Pocopson Creek and Browning Barn Tributary Watershed Assessment Report

Pocopson Township, East Marlborough Township, Newlin Township, Pennsbury Township, and Kennett Township, Chester County, Pennsylvania

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1.0 INTRODUCTION

The Brandywine Red Clay Alliance (BRC) has identified Pocopson Creek Watershed and the adjacent Browing Barn Tributary Watershed as priority watersheds that have been largely overlooked in previous watershed restoration and conservation efforts. Within Clean Water Act guidelines, the Pennsylvania Department of Environmental Protection (PA DEP) assesses streams at the watershed scale and lists impairments for Pennsylvania stream reaches that do not attain their designated uses for recreation, aquatic life, etc. Listed aquatic life impairments to Pocopson Creek and its tributaries include agricultural (siltation and habitat alterations) and urban runoff/storm sewers (siltation and water/flow variability) (PA DEP, 2024). In March of 2024, PA DEP identified recreational impairments of urban runoff/storm sewers – *Escherichia coli* (*E. coli*) and agriculture - *Escherichia coli* (*E. coli*) as part of the 2024 Integrated Report. 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. In March of 2024, PA DEP identified a recreational impairment of agriculture - *Escherichia coli* (*E. coli*) in the Browning Barn Tributary. The Browning Barn Tributary is listed as attaining for its other designated use of aquatic life. BRC has collaborated with Clauser Environmental, LLC to develop this assessment report and a corresponding restoration plan for the Pocopson Creek and Browning Barn Tributary Watersheds. Research, analysis, and strategic planning of restoration projects and phasing is necessary to maximize the impact of efforts to address impairment.

A stretch of the Pocopson Creek

2.0 BACKGROUND

The Pocopson Creek and Browning Barn Tributary Watersheds are located in Pocopson Township, East Marlborough Township, Newlin Township, Pennsbury Township, and Kennett Township, Chester County, Pennsylvania. The Pocopson Creek and Browning Barn Tributary Watersheds total area includes approximately 9.79 square miles of watershed and 13.11 miles of stream. The Pocopson Creek originates northwest of the intersection of Cannery Road and Unionville-Wawaset Road. The Pocopson Creek flows south through

farmland, woodlots, and residential areas, picking up an unnamed tributary just west of Marlboro Spring Road. From here, the Pocopson Creek continues to flow south towards Newhall Road, where it begins to veer East. An unnamed tributary from the South discharges into the Pocopson Creek just before Pocopson Creek passes under Marlboro Spring Road. It continues to run through agricultural fields and woodlots, picking up two more unnamed tributaries from the north before turning southwest to run along Red Lion Road. Pocopson Creek passes under Marlborough Road, where another unnamed tributary discharges into it from the Southwest. It flows east under Haines Mill Road and then south alongside Lenape Unionville Road. Pocopson Creek flows through farm fields and picks up two unnamed tributaries from the north before crossing under Lenape Unionville Road. To the south, a small stream originating from a lake located on Longwood Gardens property flows north to join with another small stream originating from east of the intersection of Folly Hill Road and Valley Road. The unnamed tributary formed from these small streams flows north, picking up another small tributary before meeting its confluence with Pocopson Creek just east of the roundabout along Lenape Road. The Pocopson Creek continues east through residential developments and woodlots towards Denton Hollow Road, picking up another unnamed tributary from the north. An unnamed tributary flowing north along Denton Hollow Road discharges into Pocopson Creek just before the main stream passes under Denton Hollow Road. Pocopson Creek continues southeast through agricultural fields and woodlots to cross under Street Road. Here, it picks up a final unnamed tributary from the west. Pocopson Creek meets its confluence with Brandywine Creek just east of Pocopson Road. The Pocopson Creek Watershed encompasses approximately 9.19 square miles and includes 11.95 stream miles. The Pocopson Creek and its tributaries have a Pennsylvania Code, Title 25, Chapter 93 water quality designation of Trout Stocked Fishery/Migratory Fishery (TSF/MF) and are not listed by the Pennsylvania Fish and Boat Commission as stream sections that support the natural reproduction of trout (PFBC, 2024).

The spring house at the origin of the Browning Barn Tributary within the Myrick Conservation Center

The Browning Barn tributary originates near the Brandywine Red Clay Alliance's Browning Barn, located in the Myrick Conservation Center. The Browning Barn tributary flows north through the conservation center along Unionville-Wawaset Road. The tributary flows through woodlots and agricultural fields before reaching its discharge into the West Branch

Brandywine Creek. The Browning Barn Tributary Watershed encompasses approximately 0.6 square miles and contains 1.16 stream miles. The Browing Barn Tributary has a Pennsylvania Code, Title 25, Chapter 93 water quality designation of Warm Water Fishery/Migratory Fishery (WWF/MF) and is not listed by the Pennsylvania Fish and Boat Commission as a stream that supports the natural reproduction of trout (PFBC, 2024). The Browning Barn Tributary Watershed was included in the present assessment report and restoration plan because, while too small to warrant its own plan, it presents opportunities for crucial restoration work and is adjacent to the larger watershed, making it practical to prioritize and address its needs within this assessment and restoration plan.

2.1 Agricultural Siltation and 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 are reduced. Excessive siltation within stream systems also increases maintenance costs for structures within and around the stream.

Within the Pocopson Creek and Browning Barn Tributary Watersheds, 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 stabilization and floodplain restoration projects. While soil loss from upland areas has decreased with a decrease in farming within the watershed and from the implementation of conservation farming techniques, siltation from the uplands still reaches the stream corridor, and more opportunities for conservation exist. In this assessment, siltation levels within the stream are analyzed as part of the habitat assessment.

Livestock graze along Pocopson Creek

2.2 Urban Runoff/Storm Sewers - Siltation, Water/Flow Variability

A review of recent and historic aerial photography indicates that the Pocopson Creek and Browning Barn Tributary Watersheds have become much more urban during the last 80 years (Appendices A and B). With increased urbanization and the 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 Brandywine Red Clay Alliance (BRC) works in partnership with local governmental bodies, landowners, businesses, and non-profits to promote the use of Best Management Practices (BMPs) that reduce stormwater impacts on stream ecosystems. While the oldest developments within the study area often lack stormwater management BMPs, most of the existing subdivisions within the watershed have at least stormwater rate control structures in place. Ongoing inspection and maintenance of stormwater structures is important to maintaining water quality for future generations. New developments within the study area are required to design stormwater systems that account for both stormwater rate and volume. Point sources of pollutant discharges within the Christina River Basin are subject to existing total maximum daily load (TMDL) limitations (EPA, 2006; EPA 2006 (a); EPA, 2007).

2.3 Urban Runoff/Storm Sewers and Agriculture – *Escherichia coli*

With increasing storm flows in the last 80 years, there has also been an increase in the volume of pollutants being washed into the streams. As the stormwater flows downslope to the stream, it picks up pet waste and livestock manure from agricultural operations and deposits these directly into the stream. The Pocopson Creek and Browning Barn Tributary watersheds contain long stretches of pasture where livestock have direct access to the stream, contributing fecal matter directly into the stream system. This process results in higher levels of fecal bacteria in the stream, including *E. coli*, which can be harmful to human and animal health.

Over time, the elevated levels of *E. coli* in the stream not only degrade water quality but also disrupt the natural systems within the stream. Bacteria, such as *E. coli*, compete with fish and other aquatic organisms for oxygen and nutrients in the stream. Fecal contamination also contributes to the growth of algal blooms in the stream. Algal blooms reduce oxygen levels in the stream and release toxins that can be harmful to humans and animals. Long-term, the ecological degradation from *E. coli* and other fecal bacteria can make stream restoration more challenging and impair the stream's function as a habitat, drinking water source, or safe place for recreation.

2.4 Watershed Geology

The Pocopson Creek and Browning Barn Tributary Watersheds are located within the Piedmont Upland Physiographic Section. They consist of broad, gently rolling hills and valleys. The rock formations, as described by the Pennsylvania Topographic and Geologic Survey, in the area of investigation are ultramafic rocks, felsic and intermediate gneiss, mafic gneiss, Glenarm Wissahickon formation, and felsic gneiss.

Ultramafic rocks are largely made of serpentinite and formed during the lower Paleozoic. Felsic and intermediate gneiss are largely made of quartz, feldspar, and mica. They formed during the Precambrian. Mafic gneiss is an igneous rock containing magnesium and iron that formed during the Precambrian. The Glenarm Wissahickon formation formed in the lower Paleozoic and is composed of oligoclase-mica schist. The Glenarm Wissahickon formation is the primary rock formation mapped within the area of investigation. Felsic gneiss is largely made of feldspar and silicon that formed during the Precambrian (DCNR, 2024).

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 Pocopson Creek and Browning Barn Tributary Watersheds range from approximately 160 to 490 feet above mean sea level. The primary rock formation mapped onsite, the Glenarm Wissahickon formation, is composed of metamorphic rock. 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, 2024). 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 Pocopson Creek and Browning Barn Tributary Watersheds.

3.1 Sub-watershed Analysis

The Pocopson Creek and Browning Barn Tributary Watersheds were divided into 7 sub-watersheds based on the location of major unnamed tributaries (Appendix A). For each sub-watershed, land use was analyzed through the use of USGS StreamStats version 4.21.0 (USGS, 2024). The resulting data was compiled to prepare an estimate of the 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 the watershed mapping. In order to gain a greater understanding of historical land use, aerial photography from 1937, 1946, 1958, and 1971 was compiled and reviewed (Appendix B).

3.2 Sample Locations

Ten (10) sample locations are located within the Pocopson Creek and Browning Barn Tributary Watersheds (Appendix A).

- Sample Site 1 is located on the first unnamed tributary (UNT) to Pocopson Creek, just upstream of where it discharges into Pocopson Creek west of Marlboro Spring Road. Sample Site 1 is representative of Sub-Watershed A.
- Sample Site 2 is located on Pocopson Creek, just upstream of where it picks up a tributary south of the intersection of Marlborough Road and Red Lion Road. Sample Site 2 is representative of Sub-Watershed B.
- Sample Site 3 is located on the UNT that discharges into Pocopson Creek south of the intersection of Marlborough Road and Red Lion Road, just upstream of the meeting point. Sample Site 3 corresponds to Sub-Watershed C.
- Sample Site 4 is located on Pocopson Creek, just upstream of where it picks up the largest UNT south of the roundabout on Lenape Unionville Road. Sample Site 4 is representative of Sub-Watershed D.
- Sample Site 5 is located on the northern headwaters stream of the largest UNT to Pocopson Creek, just upstream of its confluence with the other headwaters stream north of the intersection of Ballintree Lane and Lenape Road.
- Sample Site 6 is located on the southern headwaters stream of the largest UNT to Pocopson Creek, just upstream of its confluence with the northern headwaters stream.

- Sample Site 7 is located on the Largest UNT to Pocopson Creek, just upstream of where it discharges into Pocopson Creek. Sample Sites 5, 6, and 7 are representative of Sub-Watershed E.
- Sample Site 8 is located along Pocopson Creek, just upstream of where it picks up a small UNT before passing under Denton Hollow Road.
- Sample Site 9 is located on Pocopson Creek, just upstream of where it meets its confluence with Brandywine Creek. Sample Sites 8 and 9 are representative of Sub-Watershed F.
- Sample Site 10 is located on the Browning Barn Tributary, just upstream of where it drains to West Branch Brandywine Creek. Sample Site 10 is representative of Sub-Watershed G.

3.3 Macroinvertebrate Sampling

The Pennsylvania Department of Environmental Protection (PA DEP) Wadeable Riffle-Run Stream Macroinvertebrate Data Collection Protocol (PA DEP, 2023(a)) was utilized to collect benthic macroinvertebrates at each of the sample locations. Field sampling occurred on December 17, 2024. The 6 D-frame method of sample collection was utilized in accordance with the PA DEP Standardized Biological Field Collection and Laboratory Methods (PA DEP, 2006; PA DEP, 2023(a)). Samples were processed, sub-sampled, and identified in the lab by Clauser Environmental, LLC following PA DEP protocols (PA DEP, 2015). Identification of collected organisms was conducted with the aid of established taxonomic keys (Merrit and Cummins, 1996; Pekarsky et al., 1990).

