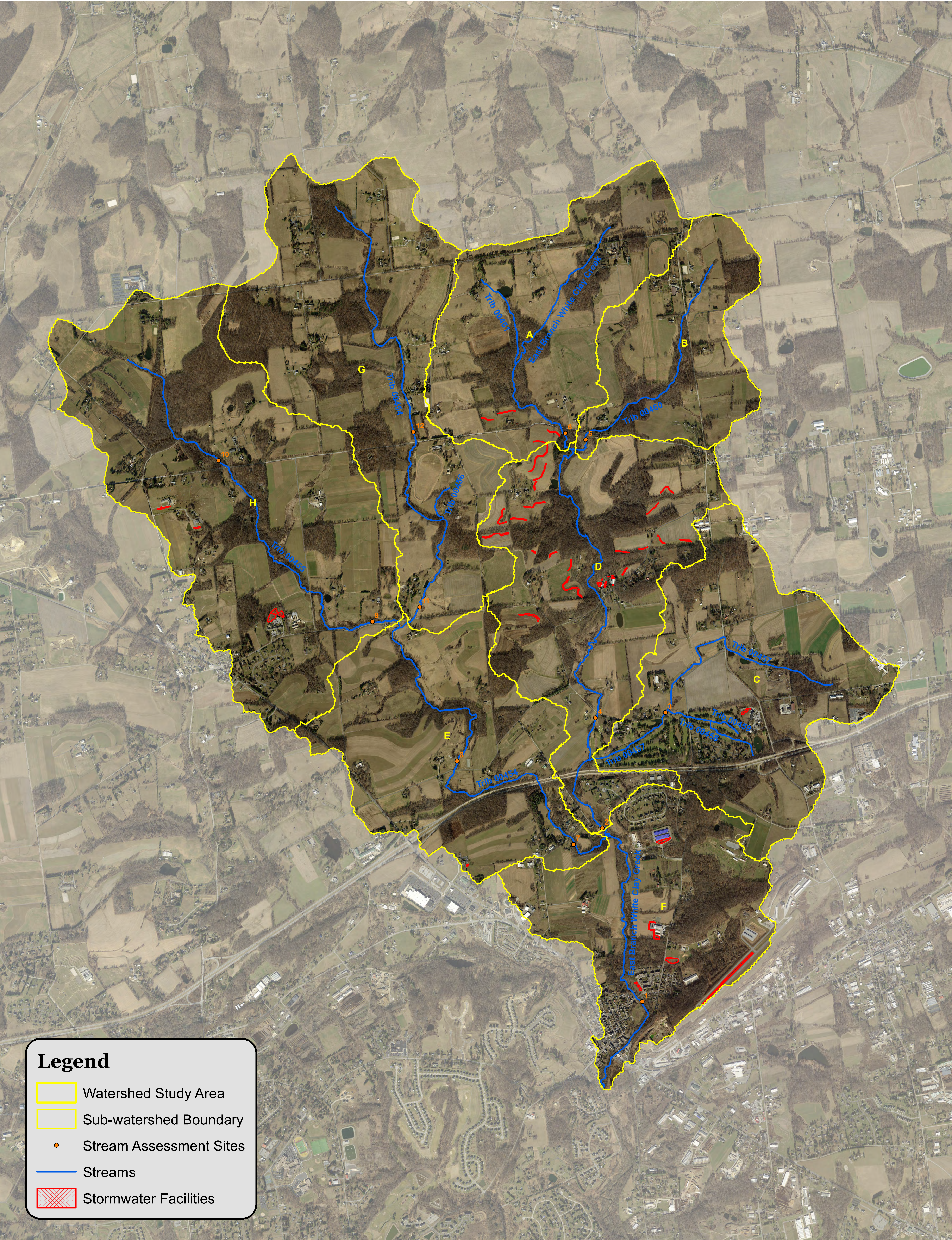
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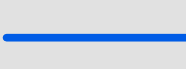

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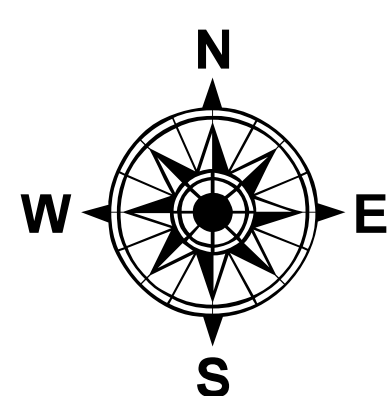
APPENDIX A
WATERSHED ASSESSMENT MAP



Legend

-  Watershed Study Area
-  Sub-watershed Boundary
-  Stream Assessment Sites
-  Streams
-  Stormwater Facilities

0 1,000 2,000 4,000 Feet

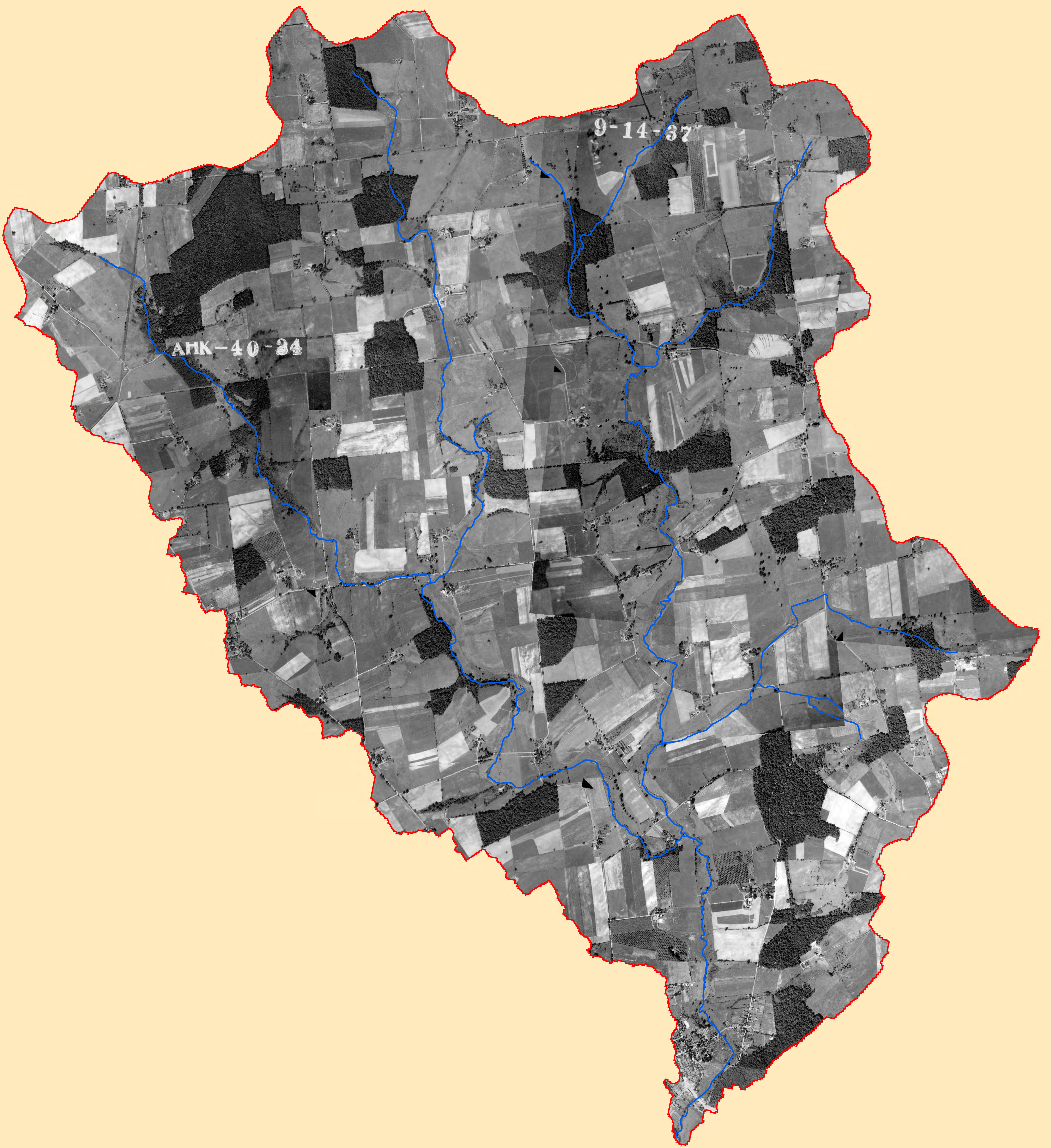


**Upper East Branch White Clay Creek
Watershed Assessment Map
Chester County, Pennsylvania**

Data Sources:
Clauser Environmental, LLC
Chester County GIS Department
www.pasda.psu.edu