Macroinvertebrate sampling along the Browning Barn Tributary

Data analysis included the evaluation of six metrics for the macroinvertebrate community at each site. The six metrics were combined via an established PA DEP weighting function to determine the more robust Index of Biological Integrity (IBI) value for each site (PA DEP, 2015). The IBI value allows for comparison with the established PA DEP threshold for biological impairment. Sites with an IBI value above the threshold for macroinvertebrates are considered unimpaired while those falling below the threshold are considered impaired for macroinvertebrates. 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 PA DEP Stream Habitat Data Collection Protocol (PA DEP, 2023; PA DEP, 2023(a)). 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 140 or less are considered impaired. Additional impairment thresholds exist. Riffle/run-dominated wadeable streams, including Pocopson Creek and its tributaries, and the Browning Barn Tributary, 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 allow for the discretion of the field investigator (PA DEP, 2013; PA DEP, 2023).

3.5 Water Quality Analysis

Water quality analysis was conducted at all sample points on December 17, 2024 and January 29, 2025. Chemical and physical water quality analyses were conducted in accordance with the guidelines for water chemistry sampling outlined in the Department of Environmental Protection Water Quality Monitoring Protocols for Surface Waters (PA DEP 2023(a)). 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.

M.J. Reider, a certified water quality laboratory, completed laboratory water quality analysis. Water quality assessment site sampling laboratory analysis parameters included Total Kjehldahl Nitrogen (TKN), Nitrite, Nitrate, Total Phosphorus, and Alkalinity.

4.0 RESULTS

4.1 Sub-watershed Analysis Results

The 7 sub-watersheds of the Pocopson Creek and Browning Barn Tributary Watersheds ranged from 0.06 to 15.36 in approximate percent of urban development (impervious cover and buildings) and from 28.43 to 53.49 in approximate percent of area forested (Table 1, Appendices C, D, and E). The other primary land uses include pastures, croplands, and developed open space. Developed open space consists of areas where vegetation is maintained as lawn or meadow, typically for recreational use, aesthetics, or for practicality surrounding more developed areas.

A. Sub-watershed A is the westernmost portion of the area of interest. It includes the drainage area to the first unnamed tributary to Pocopson Creek. The tributary is composed of two smaller streams which reach their confluence between residential developments. Sub-watershed A includes agricultural fields, urban development (6.77%), and forested area (28.43%)

B. Sub-watershed B includes the origin of Pocopson Creek from the Northeast corner of Cannery and Unionville Wawaset roads to where Pocopson Creek picks up another tributary just below Marlborough Road. It includes three unnamed tributaries, one of which drains from the south and the other two from the north. It includes 0.30% urban development and 32.96% forested area.

C. Sub-watershed C includes the area that drains to the large unnamed tributary that discharges into Pocopson Creek just south of the intersection of Marlborough Road and Red Lion Road. This sub-watershed includes agricultural fields, very little urban development (0.04%), and a lot of forested areas (42.68%).

D. Sub-watershed D includes the stretch of Pocopson Creek that goes under Red Lion Road, along Lenape Unionville Road and stops after passing under Route 52. It also includes three unnamed tributaries. Sub-watershed D has 0.5% urban development and 44.4% forested area.

E. Sub-watershed E includes the area that drains to the largest unnamed tributary that discharges into Pocopson Creek. It includes a drainage area from south of Pocopson Creek to Longwood Gardens. This sub-watershed includes forested areas (47.19%), agricultural fields, and a little urban development (4.93%).

F. Sub-watershed F picks up at the end of Sub-watershed D where Pocopson Creek passes under Route 53. From there, it extends to Pocopson Creek's confluence with Brandywine Creek. It also includes three unnamed tributaries. This sub-watershed at the easternmost part of the watershed has the most residential area of all the sub-watersheds (15.36% urban development), but also maintains a significant amount of forested area (42.10%)

G. Sub-watershed G includes all of the area that drains to the Browning Barn Tributary. This tributary connects to the West Branch Brandywine Creek. Sub-watershed G includes part of the Myrick Conservation Center. This sub-watershed has the highest percentage of forested area (53.49%) and the lowest percentage of urban development (0.06%) of all the sub-watersheds within the area of interest.

Table 1
Pocopson Creek Watershed and Browning Barn Tributary Watershed Percent Urban Development and Forested Data

Sub-watershed	Approx. Total Square Miles	Approx. Urban Development %	Approx. Forested %
A	0.74	6.77	28.43
B	1.83	0.30	32.96
C	0.84	0.04	42.68
D	1.78	0.50	44.40
E	2.12	4.93	47.19
F	1.78	15.36	42.10
Pocopson Total	9.09	4.87	40.84
G	0.60	0.06	53.49

4.2 Macroinvertebrate Sampling Results

Macroinvertebrates that were sampled within the Pocopson Creek and Browning Barn Tributary Watersheds comprised at least 76 taxa (Appendix F). During the period of November to May, when sampling occurred for this study, IBI values of less than 50 are considered impaired in both Warm Water Fisheries and Trout Stocked Fisheries. Data collected by Clauser Environmental, LLC indicates that the benthic macroinvertebrate population was impaired at three of the ten Sample Sites (Table 2).

Table 2
Pocopson Creek and Browning Barn Tributary
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	18	1.64	7.94	3.8	28.4
Site 2	4	5	20	2.19	5.27	9.9	40.7
Site 3	12	13	31	2.73	4.42	34.1	66.4
Site 4	8	9	25	2.72	4.29	30.2	57.6
Site 5	10	8	24	2.71	5.02	17.7	53.1
Site 6	15	9	31	2.61	4.63	28.3	61.9
Site 7	8	8	27	2.39	4.28	27.6	55.3
Site 8	9	13	23	1.84	2.79	81.2	68.5
Site 9	8	16	31	2.6	3.32	56.9	73.32
Site 10	6	11	27	2.22	3.23	31.28	58.91

Throughout the watershed, macroinvertebrate populations were diverse with notable differences between impaired and unimpaired stream sections. At impaired Sample Site 1, segmented worms (Oligochaeta) composed more than 45% of the sample, and at Sample Site 2, midges (Chironomidae) were the most collected family. Midge and worm species are often dominant in habitats that are impaired by sediment and high nutrient concentrations. Although the IBI score of Sample Site 5 was higher than the threshold for attainment, the site is still considered impaired. This is because the sample met the condition for impairment that the Beck's Index standardized score is <33.3 with the Percent Sensitive Individuals score <25.0. The macroinvertebrate populations improved in both diversity and sensitivity of individuals towards the bottom of the watershed and were the best along the mainstem Pocopson Creek at sites 8 and 9 (Table 2).

4.3 Habitat Analysis Results

The habitat analysis data for Pocopson Creek and Browning Barn Tributary Watersheds indicates that all 10 Sample Sites are "Blue" (un-impaired) for total habitat score (Table 3 and Appendices G and H). 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 allow for the discretion of the field investigator (PA DEP 2023).

According to the PA DEP protocol, all sites are considered "sub-optimal" for total habitat score (PA DEP, 2023). Sample Sites 2, 3, 4, 5, 7, and 9 were impaired for both riffle/run habitat and condition of banks and vegetation. Sample Sites 1 and 8 were impaired for riffle/run habitat only. Sample Site 10 was impaired for condition of banks only. Sample Site 6 was unimpaired for total habitat score, riffle/run habitat, and condition of banks.

Table 3
Pocopson Creek and Browning Barn Tributary
Impairment Determination Values

Site	Macroinvertebrate IBI Value	Total Habitat Value	Riffle/Run Habitat	Condition of Banks
1	28.4	156	15	28
2	40.7	162	19	22
3	66.4	168	21	21
4	57.6	163	18	23
5	53.1	180	22	22
6	61.9	180	25	29
7	55.3	162	17	16
8	68.5	184	24	35
9	73.32	141	18	11
10	58.91	188	31	24

Macroinvertebrate and habitat impairment as based upon the PA DEP Wadeable Riffle-Run Stream Macroinvertebrate Assessment Method (PA DEP, 2023). Blue values indicate unimpaired; red values indicate impaired.

4.4 Water Quality Analysis Results

On December 17, 2024, water temperatures throughout the Pocopson Creek and Browning Barn Tributary Watersheds ranged from 6.0 to 8.8 ^{o}C (Table 4). Dissolved oxygen (DO) levels ranged from 10.78 to 13.01 mg/L and were near saturation values for all of the sample sites (Table 4). At sample sites 1, 8, and 9 dissolved oxygen was supersaturated within the water column, likely due to increasing daytime temperatures. Throughout the watershed, pH values were near neutral and slightly alkaline or acidic. The values ranged from 6.45 to 7.51 (Table 4). Conductivity ranged from 183.4-316.4 umhos throughout the watershed. Total Alkalinity, to pH 4.5, ranged from 41 to 69 mg CaCO3/L.

Table 4
Pocopson Creek and Browning Barn Tributary
December 17, 2024 Water Quality Sampling Data

Site	Temp	DO	DO	pH	Specific Cond.	Alkalinity
	(°C)	(mg/L)	(% sat.)		(umhos)	mg CaCO3/L
1	8.8	12.26	105.1	7.19	274.3	45
2	7.1	11.01	90.8	6.79	267.2	65
3	7.7	10.78	90.3	7	203.8	41
4	7.3	10.93	90.6	6.79	257.8	50
5	8	10.81	91.3	6.72	316.4	47
6	8.6	11.12	95.1	7.22	294.5	69
7	7.6	11.42	95.4	6.89	298.8	56
8	8.3	12.7	107.6	7.51	277.4	51
9	8.5	13.01	111.1	7.4	274	56
10	6	11.8	94.8	6.45	183.4	43

On the second sampling day, January 29, 2025, the water temperatures throughout the watersheds ranged from 0.1 to 2.9 °C (Table 5). The pH values throughout the watershed were near neutral. Dissolved oxygen (DO) levels ranged from 13.15 to 15.30 mg/L. Total Alkalinity, to pH 4.5, ranged from 35 to 73 mg CaCO3/L.). Conductivity ranged from 133.27-389.78 umhos throughout the watersheds.

Table 5
Pocopson Creek and Browning Barn Tributary
January 29, 2025 Water Quality Sampling Data

Site	Temp	DO	DO	pH	Specific Cond.	Alkalinity
	(°C)	(mg/L)	(% sat.)		(umhos)	mg CaCO3/L
1	0.4	13.15	90.9	6.64	339.76	49
2	1.2	14.25	98.6	6.78	320.04	73
3	0.2	14.25	97.9	6.8	299.6	35
4	0.5	14.65	101.7	7.07	307.65	55
5	2.9	13.49	99.9	6.93	389.78	49
6	1.7	14.11	101.1	7.08	365.73	73
7	1	14.09	99	7.05	376.92	59
8	0.3	15.03	103.2	7.16	336.36	52
9	0.5	15.30	105.6	7.25	330.78	52
10	0.1	14.39	98.7	6.39	133.27	45

The data for sites 8 and 9 is in alignment with data from USGS sampling completed near Sample Site 8 in 1998 and 1999. For seven samplings completed during this two-year period, average DO concentration was 9.8 mg/L (8.1-12.1), average pH was 7.4 (6.8-8.1), and average specific conductance was 206 µS/cm (108-244) (USGS, 1999). The DO data for the 2024/2025 sampling was significantly higher than the 1998/1999 data, likely due in part to lower day time temperatures as the USGS samplings occurred in April through October while the present sampling was conducted in December and January. In November of 2016, the USGS Chester County Water Quality Monitoring Network did a one day sampling of Pocopson Creek near Sample Site 9 (USGS, 2016). For this sampling, the pH was 8.9, DO was 15.5 mg/L, and specific conductance was 319 µS/cm. These results are in alignment with the data from sites 8 and 9 in the present sampling. The limited available data does not show a significant change in these water quality parameters from one sampling event to the next.

Total kjehldahl nitrogen (TKN) was less than 0.50 mg/L at all 10 sample sites on January 29, 2025. TKN measures ammonia and organic forms of nitrogen. Nitrite levels were less than 0.10 mg/L across all sample sites throughout the study (Tables 6 and 7). Concentrations of nitrate values ranging from <1.00 to 3.98 mg/L were measured throughout the watershed in both the December and January samplings. Total nitrogen concentrations for January ranged from <1.84 to <4.58 mg/L (Table 7). During the January sampling, the calculated total nitrogen concentrations exceeded the threshold 0f 2.01 – 2.30 mg/L for impaired streams at all sample sites except for Sample Site 6 (Clune et al., 2020; Sheeder and Evans, 2004).

Total phosphorus levels within the Pocopson Creek and Browning Barn Tributary Watershed ranged from <0.01 mg/L to 0.09 mg/L (Tables 6 and 7). Studies of nutrient thresholds for impairment in the watersheds of Pennsylvania have found that impaired streams typically exceed a total phosphorus concentration of 0.035 - 0.07 mg/L (Clune et al., 2020; Sheeder and Evans, 2004). The upper limit of this range is exceeded at Sites 2, 4, and 8 in the December sampling only. Total phosphorus concentration did not exceed the threshold at the remaining sample sites during the December sampling, and none of the sample sites during the January sampling (Tables 6 and 7).

Table 6
Pocopson Creek and Browning Barn Tributary
December 17, 2024 Nutrient Sampling Data

	Nitrite (mg/L)	Nitrate (mg/L)	Total Phosphorus (PO4) (mg/L)
1	<0.10	**2.54**	**0.02**
2	<0.10	**2.71**	**0.08**
3	<0.10	**2.82**	**0.02**
4	<0.10	**2.68**	**0.04**
5	<0.10	**2.47**	**<0.01**
6	<0.10	**<1.00**	**0.01**
7	<0.10	**1.92**	**0.01**
8	<0.10	**2.39**	**0.09**
9	<0.10	**2.4**	**0.03**
10	<0.10	**1.49**	**0.02**

Table 7
Pocopson Creek and Browning Barn Tributary
January 29, 2025 Nutrient Sampling Data

Site	TKN (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (PO4) (mg/L)
1	**<0.5**	<0.10	**3.83**	**<4.43**	**0.02**
2	**<0.5**	<0.10	**3.9**	**<4.50**	**0.03**
3	**<0.5**	<0.10	**3.98**	**<4.58**	**0.02**
4	**<0.5**	<0.10	**3.77**	**<4.37**	**<0.01**
5	**<0.5**	<0.10	**3.73**	**<4.33**	**<0.01**
6	**<0.5**	<0.10	**1.24**	**<1.84**	**0.01**
7	**<0.5**	<0.10	**2.94**	**<3.54**	**<0.01**
8	**<0.5**	<0.10	**3.36**	**<3.96**	**<0.01**
9	**<0.5**	<0.10	**3.34**	**<3.94**	**<0.01**
10	**<0.5**	<0.10	**2.03**	**<2.63**	**<0.01**

It is important to note that frozen conditions existing within the watersheds during the sampling time period and additional data would be required from other seasons and runoff conditions before making a determination on the overall nutrient pollution impacts within the watersheds. The USGS Chester County Water Quality Monitoring Network found that a sampling point near Site 9 had a nitrate concentration of 2.81 mg/L, and nitrite concentration of 0.004 mg/L (USGS, 2019).

5.0 DISCUSSION

Nine of the ten sites assessed in the Pocopson Creek and Browning Barn Tributary Watersheds were impaired for either macroinvertebrate life, habitat, or both (Appendix I). The dominant impairments throughout the watershed stem from sediment and nutrient impacts exacerbated by increased stormwater discharges from development. Throughout the watershed, invasive species, degraded riparian buffers, and livestock access to the stream further impair the health of the watershed's riparian ecosystems.

Sample Site 1

Sub-Watershed A is at the top of the Pocopson Creek Watershed and includes the first unnamed tributary (UNT) to Pocopson Creek. The UNT flows through residential developments before being picked up by Pocopson Creek. Sub-Watershed A is the least forested sub-watershed, being only 28.43% forested. The water quality of the first UNT to Pocopson Creek was assessed at Sample Site 1. Sample Site 1 was impacted by sedimentation and has the lowest IBI value of 28.4, indicating it had the most impaired macroinvertebrate community in the watershed. During 2024, there was a significant drought within the watershed that may have reduced flow levels within the stream to a point where it may have potentially impacted the macroinvertebrate community at Sample Site 1. Nitrogen concentrations exceeded impairment thresholds, but phosphorus levels were within the range for unimpaired streams. The high nitrogen and sedimentation impairments are likely the result of increased stormwater from development in the watershed depositing legacy sediment from historic agricultural operations into the stream. A review of historic aerial photographs shows a significant increase in housing developments in the last 50 years (Appendix B). Increased stormwater runoff from housing developments surrounding the tributary coupled with nutrient and pesticide discharges from lawn care are exacerbating preexisting agricultural impacts to the upstream watershed. Appropriate best management practices for water quality improvement in this sub-watershed should focus on stormwater quality and volume management controls, wetland creation, and stabilizing streambanks. Additionally, the application of lawn fertilizers and chemicals should be managed to reduce future impacts on water quality.

Sub-Watershed B captures the stretch of Pocopson Creek from its origin to its confluence with an UNT south of Marlborough Road. This sub-watershed is dominated by agricultural operations, leaving only 0.3% of its area to urban development, and 32.96% forested. The water quality of Sub-Watershed C is captured at Sample Site 2. Despite an unimpaired total habitat score, habitat is impaired due to impaired riffle/run habitats and the condition of streambanks. Total phosphorus and nitrogen concentrations for Sample Site 2 exceed the thresholds for impairment. The sedimentation observed during the habitat assessment (Appendix G) and the high nutrient concentrations (Tables 6 and 7) are primarily the result of legacy sediments with nutrients bound to them being eroded into the stream channel. The macroinvertebrate community is impaired with an IBI value of 40.7. Poor instream cover, sediment loading, and increased nutrients likely all contribute to the macroinvertebrate community impairment. Upstream of Sample Site 2, long sections of Pocopson Creek flow through agricultural areas with little or no riparian buffer where the streambanks are eroding sediment into the stream (Appendix A). These areas hold substantial potential to restore the floodplain and create wetlands to aid in filtering nutrients, sediment, and other pollutants from upstream. Riparian buffer plantings, streambank stabilization, floodplain reconnection, and wetland creation should be considered to aid in restoring this sub-watershed.

Sample Site 2

Sub-Watershed C captures an UNT that discharges into Pocopson Creek just south of the Marlborough Road and Red Lion Road intersection. This sub-watershed is approximately 0.04% developed area and 42.68% forested area. The water quality of the UNT and Sub-Watershed C is captured by Sample Site 3. This sample site has an unimpaired macroinvertebrate community, with an IBI score of 66.4. Sample Site 3 is unimpaired for total habitat score, but impaired for both riffle/run habitat and condition of banks. These impaired scores are due to ongoing erosion and sedimentation. Sample Point 3 has the highest concentrations of nitrogen in this study, but phosphorus

concentrations are below the established thresholds for impairment. The UNT primarily runs through forested areas and open meadows. A review of the historic aerial photography indicates that the entire sub-watershed was primarily agricultural fields through at least 1971 (Appendix B). The legacy impacts of agriculture in this area, coupled with the stormwater from upslope development, is likely the main cause of impairment. Within this sub-watershed, appropriate best management practices for water quality improvement should focus on habitat improvements, streambank stabilization, and stormwater quality and volume management controls.

Sample Site 3

Sub-Watershed D stretches from Pocopson Creek's confluence with an UNT south of Marlborough Road and Red Lion Road to just above where Pocopson Creek joins its largest UNT. Sub-Watershed D has a similar profile to other sub-watersheds, with only 0.5% urban development and 44.40% forested area. The water quality of this section of Pocopson Creek and Sub-watershed D is captured by Sample Site 4. The water quality in this sub-watershed is impaired for nutrients with both measured nitrogen concentrations and one measured phosphorus concentration surpassing the threshold for impairment. This stream section is unimpaired for macroinvertebrate IBI (57.6) and for total habitat. However, the riffle/run and bank condition scores were impaired, making the site impaired for habitat. Long stretches of Pocopson Creek within Sub-Watershed D are mowed to the edge of the stream, leaving the streambanks exposed and vulnerable to erosion. Sediment deposition within the channel from the eroding streambanks within Sub-Watershed D is likely impacting the macroinvertebrate community, as the IBI score is unimpaired but still suboptimal (Appendix

Sample Site 4

G). Riparian buffer plantings, stormwater retrofits to decrease discharges to the stream, streambank stabilization, floodplain reconnection, and wetland creation should be considered to restore this sub-watershed. There is significant potential for restoration work in this watershed because the stream runs through fields and mowed areas that offer ample space for work to be completed.

Sub-Watershed E includes the area that drains to the longest UNT to Pocopson Creek, which flows from the south and originates on Longwood Gardens property. This sub-watershed consists of residential subdivisions and agricultural areas that are not immediately adjacent to the mainstem. Sub-Watershed E is 47.19% forested and 4.93% urban development. The water quality of Sub-Watershed E is captured by Sample Sites 5, 6, and 7. Sample Site 5 is the only sample site in this study with an IBI score (53.1) above the attainment threshold to still be considered impaired for macroinvertebrates. This is because the sample meets the criteria for impairment where the Beck's Index standardized score is <33.3 and the percent sensitive individuals score <25.0. Sample Site 5 was unimpaired for total habitat but had impaired scores of 22 for both the condition of banks and riffle/run habitat. Upstream of Sample Site 5, the tributary runs through residential areas, and sections of wetlands and forests. This site is unimpaired for phosphorus but has nitrogen concentrations that surpass the thresholds for impairment. Sample Site 6 was the only sample site to be unimpaired across all metrics. Sample Site 6 has an IBI score of 61.9 and unimpaired habitat scores. Most of the UNT upstream of Site 6 has a forested buffer on both sides of the stream. This buffer helps to capture pollutants from surrounding residences and agricultural fields and strengthens the banks, preventing erosion. Site 6 has noticeably more small litter than the other sample sites, due to its proximity to the busy Lenape Road (Route 52). Sample Site 7 is located just upstream of where the UNT discharges into Pocopson Creek. Sample Site 7 has an unimpaired macroinvertebrate community with an IBI score of 55.3. The total habitat score for Sample Site 7 is unimpaired (162), but it has the lowest riffle run score (17) and second lowest condition of banks score (16). These habitat scores are low due to erosion and sedimentation within the stream channel (Sample Site 7 photo). Site 7 is unimpaired for phosphorus but is impaired for nitrogen. A significant portion of the UNT to Pocopson Creek runs through areas with minimal riparian vegetation. The impacts of sediment deposition, erosion, and elevated nutrient

Sample Site 7

concentrations throughout the sub-watershed are likely due to increased stormwater flows from recent development. Based on a review of historical and current aerial imagery, much of the watershed has been converted from agricultural to residential uses in the last 50 years (Appendices A and B). Targeted best management practices for this sub-watershed include litter cleanups, riparian buffer plantings, streambank stabilization and floodplain reconnection. Where possible, floodplain wetlands should be created to aid in absorbing flooding flows and address sedimentation and erosion concerns.

Sub-Watershed F captures Pocopson Creek and its tributaries from just downstream of where it picks up the largest UNT to where Pocopson Creek meets its confluence with Brandywine Creek. As the Sub-Watershed at the bottom of the overall watershed, Sub-Watershed F is impacted by the water quality of Sub-Watersheds A-E. Sub-Watershed F is significantly more developed than all of the other sub-watersheds, with 15.36% urban development. Despite this, it is still a relatively well-forested area with 42.10% forest. Sample Sites 8 and 9, both located on Pocopson Creek, capture watershed F. These sites have the healthiest macroinvertebrate communities of the entire watershed, with IBI scores of 68.50 and 73.32 respectively. Sample Site 8 has one of the highest total habitat scores, however, the riffle/run habitat is impaired due to sediment deposition (Appendix G). Sample Site 8 has the highest condition of banks score of all the sites, and erosion is not a significant concern at this site. Sample Site 8 is impaired for nutrients, with both phosphorus and nitrogen concentrations exceeding impairment thresholds. Sample Site 9, which captures the downstream end of the Pocopson Creek Watershed,

Sample Site 8

Sample Site 9

was impaired for nitrogen, but not phosphorus. Despite an unimpaired total habitat score, Sample Site 9 had low scores for both riffle/run habitat (18) and the condition of banks (11), making it impaired for habitat. In the last 50 years, Sub-Watershed F has undergone the most dramatic shift from agricultural area to residential area of the entire watershed. The low habitat scores of Sample Sites 8 and 9 are due to sediment deposition likely exacerbated by stormwater from developed areas. The legacy impacts of agriculture in this area, when coupled with the stormwater from upslope development is likely the main cause of impairment in this area. Best management practices for water quality and habitat improvement within this sub-watershed should focus on restoring floodplains, nutrient discharge reduction, stabilizing streambanks, and stormwater quality and volume management.