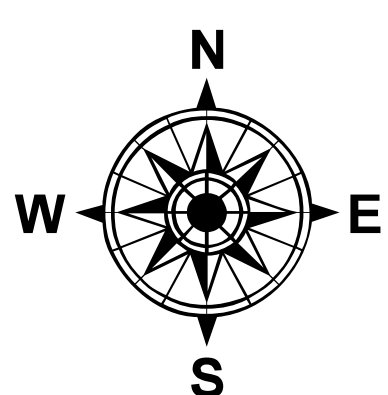
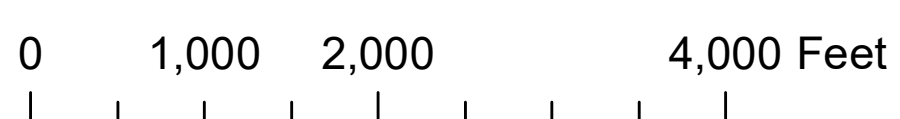


APPENDIX B
HISTORIC AERIAL PHOTOGRAPHY MAPS



Legend

- Watershed Study Area
- Streams

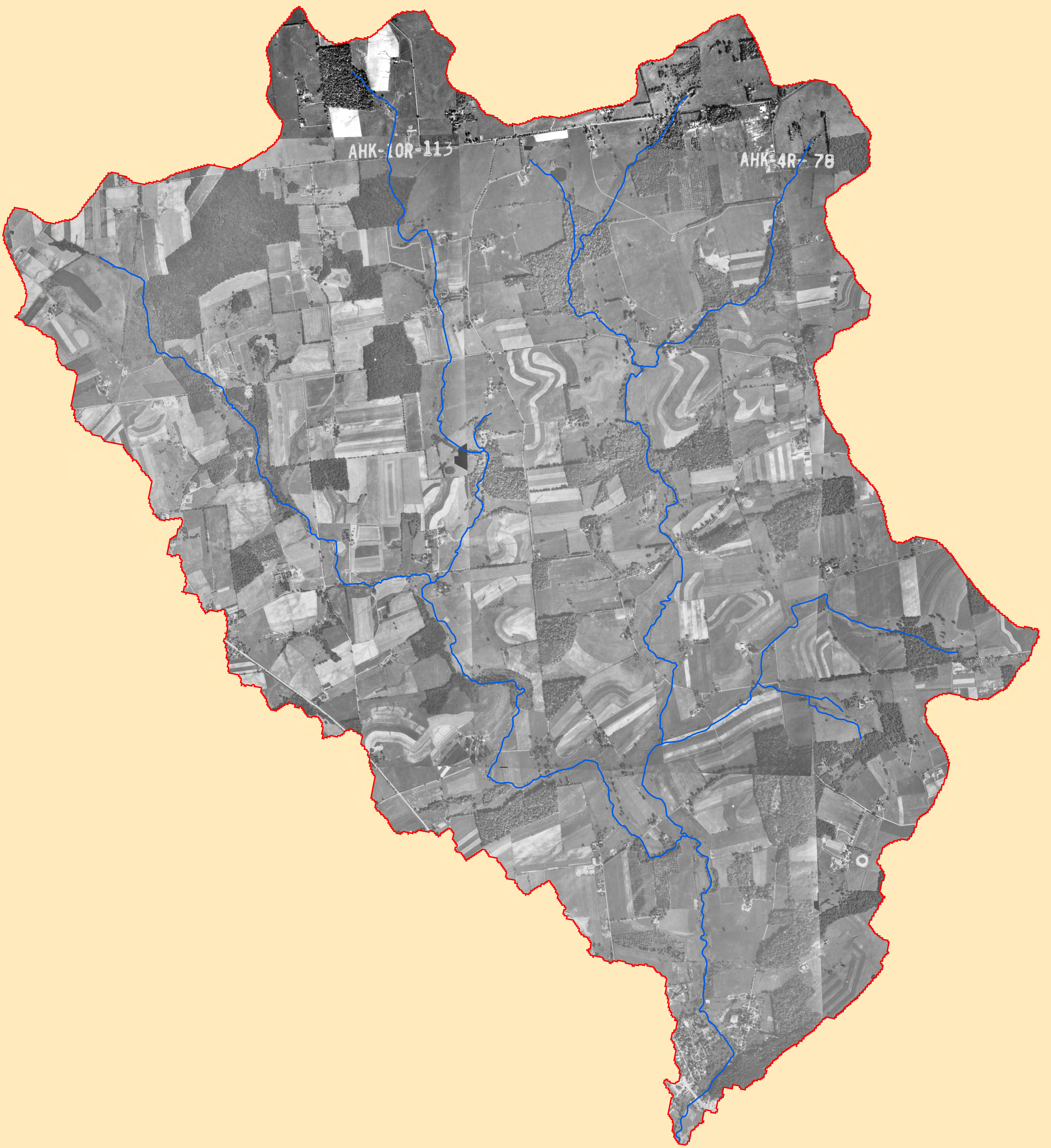


**Upper East Branch White Clay Creek
1937 Aerial Photography
Chester County, Pennsylvania**

Data Sources:
 Clauser Environmental, LLC
 Chester County GIS Department
www.pasda.psu.edu
 USDA Farm Service Agency

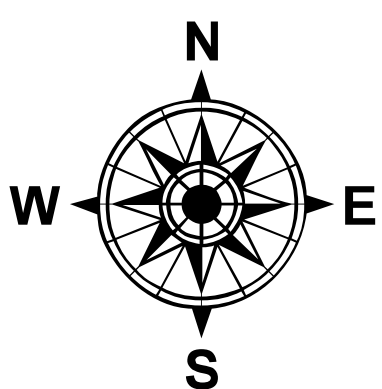
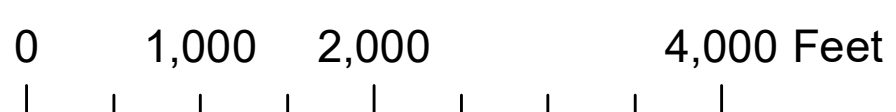
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WHITE CLAY CREEK
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Legend