The Browning Barn Tributary Watershed, identified as **Sub-Watershed G** in this study, is approximately 53.49% forested and only 0.06% urban. This watershed is less developed than the Pocopson Creek Watershed. Sample Site 10 is located near the mouth of the Browing Barn Tributary and is unimpaired for macroinvertebrate life, total habitat, and riffle/run habitat, but impaired for condition of banks (Table 3). The sample site is impaired for nitrogen concentrations, but not phosphorus concentrations. Approximately half of the total length of the tributary is located on property owned and managed by BRC. A review of the historic aerial photography indicates that between 1937 and 1971 this and neighboring parcels were in active agriculture (Appendix B). In 1981, when BRC took possession of the parcel as part of the Myrick Conservation Center, the organization prioritized restoration work on the property. BRC planted trees within the riparian zone of the stream, constructed a bioswale to minimize erosion into the stream, and converted the remaining agricultural fields to no-till contour farming. These efforts, paired with the expanding forested area within the riparian zone have likely helped stabilize streambanks and improve habitat for macroinvertebrates and other life throughout the stream. Legacy sediment is likely a major factor in stream bank impairment and conditions within the stream channel are likely still improving. Although meeting attainment thresholds for multiple criteria, the habitat and diversity of the stream bank could still be improved. Installing additional riparian buffer enhancements where opportunities exist and streambank stabilization could directly relate to improved water quality within this sub-watershed.

Sample Site 10

BRC's Bioswale During a Storm Event

Improving the water quality and habitat within the Pocopson Creek and Browning Barn Tributary Watersheds should lead to biological improvements within the stream community. The primary focus of restoration within the watersheds should be on addressing the current and legacy impacts of agriculture as well as increasing stormwater concerns from suburban sprawl. To make substantial improvements within the watershed, best management practices such as floodplain restoration, wetland creation, streambank stabilization, stormwater management retrofits, litter cleanups, native riparian buffer installations, and invasive species removals should be considered.

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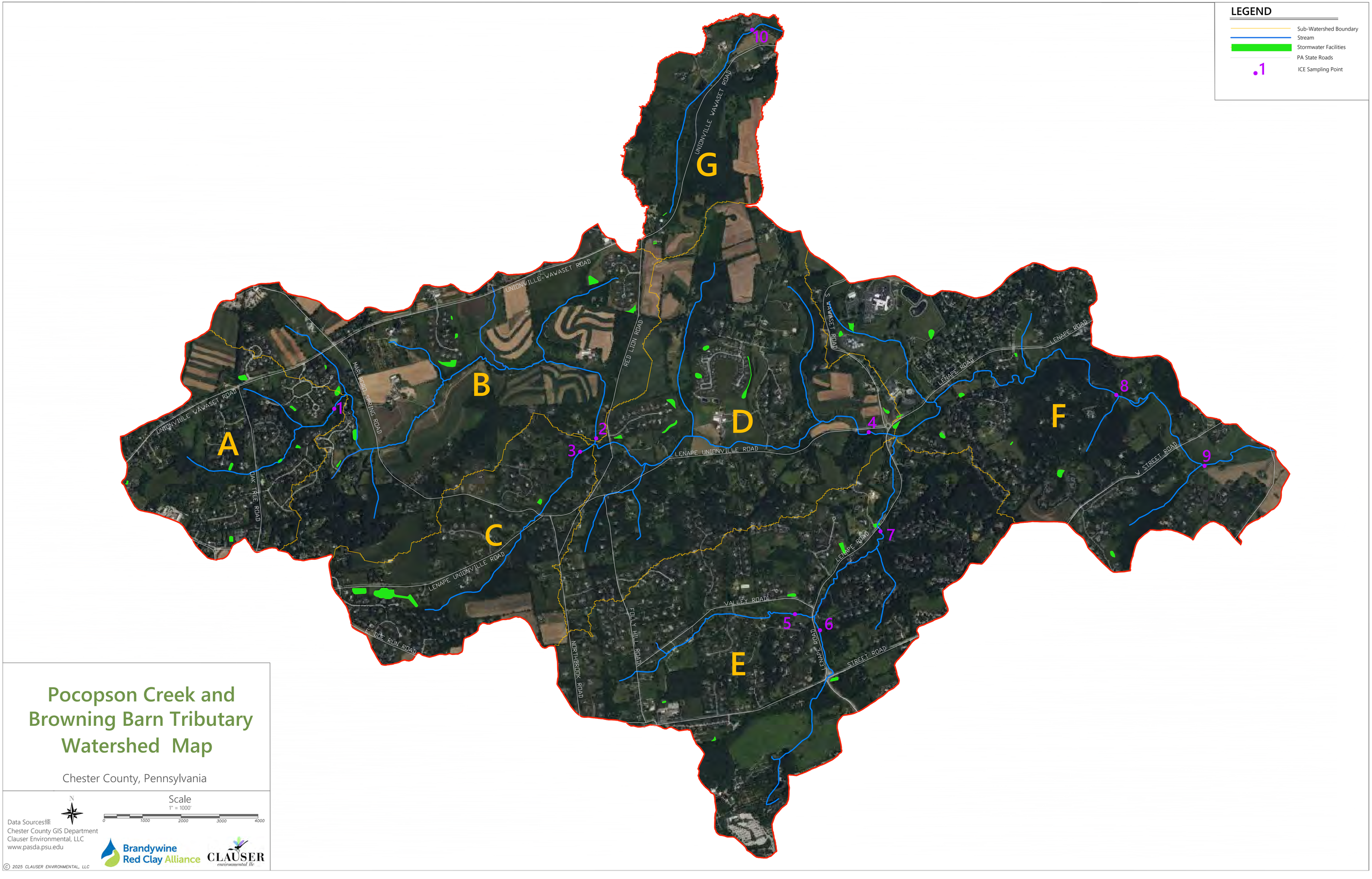
APPENDIX A
WATERSHED ASSESSMENT MAP



Pocopson Creek and Browning Barn Tributary Watershed Map

Chester County, Pennsylvania

N

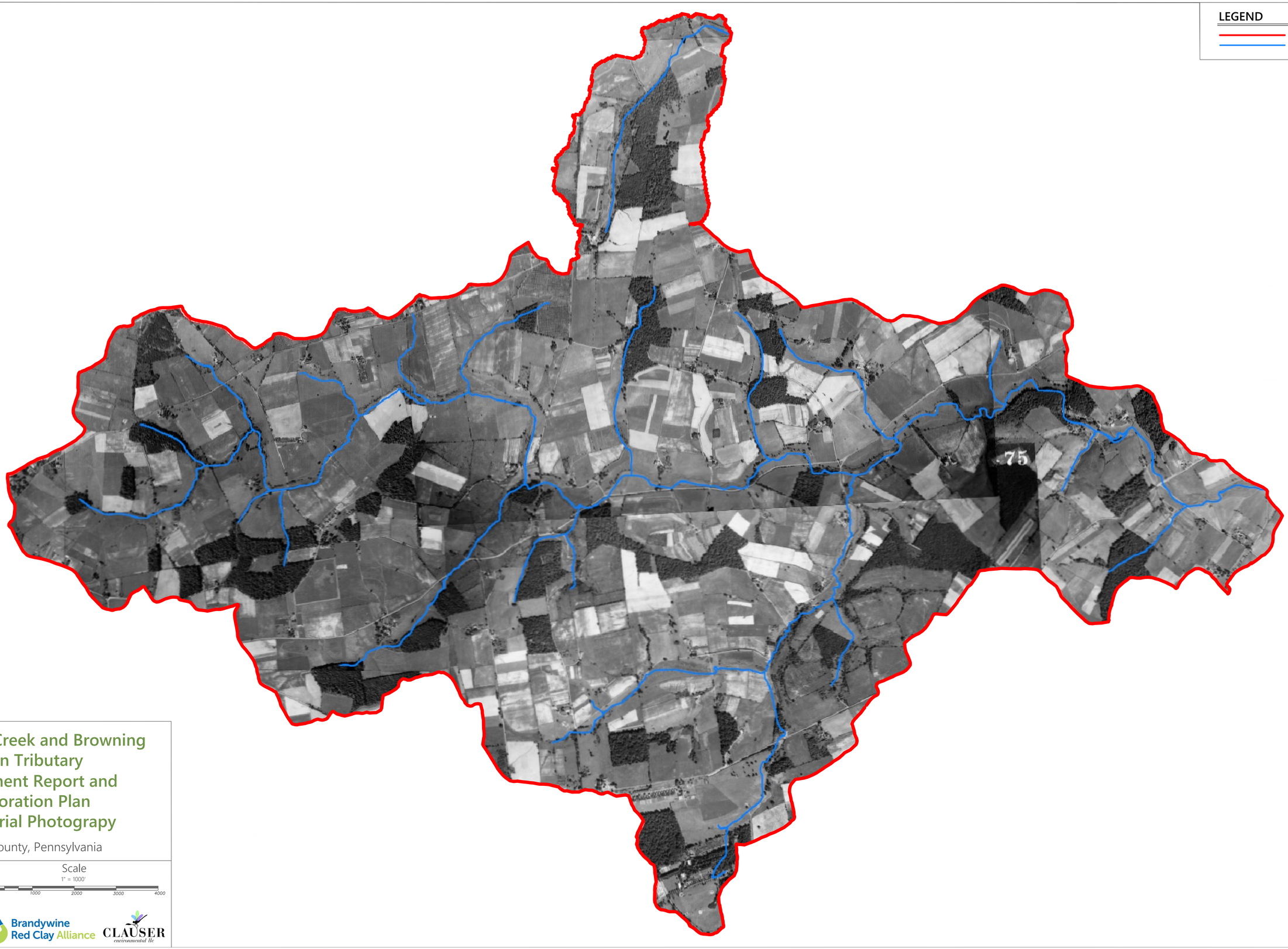
Scale
1" = 1000'
0 1000 2000 3000 4000

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

Brandywine Red Clay Alliance

CLAUSER environmental llc

APPENDIX B
HISTORIC AERIAL PHOTOGRAPHY MAPS



Pocopson Creek and Browning Barn Tributary Assessment Report and Restoration Plan 1937 Aerial Photograpy

Chester County, Pennsylvania

Data Sources:
USDA Agricultural Adjustment Administration
Chester County GIS Department
Clauser Environmental, LLC
Penn Pilot
www.pasda.psu.edu

Scale
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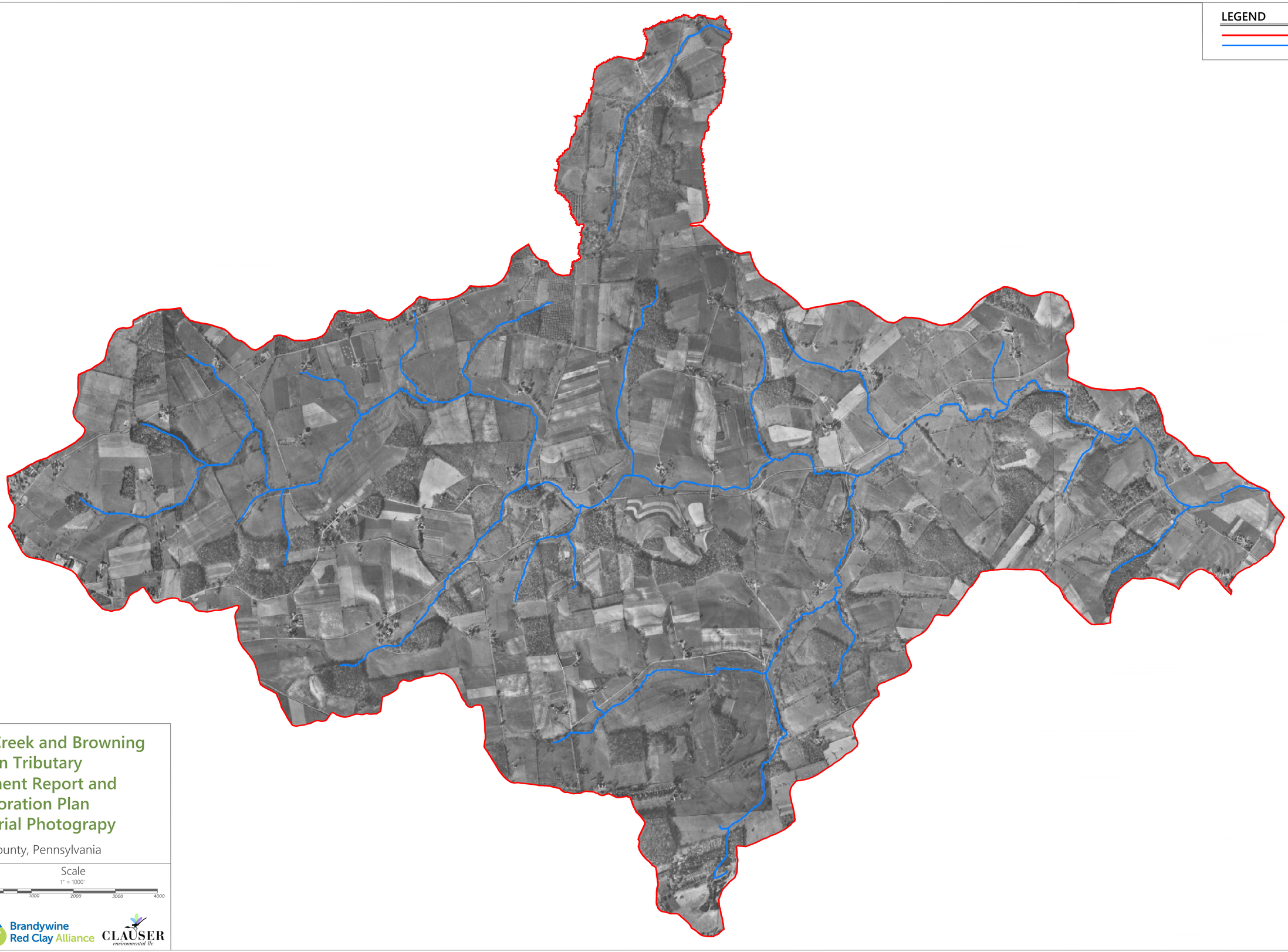
N