- Watershed Study Area
- Streams

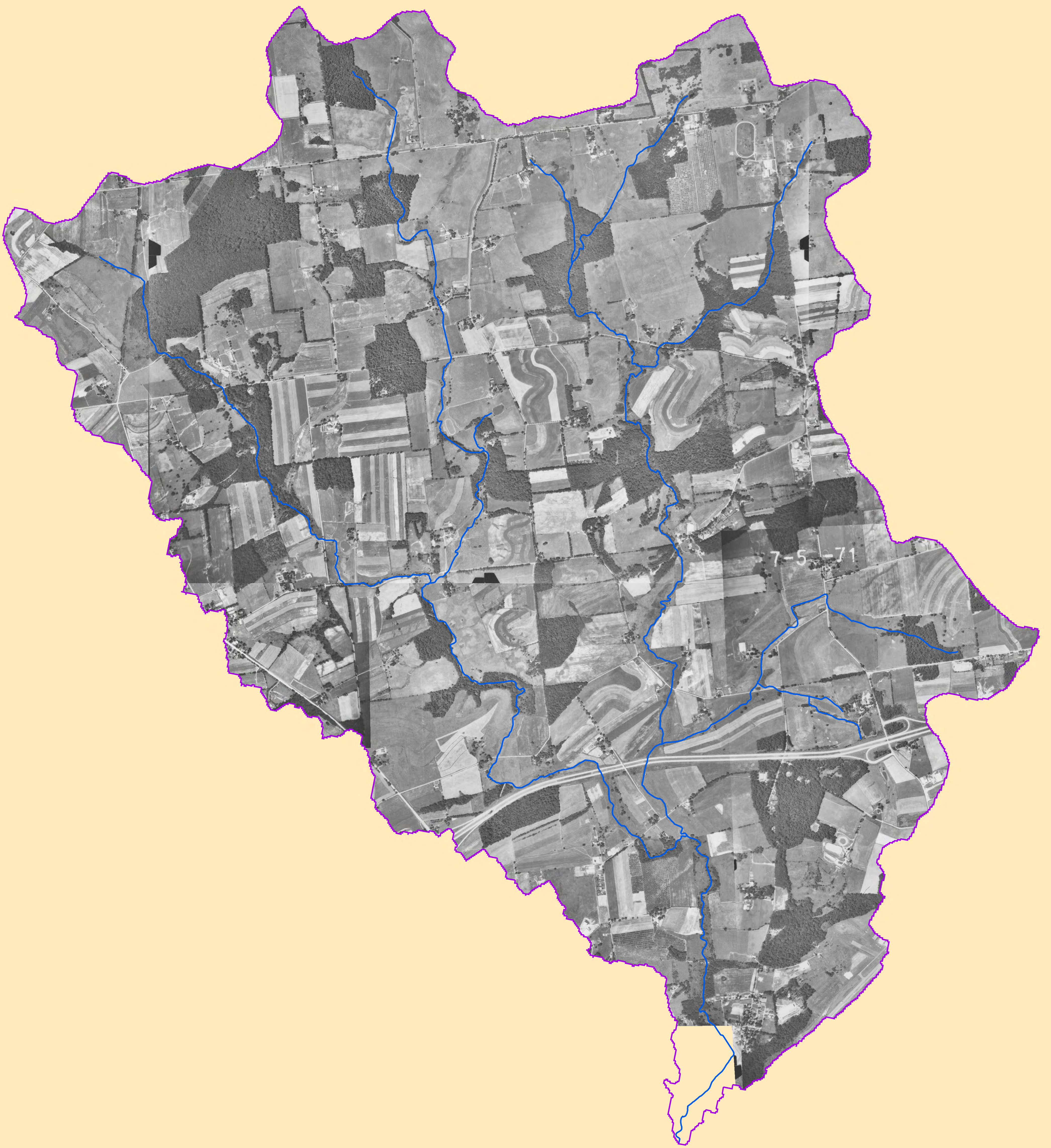


**Upper East Branch White Clay Creek
1957-58 Aerial Photography
Chester County, Pennsylvania**

Data Sources:
 Clauser Environmental, LLC
 Chester County GIS Department
www.pasda.psu.edu
 USDA Farm Service Agency

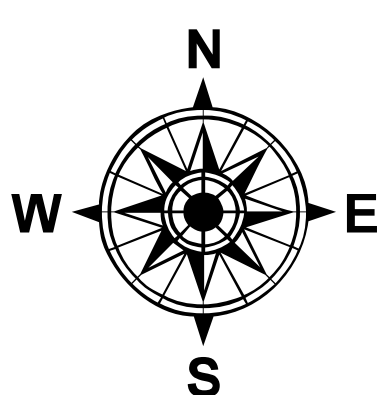
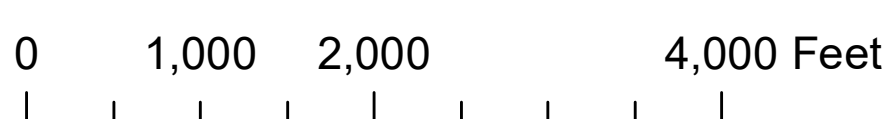
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Legend

- Watershed Study Area
- Streams



Data Sources:
 Clauser Environmental, LLC
 Chester County GIS Department
www.pasda.psu.edu
 USDA Farm Service Agency

Upper East Branch White Clay Creek 1971 Aerial Photography Chester County, Pennsylvania

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APPENDIX C
MACROINVERTEBRATE TAXA LISTS

Macroinvertebrate Taxa List

Site	Class/Order/Suborder	Family	Genus	Quantity	
1	Diptera	Chironomidae		167	
	Diptera	Tipulidae	<i>Antocha sp.</i>	1	
	Diptera	Empididae	<i>Hemerodromia sp.</i>	1	
	Diptera	Tipulidae	<i>Tipula sp.</i>	2	
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	1	
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	10	
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	7	
	Coleoptera	Psephenidae	<i>Psephenus sp.</i>	1	
	Trichoptera	Hydropsychidae	<i>Ceratopsyche sp.</i>	2	
	Trichoptera	Hydropsychidae	<i>Hydropsyche sp.</i>	2	
	Oligochaeta			1	
	Nematoda			2	
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	2	
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	15	
	Ephemeroptera	Isonychiidae	<i>Isonychia sp.</i>	1	
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	3	
	Ephemeroptera	Baetidae	<i>Acentrella sp.</i>	1	
					n=219
	2	Diptera	Chironomidae		128
		Diptera	Tipulidae	<i>Antocha sp.</i>	1
Diptera		Simuliidae	<i>Simulium sp.</i>	7	
Coleoptera		Psephenidae	<i>Psephenus sp.</i>	6	
Coleoptera		Elmidae	<i>Stenelmis sp.</i>	11	
Coleoptera		Elmidae	<i>Oulimnius sp.</i>	3	
Coleoptera		Elmidae	<i>Optioservus sp.</i>	1	
Coleoptera		Elmidae	<i>Microcylloepus sp.</i>	1	
Trichoptera		Hydropsychidae	<i>Ceratopsyche sp.</i>	1	
Trichoptera		Philopotamidae	<i>Chimarra sp.</i>	1	
Trichoptera		Philopotamidae	<i>Dolophilodes sp.</i>	1	
Trichoptera		Limnephilidae	<i>Goera sp.</i>	1	
Nematoda				32	
Oligochaeta				2	
Turbellaria				3	
Ephemeroptera		Baetidae	<i>Baetis sp.</i>	5	
Ephemeroptera		Ephemerellidae	<i>Eurylophella sp.</i>	1	
Ephemeroptera		Ephemerellidae	<i>Serratella sp.</i>	2	
Ephemeroptera		Ephemerellidae	<i>Ephemerella sp.</i>	2	
				n=209	