Brandywine Red Clay Alliance

CLAUSER environmental llc



Pocopson Creek and Browning Barn Tributary Assessment Report and Restoration Plan 1946 Aerial Photograpy

Chester County, Pennsylvania

Data Sources:
USDA Agricultural Adjustment Administration
Chester County GIS Department
Clauser Environmental, LLC
Penn Pilot
www.pasda.psu.edu

Scale
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N

Brandywine Red Clay Alliance

CLAUSER environmental llc

Pocopson Creek and Browning Barn Tributary Assessment Report and Restoration Plan
1958 Aerial Photograpy

Chester County, Pennsylvania

Data Sources:
USDA Agricultural Adjustment Administration
Chester County GIS Department
Clauser Environmental, LLC
Penn Pilot
www.pasda.psu.edu

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N

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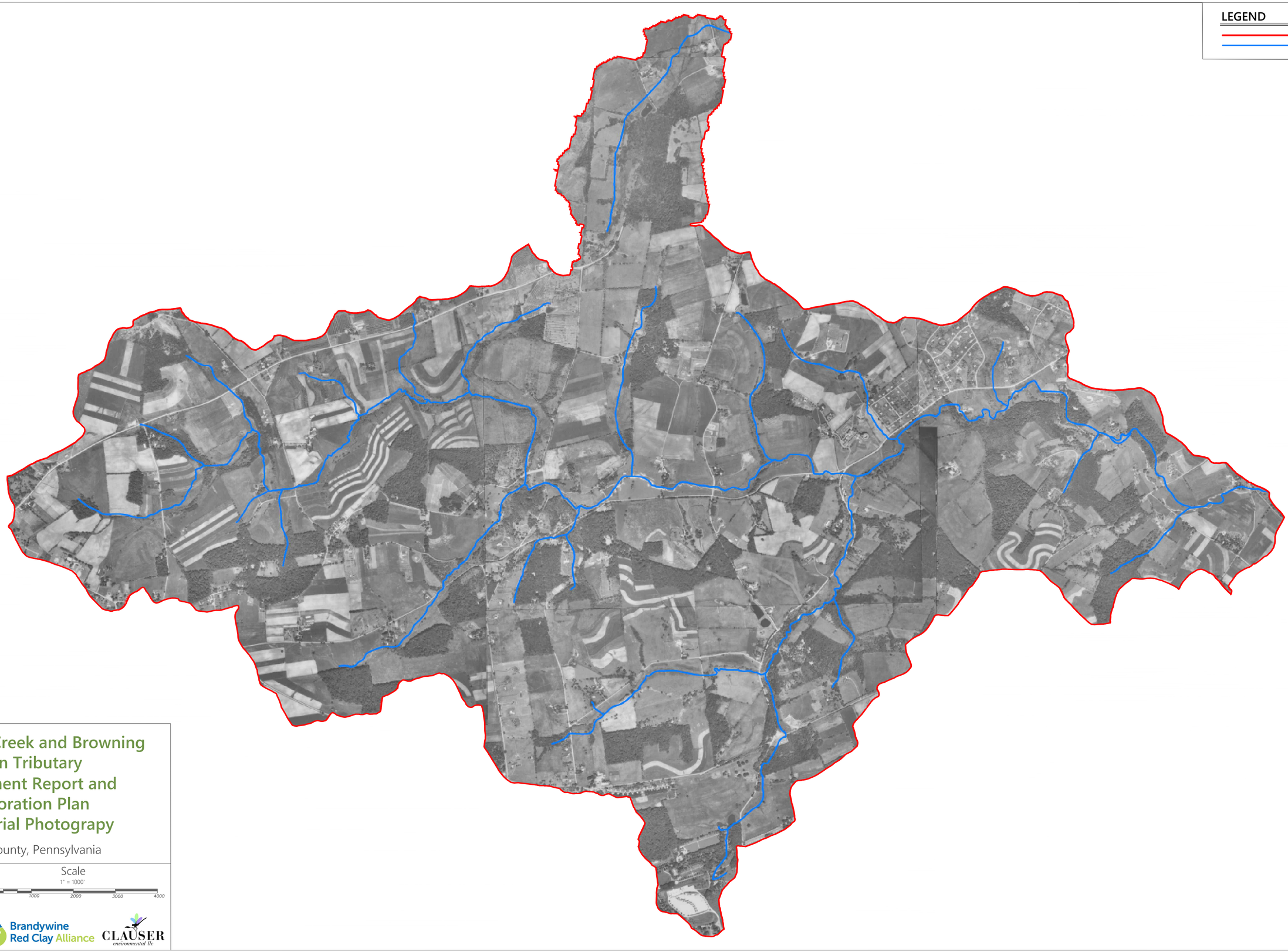

Pocopson Creek and Browning Barn Tributary Assessment Report and Restoration Plan 1971 Aerial Photograpy

Chester County, Pennsylvania

Data Sources:
USDA Agricultural Adjustment Administration
Chester County GIS Department
Clauser Environmental, LLC
Penn Pilot
www.pasda.psu.edu

Scale
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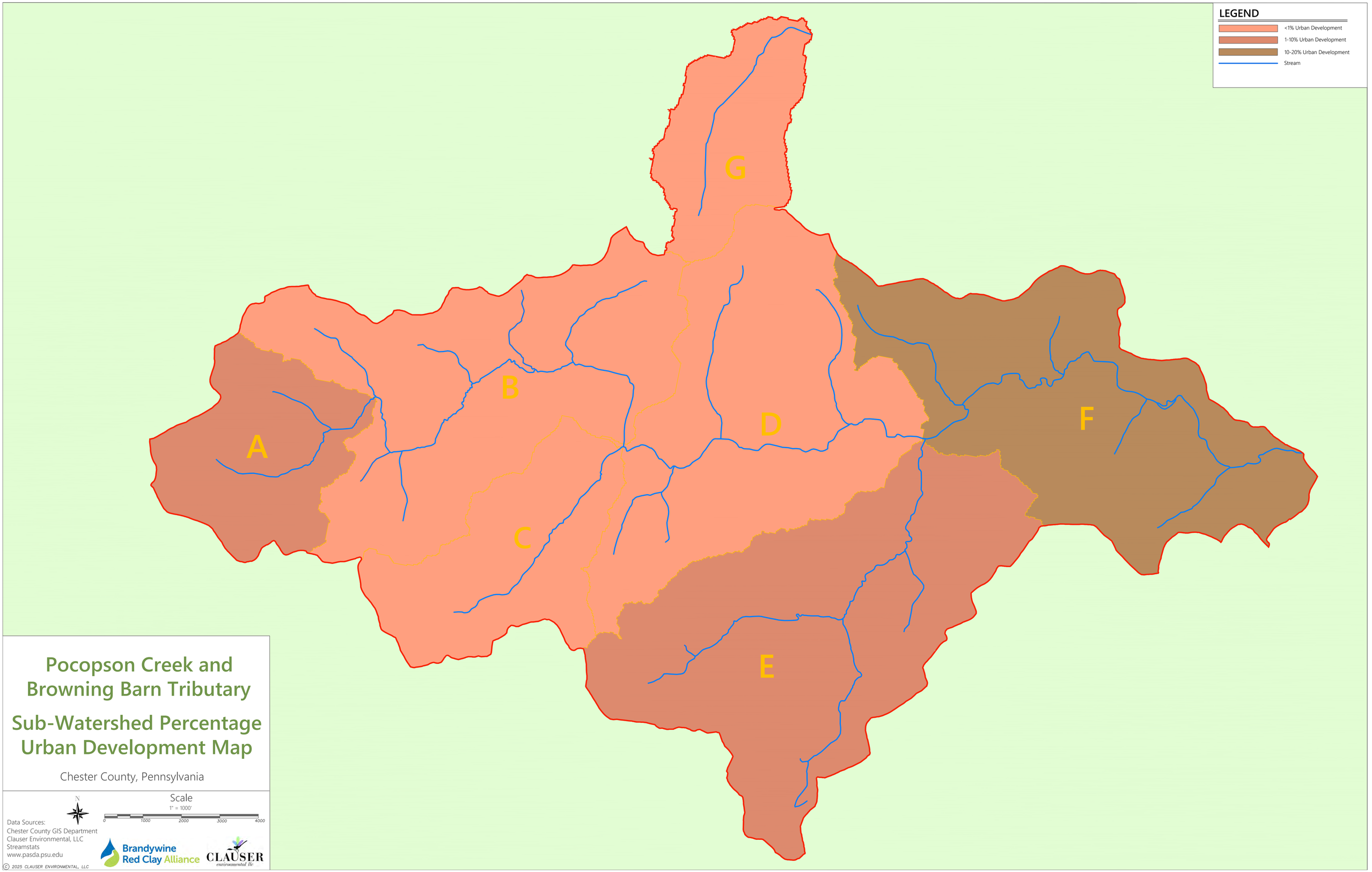
N

Brandywine Red Clay Alliance

CLAUSER environmental llc

APPENDIX C
SUB-WATERSHED PERCENTAGE URBAN DEVELOPMENT MAP



Pocopson Creek and Browning Barn Tributary

Sub-Watershed Percentage Urban Development Map

Chester County, Pennsylvania

N

Scale
1" = 1000'
0 1000 2000 3000 4000

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

Brandywine Red Clay Alliance

CLAUSER environmental llc

APPENDIX D
SUB-WATERSHED PERCENTAGE FORESTED MAP

LEGEND

- 20-30% Forested
- 30-40% Forested
- 40-50% Forested
- >50% Forested
- Stream

G

B

D

F

A

C

E

Pocopson Creek and Browning Barn Tributary

Sub-Watershed Percentage Forested Map

Chester County, Pennsylvania

N

Scale

1" = 1000'

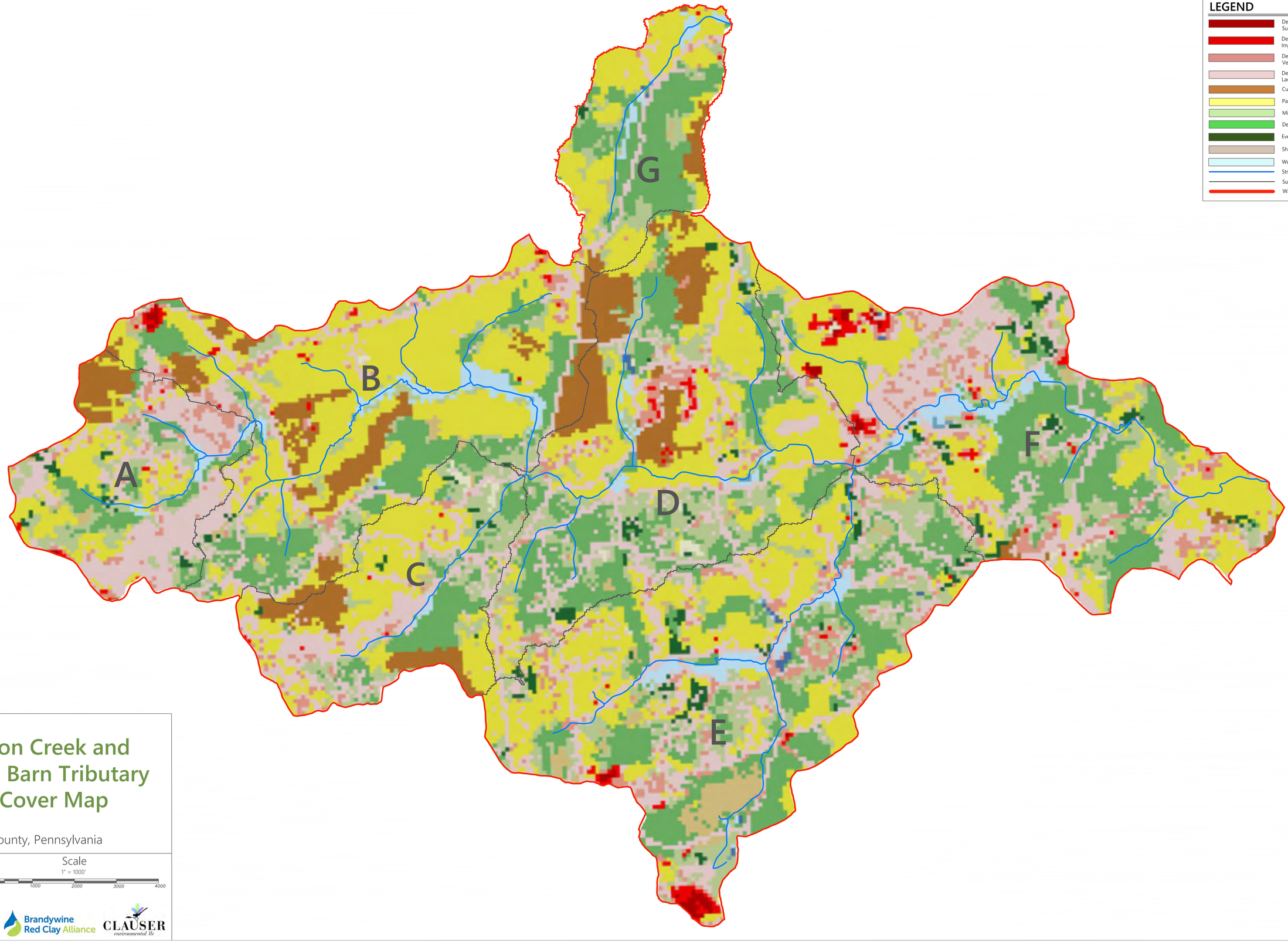
0 1000 2000 3000 4000

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

Brandywine Red Clay Alliance

CLAUSER environmental llc

APPENDIX E
LAND COVER MAP



LEGEND

- Developed High Intensity (Impervious Surfaces)
- Developed Medium Intensity (Mostly Impervious Surfaces)
- Developed Low Intensity (Mix of Vegetation and Impervious Surfaces)
- Developed Open Space (Meadows, Lawns, etc.)
- Cultivated Crops
- Pasture/Hay
- Mixed Forest
- Deciduous Forest
- Evergreen Forest
- Shrub/Scrub
- Woody Wetlands
- Stream
- Sub-Watershed Boundary
- Watershed Study Area Boundary

Pocopson Creek and Browning Barn Tributary Land Cover Map

Chester County, Pennsylvania

N

Scale
1" = 1000'
0 1000 2000 3000 4000

Data Sources:
Chester County GIS Department
Clauser Environmental, LLC
www.pasda.psu.edu
National Land Cover Database (2019)
Model My Watershed

Brandywine Red Clay Alliance

CLAUSER environmental llc

APPENDIX F
MACROINVERTEBRATE TAXA LIST

Pocopson Creek and Browning Barn Tributary Overall Macroinvertebrate Taxa List

Class/Order/Suborder	Family	Genus
Acari	Hydracarina	
Amphipoda	Gammaridae	*Gammarus* sp.
Amphipoda	Hyalellidae	*Hyalella* sp.
Bivalvia		
Coleoptera	Dytiscidae	*Hydroporus* sp.
Coleoptera	Elmidae	*Dubiraphia* sp.
Coleoptera	Elmidae	*Macronychus* sp.
Coleoptera	Elmidae	*Microcylloepus* sp.
Coleoptera	Elmidae	*Optioservus* sp.
Coleoptera	Elmidae	*Oulimnius* sp.
Coleoptera	Elmidae	*Promoresia* sp.
Coleoptera	Elmidae	*Stenelmis* sp.
Coleoptera	Psephenidae	*Psephenus* sp.
Coleoptera	Ptilodactylidae	*Anchytarsus* sp.
Collembolla		
Diptera	Ceratopogonidae	*Atrichopogon* sp.
Diptera	Ceratopogonidae	*Stilobezzia* sp.
Diptera	Chironomidae	
Diptera	Empididae	*Hemerodromia* sp.
Diptera	Simuliidae	*Cnephia* sp.
Diptera	Simuliidae	*Prosimulium* sp.
Diptera	Simuliidae	*Stegopterna* sp.
Diptera	Tipulidae	*Antocha* sp.
Diptera	Tipulidae	*Dicranota* sp.
Diptera	Tipulidae	*Tipula* sp.
Ephemeroptera	Baetidae	*Baetis* sp.
Ephemeroptera	Baetidae	*Diphetor* sp.
Ephemeroptera	Ephemerellidae	*Drunella* sp.
Ephemeroptera	Ephemerellidae	*Ephemerella* sp.
Ephemeroptera	Ephemerellidae	*Eurylophella* sp.
Ephemeroptera	Ephemerellidae	*Serratella* sp.
Ephemeroptera	Ephemerellidae	*Timpanoga* sp.
Ephemeroptera	Heptageniidae	*Stenacron* sp.
Ephemeroptera	Heptageniidae	*Stenonema* sp.
Ephemeroptera	Oligoneruiidae	*Isonychia* sp.
Ephemeroptera	Tricorythidae	*Tricorythodes* sp.
Gastropoda	Lymnaeidae	
Gastropoda	Physidae	
Hemiptera	Hebridae	*Hebrus* sp.

Isopoda		
Nematoda		
Odonata	Calopterygidae	*Calopteryx* sp.
Odonata	Coenagrionidae	*Nehalennia* sp.
Oligochaeta		
Plecoptera	Capniidae	*Allocapnia* sp.
Plecoptera	Leuctridae	*Paraleuctra* sp.
Plecoptera	Nemouridae	*Nemoura* sp.
Plecoptera	Nemouridae	*Ostrocerca* sp.
Plecoptera	Nemouridae	*Paranemoura* sp.
Plecoptera	Nemouridae	*Podmosta* sp.
Plecoptera	Nemouridae	*Prostoia* sp.
Plecoptera	Nemouridae	*Shipsa* sp.
Plecoptera	Nemouridae	*Zapada* sp.
Plecoptera	Perlidae	*Beloneuria* sp.
Plecoptera	Perlidae	*Eccoptura* sp.
Plecoptera	Perlidae	*Eccoputra* sp.
Plecoptera	Perlidae	*Perlesta* sp.
Plecoptera	Taeniopterygidae	*Taenionema* sp.
Plecoptera	Taeniopterygidae	*Taeniopteryx* sp.
Trichoptera	Brachycentridae	*Brachycentrus* sp.
Trichoptera	Glossosomatidae	*Glossosoma* sp.
Trichoptera	Helicopsychidae	*Helicopsyche* sp.
Trichoptera	Hydropsychidae	*Ceratopsyche* sp.
Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.
Trichoptera	Hydropsychidae	*Hydropsyche* sp.
Trichoptera	Lepidostomatidae	*Lepidostoma* sp.
Trichoptera	Leptoceridae	*Nectopsyche* sp.
Trichoptera	Limnephilidae	*Madeophylax* sp.
Trichoptera	Philopotamidae	*Chimarra* sp.
Trichoptera	Philopotamidae	*Wormaldia* sp.
Trichoptera	Polycentropodidae	*Cernotina* sp.
Trichoptera	Polycentropodidae	*Polycentropus* sp.
Trichoptera	Psychomyiidae	*Lype* sp.
Trichoptera	Rhyacophilidae	*Rhyacophila* sp.
Trichoptera	Uenoidae	*Neophylax* sp.
Turbellaria		

Site	Class/Order/Suborder	Family	Genus	Quantity
1	Acari	Hydracarina		3
	Bivalvia			9
	Coleoptera	Dytiscidae	*Hydroporus* sp.	1
	Coleoptera	Elmidae	*Dubiraphia* sp.	2
	Diptera	Chironomidae		57
	Diptera	Tipulidae	*Tipula* sp.	1
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	3
	Gastropoda	Physidae		6
	Hemiptera	Hebridae	*Hebrus* sp.	1
	Nematoda			5
	Oligochaeta			91
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	4
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	1
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	4
	Trichoptera	Leptoceridae	*Nectopsyche* sp.	1
	Trichoptera	Philopotamidae	*Chimarra* sp.	1
	Trichoptera	Polycentropodidae	*Cernotina* sp.	2
	Trichoptera	Psychomyiidae	*Lype* sp.	1
				n=193
2	Acari	Hydracarina		7
	Amphipoda	Gammaridae	*Gammarus* sp.	1
	Amphipoda	Hyalellidae	*Hyalella* sp.	1
	Coleoptera	Elmidae	*Microcylloepus* sp.	3
	Coleoptera	Elmidae	*Optioservus* sp.	16
	Coleoptera	Elmidae	*Oulimnius* sp.	14
	Coleoptera	Elmidae	*Stenelmis* sp.	9
	Diptera	Chironomidae		79
	Ephemeroptera	Baetidae	*Diphetor* sp.	1
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	6
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	9
	Nematoda			3
	Oligochaeta			3
	Plecoptera	Nemouridae	*Podmosta* sp.	1
	Plecoptera	Perlidae	*Eccoptura* sp.	1
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	9
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	5
	Trichoptera	Philopotamidae	*Chimarra* sp.	28
	Trichoptera	Polycentropodidae	*Cernotina* sp.	1
	Turbellaria			5
				n=202

3	Acari	Hydracarina		24
	Amphipoda	Hyalellidae	*Hyalella* sp.	1
	Coleoptera	Elmidae	*Optioservus* sp.	10
	Coleoptera	Elmidae	*Oulimnius* sp.	4
	Coleoptera	Elmidae	*Stenelmis* sp.	1
	Coleoptera	Psephenidae	*Psephenus* sp.	1
	Coleoptera	Ptilodactylidae	*Anchytarsus* sp.	1
	Diptera	Ceratopogonidae	*Stilobezzia* sp.	1
	Diptera	Chironomidae		33
	Diptera	Simuliidae	*Prosimulium* sp.	1
	Diptera	Tipulidae	*Dicranota* sp.	1
	Ephemeroptera	Ephemerellidae	*Drunella* sp.	1
	Ephemeroptera	Ephemerellidae	*Eurylophella* sp.	6
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	11
	Ephemeroptera	Ephemerellidae	*Timpanoga* sp.	2
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	41
	Isopoda			1
	Nematoda			1
	Oligochaeta			4
	Plecoptera	Capniidae	*Allocapnia* sp.	2
	Plecoptera	Nemouridae	*Ostrocerca* sp.	1
	Plecoptera	Nemouridae	*Podmosta* sp.	6
	Plecoptera	Nemouridae	*Prostoia* sp.	9
	Plecoptera	Perlidae	*Eccoptura* sp.	2
	Trichoptera	Glossosomatidae	*Glossosoma* sp.	3
	Trichoptera	Hydropsychidae	*Ceratopsyche sp.*	12
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	7
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	5
	Trichoptera	Philopotamidae	*Chimarra* sp.	14
	Trichoptera	Polycentropodidae	*Polycentropus* sp.	1
	Trichoptera	Uenoidae	*Neophylax* sp.	1
				n=208