Site	Class/Order/Suborder	Family	Genus	Quantity
3	Diptera	Chironomidae		88
	Diptera	Scathophagidae		1
	Diptera	Simuliidae	<i>Simulium sp.</i>	16
	Diptera	Ceratopogonidae	<i>Probezzia sp.</i>	1
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	2
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	1
	Coleoptera	Dytiscidae	<i>Agabus sp.</i>	1
	Coleoptera	Dytiscidae	<i>Ilybius sp.</i>	4
	Coleoptera	Elmidae	<i>Dubiraphia sp.</i>	38
	Odanata	Coenagrionidae	<i>Argia sp.</i>	5
	Isopoda			1
	Oligochaeta			34
	Bivalvia			6
				<hr/> n=198
4	Diptera	Chironomidae		92
	Diptera	Tipulidae	<i>Antocha sp.</i>	2
	Diptera	Empididae	<i>Hemerodromia sp.</i>	1
	Diptera	Simuliidae	<i>Simulium sp.</i>	1
	Coleoptera	Elmidae	<i>Macronychus sp.</i>	1
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	3
	Coleoptera	Elmidae	<i>Optioservus sp.</i>	30
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	19
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	2
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	3
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	10
	Ephemeroptera	Ephemerellidae	<i>Serratella sp.</i>	1
	Ephemeroptera	Ephemerellidae	<i>Eurylophella sp.</i>	2
	Ephemeroptera	Baetidae	<i>Barbaetis sp.</i>	1
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	8
	Ephemeroptera	Baetidae	<i>Acentrella sp.</i>	2
	Nematoda			18
	Acari	Hydracarina		2
				<hr/> n=198

Site	Class/Order/Suborder	Family	Genus	Quantity	
5	Diptera	Chironomidae		76	
	Coleoptera	Elmidae	<i>Dubiraphia sp.</i>	1	
	Coleoptera	Elmidae	<i>Gonielmis sp.</i>	1	
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	2	
	Coleoptera	Elmidae	<i>Optioservus sp.</i>	17	
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	16	
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	2	
	Coleoptera	Ptilodactylidae	<i>Anchytarsus sp.</i>	1	
	Trichoptera	Hydropsychidae	<i>Ceratopsyche sp.</i>	2	
	Trichoptera	Hydropsychidae	<i>Hydropsyche sp.</i>	1	
	Trichoptera	Philopotamidae	<i>Chimarra sp.</i>	1	
	Nematoda			26	
	Oligochaeta			8	
	Plecoptera	Leuctridae	<i>Leuctra sp.</i>	18	
	Plecoptera	Perlidae	<i>Beloneuria sp.</i>	1	
	Ephemeroptera	Ephemerellidae	<i>Serratella sp.</i>	10	
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	2	
	Ephemeroptera	Leptophlebiidae	<i>Habrophlebia sp.</i>	1	
	Ephemeroptera	Leptophlebiidae	<i>Habrophlebiodes sp.</i>	1	
	Ephemeroptera	Leptophlebiidae	<i>Paraleptophlebia sp.</i>	3	
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	1	
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	6	
					n=197
	6	Diptera	Chironomidae		70
		Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	1
		Coleoptera	Elmidae	<i>Oulimnius sp.</i>	8
Coleoptera		Elmidae	<i>Optioservus sp.</i>	2	
Coleoptera		Elmidae	<i>Dubiraphia sp.</i>	1	
Coleoptera		Dytiscidae	<i>Agabus sp.</i>	1	
Trichoptera		Hydropsychidae	<i>Hydropsyche sp.</i>	1	
Trichoptera		Philopotamidae	<i>Dolophilodes sp.</i>	3	
Plecoptera		Leuctridae	<i>Leuctra sp.</i>	10	
Plecoptera		Perlidae	<i>Perlesta sp.</i>	2	
Ephemeroptera		Heptageniidae	<i>Stenonema sp.</i>	7	
Ephemeroptera		Heptageniidae	<i>Stenacron sp.</i>	3	
Ephemeroptera		Ephemerellidae	<i>Ephemerella sp.</i>	11	
Ephemeroptera		Ephemerellidae	<i>Serratella sp.</i>	1	
Ephemeroptera		Ephemerellidae	<i>Timpanoga sp.</i>	3	
Ephemeroptera		Ephemerellidae	<i>Eurylophella sp.</i>	5	
Ephemeroptera		Baetidae	<i>Baetis sp.</i>	8	
Ephemeroptera		Baetidae	<i>Procloeon sp.</i>	1	
Nematoda				63	
Gasteropoda		Ancylidae		1	
Acari		Hydracarina		2	
				n=204	

Site	Class/Order/Suborder	Family	Genus	Quantity
7	Diptera	Chironomidae		118
	Diptera	Tipulidae	<i>Antocha sp.</i>	1
	Diptera	Ceratopogonidae	<i>Culicoides sp.</i>	1
	Coleoptera	Elmidae	<i>Optioservus sp.</i>	4
	Coleoptera	Dytiscidae	<i>Ilybius sp.</i>	1
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	2
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	5
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	7
	Coleoptera	Helichus	<i>Dryopidae sp.</i>	1
	Coleoptera	Psephenidae	<i>Psephenus sp.</i>	2
	Trichoptera	Hydropsychidae	<i>Ceratopsyche sp.</i>	2
	Trichoptera	Hydropsychidae	<i>Hydropsyche sp.</i>	1
	Trichoptera	Leptoceridae	<i>Oecetis sp.</i>	1
	Plecoptera	Perlidae	<i>Perlesta sp.</i>	2
	Idopoda			1
	Nematoda			41
	Amphipoda	Crangonyctidae	<i>Stygobromus sp.</i>	1
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	4
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	4
	Ephemeroptera	Ephemerellidae	<i>Timpanoga sp.</i>	1
	Ephemeroptera	Ephemerellidae	<i>Attenella sp.</i>	2
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	2
	Ephemeroptera	Ephemerellidae	<i>Serratella sp.</i>	2
	Acari	Hydracarina		1
				n=206

Site	Class/Order/Suborder	Family	Genus	Quantity	
8	Diptera	Chironomidae		61	
	Diptera	Tipulidae	<i>Antocha sp.</i>	1	
	Diptera	Simuliidae	<i>Simulium sp.</i>	1	
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	12	
	Coleoptera	Hydrophilidae	<i>Derallus sp.</i>	1	
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	3	
	Coleoptera	Psephenidae	<i>Psephenus sp.</i>	4	
	Coleoptera	Elmidae	<i>Optioservus sp.</i>	16	
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	2	
	Trichoptera	Hydropsychidae	<i>Ceratopsyche sp.</i>	2	
	Trichoptera	Hydropsychidae	<i>Hydropsyche sp.</i>	2	
	Trichoptera	Hydropsychidae	<i>Cheumatopsyche sp.</i>	2	
	Trichoptera	Hydroptilidae	<i>Leucotrichia sp.</i>	1	
	Plecoptera	Perlidae	<i>Perlesta sp.</i>	2	
	Oligochaeta			2	
	Nematoda			9	
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	11	
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	21	
	Ephemeroptera	Ephemerellidae	<i>Serratella sp.</i>	15	
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	23	
	Ephemeroptera	Baetidae	<i>Acentrella sp.</i>	2	
	Ephemeroptera	Oligoneuriidae	<i>Isonychia sp.</i>	1	
	Acari	Hydracarina		2	
				n=196	
	9	Diptera	Chironomidae		126
		Coleoptera	Elmidae	<i>Stenelmis sp.</i>	9
Coleoptera		Elmidae	<i>Oulimnius sp.</i>	20	
Coleoptera		Elmidae	<i>Microcylloepus sp.</i>	5	
Coleoptera		Elmidae	<i>Optioservus sp.</i>	9	
Trichoptera		Hydropsychidae	<i>Hydropsyche sp.</i>	2	
Trichoptera		Hydropsychidae	<i>Cheumatopsyche sp.</i>	1	
Trichoptera		Hydroptilidae	<i>Hydroptila Sp.</i>	1	
Plecoptera		Leuctridae	<i>Zealeuctra sp.</i>	1	
Oligochaeta				2	
Nematoda				2	
Ephemeroptera		Ephemerellidae	<i>Eurylophella sp.</i>	1	
Ephemeroptera		Ephemerellidae	<i>Ephemerella sp.</i>	12	
Ephemeroptera		Ephemerellidae	<i>Serratella sp.</i>	1	
Ephemeroptera		Baetidae	<i>Baetis sp.</i>	13	
Acari		Hydracarina		2	
			n=207		

Site	Class/Order/Suborder	Family	Genus	Quantity
10	Diptera	Chironomidae		26
	Diptera	Tipulidae	<i>Antocha sp.</i>	1
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	13
	Coleoptera	Ptilodactylidae	<i>Anchytarsus sp.</i>	2
	Coleoptera	Psephenidae	<i>Ectopria sp.</i>	1
	Collembolla			1
	Coleoptera	Elmidae	<i>Optioservus sp.</i>	7
	Trichoptera	Hydropsychidae	<i>Ceratopsyche sp.</i>	2
	Trichoptera	Hydropsychidae	<i>Hydropsyche sp.</i>	10
	Trichoptera	Philopotamidae	<i>Chimarra sp.</i>	3
	Trichoptera	Polycentropodidae	<i>Polycentropus sp.</i>	2
	Trichoptera	Lepidostomatidae	<i>Lepidostoma sp.</i>	3
	Trichoptera	Odontoceridae	<i>Psilotreta sp.</i>	1
	Trichoptera	Glossosomatidae	<i>Agapetus sp.</i>	3
	Trichoptera	Hydroptilidae	<i>Hydroptila Sp.</i>	1
	Plecoptera	Peltoperlidae	<i>Tallaperla sp.</i>	11
	Plecoptera	Perlidae	<i>Perlesta sp.</i>	1
	Plecoptera	Perlidae	<i>Eccoptura sp.</i>	1
	Plecoptera	Perlidae	<i>Beloneuria sp.</i>	2
	Plecoptera	Perlodidae	<i>Diploperla sp.</i>	1
	Plecoptera	Perlodidae	<i>Isoperla sp.</i>	4
	Plecoptera	Leuctridae	<i>Leuctra sp.</i>	9
	Plecoptera	Nemouridae	<i>Amphinemura sp.</i>	1
	Plecoptera	Nemouridae	<i>Podmosta sp.</i>	3
	Plecoptera	Capniidae	<i>Paracapnia sp.</i>	1
	Oligochaeta			5
	Nematoda			3
	Ephemeroptera	Ephemerellidae	<i>Eurylophella sp.</i>	1
	Ephemeroptera	Ephemerellidae	<i>Serratella sp.</i>	10
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	19
	Ephemeroptera	Leptophlebiidae	<i>Paraleptophlebia sp.</i>	2
	Ephemeroptera	Leptophlebiidae	<i>Habrophlebiodes sp.</i>	4
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	4
	Ephemeroptera	Heptageniidae	<i>Epeorus sp.</i>	2
	Ephemeroptera	Heptageniidae	<i>Leucrocuta sp.</i>	2
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	32
	Acari	Hydracarina		8
	Gastropoda	Hydrobiidae		12
	Decapoda			1
				n=215

Site	Class/Order/Suborder	Family	Genus	Quantity	
11	Diptera	Chironomidae		71	
	Diptera	Ceratopogonidae	<i>Probezzia sp.</i>	1	
	Diptera	Tipulidae	<i>Antocha sp.</i>	1	
	Coleoptera	Elmidae	<i>Oulimnius sp.</i>	27	
	Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	10	
	Coleoptera	Elmidae	<i>Optioservus sp.</i>	15	
	Coleoptera	Elmidae	<i>Stenelmis sp.</i>	18	
	Coleoptera	Elmidae	<i>Dubiraphia sp.</i>	5	
	Coleoptera	Hydraenidae	<i>Limnebius sp.</i>	2	
	Coleoptera	Psephenidae	<i>Psephenus sp.</i>	8	
	Trichoptera	Hydropsychidae	<i>Ceratopsyche sp.</i>	1	
	Plecoptera	Nemouridae	<i>Podmosta sp.</i>	1	
	Oligochaeta			4	
	Nematoda			4	
	Ephemeroptera	Ephemerellidae	<i>Eurylophella sp.</i>	2	
	Ephemeroptera	Ephemerellidae	<i>Ephemerella sp.</i>	16	
	Ephemeroptera	Heptageniidae	<i>Stenonema sp.</i>	1	
	Ephemeroptera	Heptageniidae	<i>Stenacron sp.</i>	2	
	Ephemeroptera	Caenidae	<i>Caenis sp.</i>	1	
	Ephemeroptera	Baetidae	<i>Barbaetis sp.</i>	1	
	Ephemeroptera	Baetidae	<i>Baetis sp.</i>	2	
	Acari	Hydracarina		6	
					n=199
	12	Diptera	Chironomidae		122
		Diptera	Simuliidae	<i>Simulium sp.</i>	2
		Coleoptera	Elmidae	<i>Microcylloepus sp.</i>	5
Coleoptera		Elmidae	<i>Stenelmis sp.</i>	6	
Coleoptera		Elmidae	<i>Oulimnius sp.</i>	14	
Coleoptera		Elmidae	<i>Optioservus sp.</i>	3	
Coleoptera		Dytiscidae	<i>Ilybius sp.</i>	1	
Coleoptera		Psephenidae	<i>Psephenus sp.</i>	3	
Collembolla				1	
Tricoptera		Glossosomatidae	<i>Glossosoma sp.</i>	1	
Trichoptera		Hydropsychidae	<i>Ceratopsyche sp.</i>	3	
Trichoptera		Hydropsychidae	<i>Hydropsyche sp.</i>	1	
Trichoptera		Philopotamidae	<i>Dolophilodes sp.</i>	5	
Plecoptera		Perlidae	<i>Perlesta sp.</i>	2	
Plecoptera		Leuctridae	<i>Leuctra sp.</i>	3	
Oligochaeta				2	
Nematoda				1	
Ephemeroptera		Heptageniidae	<i>Stenonema sp.</i>	1	
Ephemeroptera		Ephemerellidae	<i>Ephemerella sp.</i>	9	
Ephemeroptera		Baetidae	<i>Acentrella sp.</i>	3	
Ephemeroptera	Baetidae	<i>Baetis sp.</i>	19		
				n=207	

APPENDIX D
WATER QUALITY NETWORK HABITAT ASSESSMENT FORMS



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME East Branch White Clay Creek STR CODE/RMI 0204020500135
 STATION NUMBER MP-1 LOCATION 39.82788 N 75.8012 W
 DATE 5/19/2022 TIME 8:47 am
 AQUATIC ECOREGION _____ COUNTY Chester
 INVESTIGATORS ASC, HSC, SM
 FORM COMPLETED BY Aaron S. Clauser, Ph.D.