4	Acari	Hydracarina		3
	Bivalvia			3
	Coleoptera	Elmidae	*Macronychus* sp.	1
	Coleoptera	Elmidae	*Microcylloepus* sp.	4
	Coleoptera	Elmidae	*Optioservus* sp.	22
	Coleoptera	Elmidae	*Oulimnius* sp.	31
	Coleoptera	Elmidae	*Stenelmis* sp.	14
	Coleoptera	Psephenidae	*Psephenus* sp.	2
	Diptera	Chironomidae		21
	Diptera	Empididae	*Hemerodromia* sp.	1
	Diptera	Tipulidae	*Antocha* sp.	2

	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.	2
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	30
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	13
	Nematoda			2
	Plecoptera	Capniidae	*Allocapnia* sp.	1
	Plecoptera	Nemouridae	*Podmosta* sp.	2
	Plecoptera	Nemouridae	*Prostoia* sp.	3
	Plecoptera	Taeniopterygidae	*Taeniopteryx* sp.	2
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	10
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	12
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	5
	Trichoptera	Philopotamidae	*Chimarra* sp.	12
	Trichoptera	Uenoidae	*Neophylax* sp.	3
	Turbellaria			4
				n=205

5	Acari	Hydracarina		18
	Bivalvia			5
	Coleoptera	Elmidae	*Macronychus* sp.	1
	Coleoptera	Elmidae	*Optioservus* sp.	7
	Coleoptera	Elmidae	*Oulimnius* sp.	2
	Coleoptera	Elmidae	*Promoresia* sp.	2
	Coleoptera	Elmidae	*Stenelmis* sp.	1
	Diptera	Chironomidae		31
	Diptera	Tipulidae	*Antocha* sp.	2
	Diptera	Tipulidae	*Dicranota* sp.	4
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	3
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	16
	Oligochaeta			3
	Plecoptera	Capniidae	*Allocapnia* sp.	3
	Plecoptera	Nemouridae	*Podmosta* sp.	2
	Plecoptera	Nemouridae	*Zapada* sp.	1
	Trichoptera	Brachycentridae	*Brachycentrus* sp.	3
	Trichoptera	Glossosomatidae	*Glossosoma* sp.	2
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	49
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	22
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	11
	Trichoptera	Limnephilidae	*Madeophylax* sp.	8
	Trichoptera	Philopotamidae	*Chimarra* sp.	3
	Turbellaria			4
				n=203

6	Acari	Hydracarina		9
	Coleoptera	Elmidae	*Macronychus* sp.	1
	Coleoptera	Elmidae	*Microcylloepus* sp.	2
	Coleoptera	Elmidae	*Optioservus* sp.	8
	Coleoptera	Elmidae	*Oulimnius* sp.	13
	Coleoptera	Elmidae	*Stenelmis* sp.	2
	Collembolla			1
	Diptera	Chironomidae		48
	Diptera	Simuliidae	*Cnephia* sp.	2
	Diptera	Simuliidae	*Prosimulium* sp.	8
	Diptera	Simuliidae	*Stegopterna* sp.	1
	Diptera	Tipulidae	*Antocha* sp.	3
	Diptera	Tipulidae	*Tipula* sp.	1
	Ephemeroptera	Baetidae	*Baetis* sp.	1
	Ephemeroptera	Ephemerellidae	*Eurylophella* sp.	3
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	25
	Hemiptera	Hebridae	*Hebrus* sp.	1
	Isopoda			1
	Nematoda			1
	Oligochaeta			3
	Plecoptera	Capniidae	*Allocapnia* sp.	1
	Plecoptera	Leuctridae	*Paraleuctra* sp.	2
	Plecoptera	Nemouridae	*Prostoia* sp.	9
	Trichoptera	Glossosomatidae	*Glossosoma* sp.	4
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	39
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	4
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	7
	Trichoptera	Philopotamidae	*Chimarra* sp.	1
	Trichoptera	Philopotamidae	*Wormaldia* sp.	2
	Trichoptera	Polycentropodidae	*Cernotina* sp.	1
	Trichoptera	Rhyacophilidae	*Rhyacophila* sp.	1
				n=205

7	Acari	Hydracarina		7
	Bivalvia			1
	Coleoptera	Elmidae	*Dubiraphia* sp.	2
	Coleoptera	Elmidae	*Microcylloepus* sp.	5
	Coleoptera	Elmidae	*Optioservus* sp.	16
	Coleoptera	Elmidae	*Oulimnius* sp.	35
	Coleoptera	Elmidae	*Stenelmis* sp.	2
	Coleoptera	Psephenidae	*Psephenus* sp.	1
	Diptera	Chironomidae		51
	Diptera	Empididae	*Hemerodromia* sp.	1
	Diptera	Simuliidae	*Cnephia* sp.	1

	Diptera	Simuliidae	*Prosimulium* sp.	2
	Diptera	Tipulidae	*Antocha* sp.	2
	Diptera	Tipulidae	*Tipula* sp.	1
	Ephemeroptera	Ephemerellidae	*Eurylophella* sp.	2
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	3
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	25
	Hemiptera	Hebridae	*Hebrus* sp.	1
	Nematoda			1
	Oligochaeta			2
	Plecoptera	Nemouridae	*Nemoura* sp.	14
	Plecoptera	Taeniopterygidae	*Taenionema* sp.	1
	Plecoptera	Taeniopterygidae	*Taeniopteryx* sp.	1
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	6
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	2
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	6
	Trichoptera	Philopotamidae	*Chimarra* sp.	11
	Trichoptera	Uenoidae	*Neophylax* sp.	1
	Turbellaria			1
				204
8	Bivalvia			2
	Coleoptera	Elmidae	*Optioservus* sp.	9
	Coleoptera	Elmidae	*Stenelmis* sp.	1
	Diptera	Chironomidae		19
	Diptera	Empididae	*Hemerodromia* sp.	1
	Diptera	Tipulidae	*Antocha* sp.	3
	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.	10
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	112
	Ephemeroptera	Ephemerellidae	*Timpanoga* sp.	2
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	15
	Ephemeroptera	Oligoneruiidae	*Isonychia* sp.	17
	Oligochaeta			2
	Plecoptera	Capniidae	*Allocapnia* sp.	1
	Plecoptera	Nemouridae	*Paranemoura* sp.	1
	Plecoptera	Nemouridae	*Shipsa* sp.	1
	Plecoptera	Taeniopterygidae	*Taeniopteryx* sp.	2
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	3
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	1
	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	3
	Trichoptera	Limnephilidae	*Madeophylax* sp.	1
	Trichoptera	Philopotamidae	*Chimarra* sp.	1
	Trichoptera	Uenoidae	*Neophylax* sp.	1
	Turbellaria			1
				n=209

9	Acari	Hydracarina		3
	Amphipoda	Gammaridae	*Gammarus* sp.	3
	Bivalvia			2
	Coleoptera	Elmidae	*Microcylloepus* sp.	7
	Coleoptera	Elmidae	*Optioservus* sp.	13
	Coleoptera	Elmidae	*Oulimnius* sp.	8
	Coleoptera	Elmidae	*Stenelmis* sp.	3
	Coleoptera	Psephenidae	*Psephenus* sp.	2
	Diptera	Chironomidae		10
	Diptera	Tipulidae	*Tipula* sp.	1
	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.	7
	Ephemeroptera	Ephemerellidae	*Eurylophella* sp.	1
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	72
	Ephemeroptera	Heptageniidae	*Stenacron* sp.	2
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	7
	Ephemeroptera	Oligoneruiidae	*Isonychia* sp.	3
	Ephemeroptera	Tricorythidae	*Tricorythodes* sp.	1
	Oligochaeta			1
	Plecoptera	Capniidae	*Allocapnia* sp.	1
	Plecoptera	Nemouridae	*Prostoia* sp.	1
	Plecoptera	Perlidae	*Perlesta* sp.	1
	Plecoptera	Taeniopterygidae	*Taeniopteryx* sp.	2
	Trichoptera	Helicopsychidae	*Helicopsyche* sp.	1
	Trichoptera	Hydropsychidae	*Ceratopsyche* sp.	6
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	3
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	1
	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	5
	Trichoptera	Limnephilidae	*Madeophylax* sp.	21
	Trichoptera	Philopotamidae	*Chimarra* sp.	3
	Trichoptera	Uenoidae	*Neophylax* sp.	10
	Turbellaria			5
				n=206

10	Acari	Hydracarina		1
	Bivalvia			4
	Coleoptera	Elmidae	*Microcylloepus* sp.	1
	Coleoptera	Elmidae	*Optioservus* sp.	30
	Coleoptera	Elmidae	*Oulimnius* sp.	10
	Coleoptera	Elmidae	*Stenelmis* sp.	2
	Coleoptera	Psephenidae	*Psephenus* sp.	1
	Coleoptera	Ptilodactylidae	*Anchytarsus* sp.	7
	Diptera	Ceratopogonidae	*Atrichopogon* sp.	2
	Diptera	Chironomidae		41
	Diptera	Empididae	*Hemerodromia* sp.	1
	Diptera	Tipulidae	*Antocha* sp.	1
	Diptera	Tipulidae	*Dicranota* sp.	2
	Diptera	Tipulidae	*Tipula* sp.	1
	Ephemeroptera	Ephemerellidae	*Eurylophella* sp.	2
	Ephemeroptera	Ephemerellidae	*Serratella* sp.	28
	Ephemeroptera	Heptageniidae	*Stenonema* sp.	17
	Gastropoda	Lymnaeidae		4
	Nematoda			1
	Odonata	Calopterygidae	*Calopteryx* sp.	1
	Odonata	Coenagrionidae	*Nehalennia* sp.	2
	Oligochaeta			13
	Plecoptera	Capniidae	*Allocapnia* sp.	5
	Plecoptera	Nemouridae	*Ostrocerca* sp.	1
	Plecoptera	Nemouridae	*Podmosta* sp.	3
	Plecoptera	Nemouridae	*Shipsa* sp.	3
	Plecoptera	Perlidae	*Beloneuria* sp.	2
	Plecoptera	Perlidae	*Eccoputra* sp.	2
	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	6
	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	1
	Trichoptera	Philopotamidae	*Chimarra* sp.	2
	Trichoptera	Uenoidae	*Neophylax* sp.	1
	Turbellaria			1
				n=199

APPENDIX G
WATER QUALITY NETWORK HABITAT ASSESSMENT FORMS

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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	20241217 · 1302 · ASC (Date · Time · Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02640205005754	TSF/MF
Secondary Station ID	1 Pocopson	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:	Newlin Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	6.77%	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	28.43%	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		8.8	12.26	7.19	274.3	45	
2.			105.1				
3.							

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

Findings

Not Impaired:	☐	Impaired biology?	☒	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	28.4	Total Habitat Score:	156

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	15
#9 Condition of Banks + #10 Bank Vegetation = 24 or less *(20 or less for warm water, low gradient streams*	28
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	156
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	20241215 (Date) 0819 (Time) ASC (Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02640205005755	TSF/MF
Secondary Station ID	02 Pocopson	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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	2.16 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	31.65 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		7.1	11.01	6.79	2672	65	
2.			90.8				
3.							

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)
slightly brown
No odor
salinity
0.1ppt

Findings

Not Impaired:	☐	Impaired biology?	☒	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	40.7	Total Habitat Score:	162

MP-2

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	19
#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)*	162
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	20241217 · 0845 · ASC (Date · Time · Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02040205000669	TSF/MF
Secondary Station ID	3 Pocopson	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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	0.04 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	42.68 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		7.7	10.78	7.00	263.8	41	
2.			90.3				
3.							

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)
Clear / colorless
No odor
salinity = 0.1 ppt

Findings

Not Impaired:	☐	Impaired biology?	☐	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	66.4	Total Habitat Score:	168

MP-3

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #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)*	168
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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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	20241217 0923 ASC (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02040205000139	TSF/MF
Secondary Station ID	4 Pocopson	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) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]: 4

Location

County:	Chester	Municipality:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	1.25 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	37.81 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		7.3	10.93	6.79	257.8	50	
2.			90.6				
3.							