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>12</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>13</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>4</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>17</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>14</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>60</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>9</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>13</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>9</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>12</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the streambank surface covered by vegetation. 15 14 13 12 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>16</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>12</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>91</u>				
Total Score <u>151</u>				

WATER QUALITY NETWORK HABITAT ASSESSMENT

 WATERBODY NAME East Branch White Clay Creek STR CODE/RMI 02040205000136

 STATION NUMBER MP-2 LOCATION 39.84122 N 75.78375 W

 DATE 5/19/2022 TIME 10:41 am

 AQUATIC ECOREGION _____ COUNTY Chester

 INVESTIGATORS ASC, HSC, SM

 FORM COMPLETED BY Aaron S. Clauser, PhD
RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>13</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 (13) 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>16</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 (16)	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>11</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 (11)	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>18</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 (18) 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 (13) 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>71</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>10</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>17</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>9</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>12</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the stream-bank surface covered by vegetation. 15 14 13 12 11	50-70% of the stream-bank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>8</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>8</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>84</u>				
Total Score <u>155</u>				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040205000605
 STATION NUMBER MP-3 LOCATION 39.84992 N 75.77718 W
 DATE 5/19/2022 TIME 11:48 am
 AQUATIC ECOREGION _____ COUNTY Chester
 INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Aaron S. Clauser, PhD **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>13</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 <u>13</u> 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>12</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 <u>12</u> 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>8</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 <u>8</u> 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>14</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 <u>14</u> 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 <u>13</u> 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>60</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>8</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>12</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>12</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>15</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the streambank surface covered by vegetation. 15 14 13 12 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>13</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>10</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>90</u>				
Total Score <u>150</u>				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME East Branch White Clay Creek STR CODE/RMI 02040205000137

STATION NUMBER MP-4 LOCATION 39.84969 N 75.78916 W

DATE 5/19/2022 TIME 12:25 pm

AQUATIC ECOREGION _____ COUNTY Chester

INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Asaon S. Clauser, PhD **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>9</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 <u>9</u> 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>12</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 <u>12</u> 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>9</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 <u>9</u> 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>12</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 <u>12</u> 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>12</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 <u>12</u> 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>54</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category																			
	Optimal					Suboptimal					Marginal					Poor				
6. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE <u>9</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.				
SCORE <u>12</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.					Water fills > 75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.				
SCORE <u>20</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.					Moderately stable; infrequent, small areas of erosion mostly healed over.					Moderately unstable; up to 60% of banks in reach have areas of erosion.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.				
SCORE <u>9</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
10. Bank Vegetative Protection	More than 90% of the streambank surface covered by vegetation.					70-90% of the streambank surface covered by vegetation.					50-70% of the streambank surfaces covered by vegetation.					Less than 50% of the streambank surface covered by vegetation.				
SCORE <u>13</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
11. Grazing or Other Disruptive Pressure	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.					Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.				
SCORE <u>12</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
12. Riparian Vegetative Zone Width	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.				
SCORE <u>9</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Total Side 2 <u>89</u>																				
Total Score <u>138</u>																				

WATER QUALITY NETWORK HABITAT ASSESSMENT

 WATERBODY NAME East Branch White Clay Creek STR CODE/RMI 090205000138

 STATION NUMBER MP-5 LOCATION 39.8709 N 75.78457 W

 DATE 5/19/2022 TIME 2:4pm

 AQUATIC ECOREGION _____ COUNTY Chester

 INVESTIGATORS ASC, HSC, SM

 FORM COMPLETED BY Aaron S. Clauser, Ph.D

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>18</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 <u>18</u> 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>18</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 <u>18</u> 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>17</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 <u>17</u> 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>18</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 <u>18</u> 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 <u>13</u> 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>84</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>14</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 (14) 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>18</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 (18) 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. (20) 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>13</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 (13) 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>16</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 (16)	70-90% of the streambank surface covered by vegetation. 15 14 13 12 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>17</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 (17) 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>14</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 (14) 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>112</u>				
Total Score <u>196</u>				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch Little Chop Creek STR CODE/RMI 02040205000606

STATION NUMBER MP-6 LOCATION 39.87146 N 75.78635 W

DATE 5/19/22 TIME 1:47 pm

AQUATIC ECOREGION _____ COUNTY Chester

INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Aaron S. Clauser, PhD **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>12</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 (12) 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>19</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 (19) 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>16</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 (16)	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>16</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 (16)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 (13) 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>76</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category																			
	Optimal					Suboptimal					Marginal					Poor				
6. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE <u>12</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.				
SCORE <u>16</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.					Water fills > 75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.				
SCORE <u>18</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.					Moderately stable; infrequent, small areas of erosion mostly healed over.					Moderately unstable; up to 60% of banks in reach have areas of erosion.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.				
SCORE <u>17</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
10. Bank Vegetative Protection	More than 90% of the streambank surface covered by vegetation.					70-90% of the streambank surface covered by vegetation.					50-70% of the streambank surfaces covered by vegetation.					Less than 50% of the streambank surface covered by vegetation.				
SCORE <u>18</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
11. Grazing or Other Disruptive Pressure	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.					Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.				
SCORE <u>18</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
12. Riparian Vegetative Zone Width	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.				
SCORE <u>15</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Total Side 2 <u>114</u>																				
Total Score <u>190</u>																				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040203000607
 STATION NUMBER MP-7 LOCATION 39.84007 N 75.78658 W
 DATE 5/19/2022 TIME 9:20 am
 AQUATIC ECOREGION _____ COUNTY Chester
 INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Aaron S. Clauser PhD

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>15</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>16</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>9</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>18</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>71</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>9</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 <u>9</u> 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>17</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 <u>17</u> 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. <u>20</u> 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>10</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. <u>10</u> 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>12</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the streambank surface covered by vegetation. 15 14 13 <u>12</u> 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>10</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. <u>10</u> 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>10</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. <u>10</u> 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>88</u>				
Total Score <u>159</u>				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040205000607

STATION NUMBER MP-8 LOCATION 39.84656 N 75.7978 W

DATE 5/19/2022 TIME 9:09 am

AQUATIC ECOREGION _____ COUNTY Chester

INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Anton S. Clausen, PhD **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>17</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 <u>(17)</u> 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>18</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 <u>(18)</u> 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>16</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 <u>(16)</u>	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>18</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 <u>(18)</u> 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 <u>(13)</u> 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>82</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>13</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 (13) 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>18</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 (18) 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. (20) 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>10</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. (10) 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>14</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the streambank surface covered by vegetation. 15 (14) 13 12 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>11</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 (11)	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>10</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. (10) 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>96</u>				
Total Score <u>178</u>				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040205000608

STATION NUMBER MP-9 LOCATION 39.85732 N 75.80603 W

DATE 5/19/2022 TIME 1:16 pm

AQUATIC ECOREGION _____ COUNTY Chester

INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Aaron S. Clauser, PhD RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>12</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 <u>12</u> 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>17</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 <u>17</u> 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>17</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 <u>17</u> 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>17</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 <u>17</u> 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 <u>13</u> 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>76</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>13</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>16</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>8</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>13</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the streambank surface covered by vegetation. 15 14 13 12 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>13</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>11</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>94</u>				
Total Score <u>170</u>				

WATER QUALITY NETWORK HABITAT ASSESSMENT

 WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040205000602

 STATION NUMBER MP-10 LOCATION 39.86987 N 75.82091 W

 DATE 5/19/2022 TIME 3:14 pm

 AQUATIC ECOREGION _____ COUNTY Chester

 INVESTIGATORS ASC, KSC, SM

 FORM COMPLETED BY Avon S. Clausen PhD **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>19</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>19</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 13 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>18</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>18</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>15</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 13 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>89</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category																			
	Optimal					Suboptimal					Marginal					Poor				
6. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE <u>18</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.				
SCORE <u>19</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.					Water fills > 75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.				
SCORE <u>20</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.					Moderately stable; infrequent, small areas of erosion mostly healed over.					Moderately unstable; up to 60% of banks in reach have areas of erosion.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.				
SCORE <u>17</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
10. Bank Vegetative Protection	More than 90% of the streambank surface covered by vegetation.					70-90% of the streambank surface covered by vegetation.					50-70% of the streambank surfaces covered by vegetation.					Less than 50% of the streambank surface covered by vegetation.				
SCORE <u>19</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
11. Grazing or Other Disruptive Pressure	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.					Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.				
SCORE <u>18</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
12. Riparian Vegetative Zone Width	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.				
SCORE <u>15</u>	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Total Side 2 <u>126</u>																				
Total Score <u>215</u>																				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040205000609
 STATION NUMBER MP-11 LOCATION 39.85834 N 75.85835 W
 DATE 5/19/2022 TIME 12:54 pm
 AQUATIC ECOREGION _____ COUNTY Chester
 INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Anna S. Clauser PhD

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>13</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 17 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 (13) 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>13</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 (13) 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>14</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 (14) 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 9 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>14</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 16	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 (13) 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 (13) 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>67</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE <u>9</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE <u>13</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE <u>6</u>	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE <u>11</u>	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the streambank surface covered by vegetation. 15 14 13 12 11	50-70% of the streambank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE <u>12</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE <u>10</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 <u>81</u>				
Total Score <u>148</u>				



WATER QUALITY NETWORK HABITAT ASSESSMENT

WATERBODY NAME Unnamed Tributary to East Branch White Clay Creek STR CODE/RMI 02040205060211

STATION NUMBER MP-12 LOCATION 39.87174 N 75.8015 W

DATE 5/19/2022 TIME 2:45 pm

AQUATIC ECOREGION _____ COUNTY Chester

INVESTIGATORS ASC, KSC, SM

FORM COMPLETED BY Aaron S. Clausen, PLD RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish) SCORE <u>17</u>	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat. 20 19 18 <u>17</u> 16	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat. 15 14 13 12 11	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable. 10 9 8 7 6	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious. 5 4 3 2 1
2. Epifaunal Substrate SCORE <u>13</u>	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble. 20 19 18 17 16	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common. 15 14 <u>13</u> 12 11	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present. 10 9 8 7 6	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking. 5 4 3 2 1
3. Embeddedness SCORE <u>9</u>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. 20 19 18 17 16	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. 15 14 13 12 11	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. 10 <u>9</u> 8 7 6	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. 5 4 3 2 1
4. Velocity/Depth Regimes SCORE <u>16</u>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). 20 19 18 17 <u>16</u>	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). 15 14 13 12 11	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes). 10 9 8 7 6	Dominated by 1 velocity/depth regime (usually slow-deep). 5 4 3 2 1
5. Channel Alteration SCORE <u>13</u>	No channelization or dredging present. 20 19 18 17 16	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. 15 14 <u>13</u> 12 11	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted. 10 9 8 7 6	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted. 5 4 3 2 1
Total Side 1 <u>68</u>				

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category																			
	Optimal					Suboptimal					Marginal					Poor				
6. Sediment Deposition SCORE <u>7</u>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles SCORE <u>16</u>	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Channel Flow Status SCORE <u>20</u>	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.					Water fills > 75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Condition of Banks SCORE <u>14</u>	Banks stable; no evidence of erosion or bank failure.					Moderately stable; infrequent, small areas of erosion mostly healed over.					Moderately unstable; up to 60% of banks in reach have areas of erosion.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
10. Bank Vegetative Protection SCORE <u>15</u>	More than 90% of the streambank surface covered by vegetation.					70-90% of the streambank surface covered by vegetation.					50-70% of the streambank surfaces covered by vegetation.					Less than 50% of the streambank surface covered by vegetation.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
11. Grazing or Other Disruptive Pressure SCORE <u>15</u>	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.					Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
12. Riparian Vegetative Zone Width SCORE <u>15</u>	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Total Side 2 <u>102</u>																				
Total Score <u>170</u>																				

APPENDIX E
FLOWING WATER BODY FIELD DATA FORMS



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	0847	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000135	C.WF/MF
Secondary Station ID	MP-1	UEBWC		Surveyed by: Aaron S. Clausen, PhD		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County: Chester	Municipality: Avondale Borough	Topo Quad: West Grove
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Location Description:

Landuse

Residential: 3.5 %	Commercial: %	Industrial: %	Cropland: %	Pasture: %
Abd. Mining: %	Old Fields: %	Forest: 29.7 %	Other: %	

Landuse Comments: Streamstats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	15.2	8.24	7.00	3734		
2.		81.8%				
3.				0.2		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.2

Findings

Not Impaired: <input type="checkbox"/>	Impaired biology? <input checked="" type="checkbox"/>	Impaired habitat? <input type="checkbox"/>	Is impact localized? <input type="checkbox"/>	Reevaluate designated use? <input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score: 30.2	Total Habitat Score: 151
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MP-1

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	13
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	21
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	151
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	1041	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	09040205000136	EV
Secondary Station ID	MP-2 UEBWC			Surveyed by:	Aaron S. Clauser, Ph.D	

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxicants, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	New Garden Twp	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	2.3 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	29.9 %	Other:	%		

Landuse Comments:

Streamstats

Canopy cover: open (partly shaded) mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	14.8	9.34	7.03	329.7		
2.		92.2%				
3.				0.2		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.2

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	36.6	Total Habitat Score:	155
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MP-2

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	21
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	21
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	155
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
<small>^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?</small>	



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ		20220519 · 1148 · ASC Date Time Initials			Watershed Code (HUC) 02040205	Stream Code 02040205000605	Ch. 93 Use EV
Secondary Station ID MP-3		UEBWC			Surveyed by: Aaron S. Clauser, PhD		
*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.						SWP Watershed	
Survey Type							
(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]							4
Location							
County:	Chester		Municipality:	Neshaminy Township		Topo Quad:	West Grove
Location Description:							
Landuse							
Residential:	0.5 %	Commercial:	%	Industrial:	%	Cropland:	%
Abd. Mining:	%	Old Fields:	%	Forest:	25.7 %	Other:	%
Landuse Comments: Streamstats							
Canopy cover: open <u>partly shaded</u> mostly shaded fully shaded							
Water Quality							
	Collector-sequence #	Field Meter Readings:				Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)	
		Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity (mg/l)	
1.		16.1	8.27	7.22	479.0		
2.			8.40%				
3.					0.2		
Water Appearance/Odor Comments: (^see bottom of back for common descriptors)							
Salinity = 0.2							
Findings							
Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>
						Reevaluate designated use?	<input type="checkbox"/>
Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:							
IBI Score:	23.5		Total Habitat Score:	150			

MP-3

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	16
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	27
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	150
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	1225	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000137	EV
Secondary Station ID	MP-4	UEBWC		Surveyed by:	Aaron S. Clauson, PhD	

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	0.6 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	31.8 %	Other:	%		

Landuse Comments: Streamstats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	15.7	11.01	7.44	238.3		
2.		110.42				
3.						

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)
Salinity=0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input checked="" type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	37.9	Total Habitat Score:	138
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MP-4

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	18
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	22
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	138
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time 14:14	Initials	02040205	040205000138
Secondary Station ID	MP-5	UEBWC		Surveyed by:	Aaron S. Clauser, PhD

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	West Marlborough	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	0.04%	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	34.2%	Other:	%		

Landuse Comments: Streamstats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	16.1	11.48	7.42	167.1		
2.		116.2				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

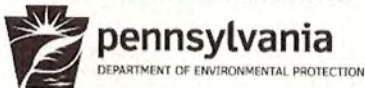
Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	48.5	Total Habitat Score:	196
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MP-5

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	31
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	29
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	196
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	13:47	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000606	EV
Secondary Station ID	MP-6		LIEBWC	Surveyed by: Aaron S. Clauser, PhD		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	West Marlborough	Topo Quad:	West Grove
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Location Description:

Twp

Landuse

Residential:	0.1 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	29.0 %	Other:	%		

Landuse Comments: Streams tats

Canopy cover: open partly shaded (mostly shaded) fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	16.3	9.98	7.06	242.5		
2.		100.3%				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	46.8	Total Habitat Score:	190
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MP-6

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	28
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	35
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	190
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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BUREAU OF CLEAN WATER

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519-0920-ASC			Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000607	EV
Secondary Station ID	MP-7 UE BWC			Surveyed by: Aaron S. Clauser PhD		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	1.9 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	28.3 %	Other:	%		

Landuse Comments: Streamstats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	14.9°	9.27	7.08	283.0		
2.		91.4%				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	44.3	Total Habitat Score:	159
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MP-7

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	18
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	22
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	159
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519 - 9:09 - ASC			Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000607	EV
Secondary Station ID	MP-8 WEBWC			Surveyed by:	Aaron S. Clauser PhD	

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove Twp	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	1.1 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	29 %	Other:	%		

Landuse Comments:

Streamstats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	14.4	9.57	6.80	219.3		
2.		93.6%				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	41.7	Total Habitat Score:	178
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MP-8

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	29
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	24
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	178
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	13:16	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205 00608	EV
Secondary Station ID	MP-9		UEBWC	Surveyed by:	Aaron S. Clauser, PhD	

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove Twp	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	2.3 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	29.1 %	Other:	%		

Landuse Comments: Streamstats

Canopy cover: open partly shaded (mostly shaded) fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	15.6	10.33	6.81	242.9		
2.		10.33%				
3.				Od		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity=0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	32.9	Total Habitat Score:	170
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MP-9

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	30
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	21
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	170
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519 - 15:14 - ASW			Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000608	EV
Secondary Station ID	MP-10			Surveyed by: Aaron S. Clauser, PhD		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove Twp	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	0.08 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	36.2 %	Other:	%		

Landuse Comments: streams tats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	15.2	10.06	6.94	231.2		
2.		100%				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

Not Impaired:	<input checked="" type="checkbox"/>	Impaired biology?	<input type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	91.7	Total Habitat Score:	215
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MP-10

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <u>or</u> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	36
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	36
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	215
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519	1254	ASC	Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials	02040205	02040205000609	EV
Secondary Station ID	MP-11			Surveyed by: Aaron S. Clauser, PhD		
*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.				SWP Watershed		

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove Twp	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	0.2 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	31.3 %	Other:	%		

Landuse Comments: streamstats

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	16.0	10.69	7.14	1570		
2.		108.1				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	45.3	Total Habitat Score:	148
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MP-11

Macroinvertebrate sampling	
Sampling protocol: Std. kick screen: <input type="checkbox"/> D-frame: <input checked="" type="checkbox"/> Other: <input type="checkbox"/> protocol?: _____	
Comments/Abundance Notes:	
Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness <i>or</i> #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less (20 or less for warm water, low gradient streams)	23
#9 Condition of Banks + #10 Bank Vegetation = 24 or less (20 or less for warm water, low gradient streams)	17
Total habitat score 140 or less for forested, cold water, high gradient streams (120 or less for warm water, low gradient streams)	148
Habitat Comments:	
Special Condition	
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.	
^Common descriptors: Water Odors - none normal sewage petroleum chemical other; Water Surface Oils - none slick sheen globs flecks; Turbidity - clear slight turbid opaque; NPS Pollution - no evidence some potential obvious; Sediment Odors - none normal sewage petroleum chemical anaerobic; Sediment Oils - absent slight moderate profuse; Deposits - none sludge sawdust paper fiber sand relict shells other. Are the undersides of stones deeply embedded black?	



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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20220519 - 1445 - ASC			Watershed Code (HUC)	Stream Code	Ch. 93 Use
	Date	Time	Initials			
Secondary Station ID	MP-12	VEBWC		Surveyed by: Aaron S. Clausen PhD		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

4

Location

County:	Chester	Municipality:	London Grove Twp	Topo Quad:	West Grove
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Location Description:

Landuse

Residential:	0.03 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	32.8 %	Other:	%		

Landuse Comments: Streamstats

Canopy cover: open partly shaded (mostly shaded) fully shaded

Water Quality

Collector-sequence #	Field Meter Readings:					Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
	Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	
1.	17.1	10.38	7.13	157.2		
2.		10.21%				
3.				0.1		

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)

Salinity = 0.1

Findings

Not Impaired:	<input type="checkbox"/>	Impaired biology?	<input checked="" type="checkbox"/>	Impaired habitat?	<input type="checkbox"/>	Is impact localized?	<input type="checkbox"/>	Reevaluate designated use?	<input type="checkbox"/>
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Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	46.5	Total Habitat Score:	170
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APPENDIX F
PROFESSIONAL QUALIFICATIONS

Aaron S. Clauser, PhD, CPESC

At Clauser Environmental, LLC, he serves as the technical/production lead on scientific projects. Dr. Clauser earned his bachelor's degree in Biology and Environmental Studies from East Stroudsburg University of Pennsylvania and a doctorate in Environmental Science from Lehigh University. Dr. Clauser is a Certified Professional in Erosion and Sediment Control. He served as an environmental regulator with the Berks and Schuylkill Conservation Districts where he performed at both the technician and managerial levels. Dr. Clauser consulted as a Senior Environmental Scientist and Project Manager for RETTEW Associates, Inc. He has given oral presentations at conferences held by the Ecological Society of America, American Society of Limnology and Oceanography, Coldwater Heritage Partnership, Partnership for the Delaware Estuary, Delaware Riverkeeper, Pocono Comparative Lakes Program and Schuylkill and Berks Conservation Districts and has collaborated on an article published about Pacific Northwest amphibians in a peer-reviewed journal. Dr. Clauser has completed numerous training courses including DEP sponsored NPDES, Chapter 102 and 105 technical seminars, Applied Fluvial Geomorphology for Engineers (FGE) by Wildland Hydrology, Inc., and Environmentally Sensitive Maintenance of Dirt and Gravel Roads Training. Dr. Clauser served in the PA Air National Guard where he attained the rank of Staff Sergeant. His doctoral dissertation entitled "Zooplankton to Amphibians: Sensitivity to UVR in Temporary Pools" includes quantitative optical and organismal level models that are extended to landscape level variations in pool optical properties and population level sensitivity to Ultraviolet Radiation.

Kora S. Clauser, BS

Kora works as a biologist with Clauser Environmental, LLC. She has experience with watershed studies, wetland delineation, scientific field investigations, and project delivery. She is currently working towards an M.B.A degree at Lehigh University. She completed her B.S. in Biological Science with a minor in Psychology at Rowan University.

Krista S. Clauser, MEd

As the president of Clauser Environmental, LLC, she is responsible for overall client satisfaction, quality assurance, educational outreach programs, and project management. Krista has her bachelor's degree in Special Education and Elementary Education from Kutztown University of Pennsylvania. She has her Master of Education degree from the University of Georgia, with a concentration in Learning, Leadership, and Organization Development. Krista has completed additional graduate level coursework at Kutztown University of Pennsylvania and Indiana Wesleyan University. Currently, she is a doctoral student, pursuing her EdD at Drexel University in Leadership and Management, concentrating in Creativity and Innovation. She is a certified yoga teacher, breathwork coach, reiki teacher, and qi gong teacher. She has experience as a special education teacher at Schuylkill Intermediate Unit and as a homeschool educator at the elementary, middle, and high school levels. Krista has expertise in integrating environmental/outdoor curricula into a diversity of subjects and educational settings.