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

Salinity = 0.1 ppt

Findings

Not Impaired:	☐	Impaired biology?	☐	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	57.6	Total Habitat Score:	163

MP-4

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #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*	23
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	163
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	20241217 · 1030 · ASC (Date · Time · Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02040205000671	TSF/MF
Secondary Station ID	5 Pocopson	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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	4.92 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	47.19 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		8.0	[illegible]	6.72	316.4	47	
2.			91.3				
3.			10.18				

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)
Clear/
Colorless/No odor
salinity 0.2 ppt

Findings

Not Impaired:	☐	Impaired biology?	☒	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	53.1	Total Habitat Score:	180

MP-5

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	22
#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)*	180
Habitat Comments:	

Special Condition
Use this block to describe conditions that justify attainment/impairment of stations w th IBI score <63 and >53. The Beck's Index standardized score is <33.3 with the Percent Sensitive Individuals standardized score <25.0.

^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	20241217 · 1050 · ASC (Date · Time · Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02640205000678	TSF/MF
Secondary Station ID	6 Pocopson	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) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]: 4

Location

County:	Chester	Municipality:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	4.92 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	47.19 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		8.6	11.72	7.22	294.5	69	
2.			95.1				
3.							

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)
clear/colorless/odorless Salinity 0.1 ppt

Findings

Not Impaired:	☒	Impaired biology?	☐	Impaired habitat?	☐	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	61.9	Total Habitat Score:	180

MP-6

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	25
#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)*	180
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	20241217 - 1000 - ASC (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02040205000670	TSF/MF
Secondary Station ID	7 Pocopson	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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	4.92 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	47.19 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		7.6	11.42	6.89	298.8	56	
2.			95.4				
3.							

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

Clear / colorless Salinity 0.1 ppt

Findings

Not Impaired:	☐	Impaired biology?	☐	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	55.3	Total Habitat Score:	162

MP-7

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	17
#9 Condition of Banks + #10 Bank Vegetation = 24 or less *(20 or less for warm water, low gradient streams*	16
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	162
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	20241217 (Date)	1345 (Time)	ASC (Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
				02040205	02040205000233	TSF, MF
Secondary Station ID	8	Pocopson		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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	4.87 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	40.84 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		8.3	12.20	7.51	277.4	51	
2.			107.6%				
3.							

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

clear / colorless / odorless salinity 0.1 ppt

Findings

Not Impaired:	☐	Impaired biology?	☐	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	68.5	Total Habitat Score:	184

MP-8

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	24
#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)*	184

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	20241217 · 1420 · ASC (Date · Time · Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02040205000233	TSF/MF
Secondary Station ID	9 Pocopson	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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	4.87%	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	40.84%	Other:	%		

Landuse Comments: Stream stats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		8.5	13.81	7.40	2740	56	
2.			111.1%				
3.							

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

Salinity
0.1 ppt

Findings

Not Impaired:	☐	Impaired biology?	☐	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	73.32	Total Habitat Score:	141

MP-9

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #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*	11
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	141
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	20241217 · 0741 · ASC (Date · Time · Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
		02040205	02040205000802	WWF / MF
Secondary Station ID	10 Pocopson	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:	Pocopson Twp.	Topo Quad:	Unionville

Location Description:

Landuse

Residential:	.06 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	53.99 %	Other:	%		

Landuse Comments: Streamstats

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

Water Quality

	Collector-sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	SPC (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		6.0°C	11.80	6.45	185.4	43	
2.			94.8%				
3.							

Water Appearance/Odor Comments: (^see bottom of back for common descriptors)
Clear / colorless / No odor

Salinity 0.1 ppt

Findings

Not Impaired:	☐	Impaired biology?	☐	Impaired habitat?	☒	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:	58.91	Total Habitat Score:	188

MP-10

Macroinvertebrate sampling
Sampling protocol: Std. kick screen: ☐ D-frame: ☒ Other: ☐ protocol?: _____
Comments/Abundance Notes:

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #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*	24
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	188
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?**

APPENDIX H
PHYSICAL HABITAT EVALUATION DATA FORMS

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: UNT to Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 1

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD.

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 15

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)**

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)* 8	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 >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[2] 20	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**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 (6)	5 4 3	2 1
Total 13 RDB	10 9 8	(7) 6	5 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 (8)	7 6	5 4 3	2 1
Total 15 RDB	10 9 8	(7) 6	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	(10) 9 8	7 6	5 4 3	2 1
Total 18 RDB	10 9 (8)	7 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	7 (6)	5 4 3	2 1
Total 10 RDB	10 9 8	7 6	5 (4) 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 28

TOTAL HABITAT SCORE 156

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 2

Investigators: ASC, HSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 19

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)**

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 6	5 (4) 3	2 1
Total 8 RDB	10 9 8	7 6	5 (4) 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 (8)	7 6	5 4 3	2 1
Total 14 RDB	10 9 8	7 (6)	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 9 (8)	7 6	5 4 3	2 1
Total 14 RDB	10 9 8	7 (6)	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 (8)	7 6	5 4 3	2 1
Total 15 RDB	10 9 8	(7) 6	5 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 22

TOTAL HABITAT SCORE 162

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: UNT to Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 3

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 21

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)**

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 6	(5) 4 3	2 1
Total 9 RDB	10 9 8	7 6	5 (4) 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	7 (6)	5 4 3	2 1
Total 12 RDB	10 9 8	7 (6)	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 9 8	7 6	(5) 4 3	2 1
Total 13 RDB	10 (9) 8	7 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	7 6	5 (4) 3	2 1
Total 12 RDB	10 9 (8)	7 6	5 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 21

TOTAL HABITAT SCORE 168

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 4

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 18

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)** _____

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 6	5 4 3	2 1
Total 10 RDB	10 9 8	7 6	5 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	7 6	(5) 4 3	2 1
Total 13 RDB	10 9 (8)	7 6	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 9 8	7 6	5 (4) 3	2 1
Total 12 RDB	10 9 (8)	7 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	7 6	5 4 (3)	2 1
Total 10 RDB	10 9 8	(7) 6	5 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 23

TOTAL HABITAT SCORE 163

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: UNT to Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 5

Investigators: ASC, MSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 22

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)** _____

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 6	(5) 4 3	2 1
Total 10 RDB	10 9 8	7 6	(5) 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	7 (6)	5 4 3	2 1
Total 12 RDB	10 9 8	7 (6)	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 (9) 8	7 6	5 4 3	2 1
Total 17 RDB	10 9 (8)	7 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	(7) 6	5 4 3	2 1
Total 13 RDB	10 9 8	7 (6)	5 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 22

TOTAL HABITAT SCORE 180

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: UNT to Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 6

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 25

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)** _____

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
16	20 19 18 17 **(16)**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	**(20)** 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	**(7)** 6	5 4 3	2 1
Total 14 RDB	10 9 8	**(7)** 6	5 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	**(7)** 6	5 4 3	2 1
Total 15 RDB	10 9 **(8)**	7 6	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
13 LDB	10 9 8	7 **(6)**	5 4 3	2 1
Total RDB	10 9 8	**(7)** 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	7 6	5 4 **(3)**	2 1
Total 10 RDB	10 9 8	**(7)** 6	5 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 29

TOTAL HABITAT SCORE 180

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: UNT to Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 7

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 17

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)** _____

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity: consider run:bend ratio)*	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 >25.
18	20 19 **(18)** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	**(20)** 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 6	5 4 3	**(2)** 1
Total 7 RDB	10 9 8	7 6	**(5)** 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	7 6	5 **(4)** 3	2 1
Total 9 RDB	10 9 8	7 6	**(5)** 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 **(9)** 8	7 6	5 4 3	2 1
Total 18 RDB	10 **(9)** 8	7 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	**(7)** 6	5 4 3	2 1
Total 13 RDB	10 9 8	7 **(6)**	5 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 16

TOTAL HABITAT SCORE 162

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.
[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.
[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: Pocaposan Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 8

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 24

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)** _____

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
17	20 19 18 **(17)** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	**(20)** 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	**(7)** 6	5 4 3	2 1
Total 17 RDB	10 **(9)** 8	7 6	5 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	**(10)** 9 8	7 6	5 4 3	2 1
Total 18 RDB	10 9 **(8)**	7 6	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 9 **(8)**	7 6	5 4 3	2 1
Total 12 RDB	10 9 8	7 6	5 **(4)** 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	7 6	5 **(4)** 3	2 1
Total 9 RDB	10 9 8	7 6	**(5)** 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 35

TOTAL HABITAT SCORE 184

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.
[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.
[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: Pocopson Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 9

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 18

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)** _____

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)* 17	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 >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[2] 20	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**[3] *(edge of water to bankfull delineation)* 4	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.
LDB	10 9 8	7 6	5 4 3	(2) 1
Total RDB	10 9 8	7 6	5 4 3	(2) 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)* 7	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	7 6	5 (4) 3	2 1
Total RDB	10 9 8	7 6	5 4 (3)	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)* 5	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 9 8	7 6	5 4 (3)	2 1
Total RDB	10 9 8	7 6	5 4 3	(2) 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)* 5	Width or 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.
LDB	10 9 8	7 6	5 4 (3)	2 1
Total RDB	10 9 8	7 6	5 4 3	(2) 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 11

TOTAL HABITAT SCORE 141

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.
[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.
[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

Physical Habitat Evaluation Form for Riffle/Run Prevalence

Waterbody Name: UNT to W Branch Brandywine Creek | GIS Key (YYYYMMDD-hhmm-User):

Location: Site 10

Investigators: ASC, KSC, BW | Completed By: Aaron S. Clauser, PhD

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

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable couplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

* **WADEABLE COUPLET SCORE (EMBEDDEDNESS + SEDIMENT DEPOSITION)** 31

† **SEMIWADEABLE TRIPLET SCORE (INSTREAM COVER + EPIFANUAL SUBSTRATE + EMBEDDEDNESS)**

Parameter	Optimal	Suboptimal	Marginal	Poor
7. Riffle Frequency[2] *(riffle quantity; consider run:bend ratio)*	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 >25.
19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status[2]	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	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
****9. Condition of Banks**[3] *(edge of water to bankfull delineation)*	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.
LDB	10 9 8	7 6	5 (4) 3	2 1
Total 10 RDB	10 9 8	7 (6)	5 4 3	2 1
****10. Bank Vegetative Protection**[3] *(edge of water to bankfull delineation)*	More than 90% of the stream bank surfaces covered by vegetation.	70-90% of the stream bank surfaces covered by vegetation.	50-70% of the stream bank surfaces covered by vegetation.	Less than 50% of the stream bank surfaces covered by vegetation.
LDB	10 9 8	(7) 6	5 4 3	2 1
Total 14 RDB	10 9 8	(7) 6	5 4 3	2 1
11. Grazing or Other Disruptive Pressure[3] *(bankfull through riparian zone)*	Vegetative disruption through grazing or mowing is 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 stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
LDB	10 9 (8)	7 6	5 4 3	2 1
Total 15 RDB	10 9 8	(7) 6	5 4 3	2 1
12. Riparian Vegetative Zone[3] *(bankfull through riparian zone)*	Width or 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.
LDB	10 9 8	7 6	(5) 4 3	2 1
Total 10 RDB	10 9 8	7 6	(5) 4 3	2 1

Note: Wadeable couplet scores only calculated if the Wadeable Riffle-Run Protocol (Chapter 3.1) is used. Semiwadable triplet score only calculated if Semiwadeable Large River Protocol (Chapter 3.4) is used.

**** WADEABLE COUPLET SCORE (CONDITION OF BANKS + BANK VEGETATIVE PROTECTION)** 24

TOTAL HABITAT SCORE 188

[1] Reach scale: Evaluate parameter within the immediate vicinity of biological sampling reach.

[2] Expanded scale: Evaluate parameter within sampling reach and at least 100m UPS of sampled reach, longer if visual extent allows.

[3] Macro scale: Evaluate parameter based on expanded scale; can be extended further to account for characteristics within representative reach.

APPENDIX I
WATERSHED IMPAIRMENTS MAP


LEGEND
Sub-Watershed Boundary
PA State Roads
Impaired IBI
Unimpaired IBI
Impaired Habitat
Unimpaired Habitat
Impaired Total Nitrogen
Unimpaired Total Nitrogen
Impaired Total Phosphorous
Unimpaired Total Phosphorous
A
B
C
D
E
F
G
UNIONVILLE WAWASET ROAD
MARLBORO SPRING ROAD
OAK TREE ROAD
RED LION ROAD
LENAPE UNIONVILLE ROAD
S WAWASET ROAD
LENAPE ROAD
V STREET ROAD
VALLEY ROAD
FOLLY HILL ROAD
NORTHBROOK ROAD
E DOE RUN ROAD
STREET ROAD
Pocopson Creek and
Browning Barn Tributary
Stream Impairment Map
Chester County, Pennsylvania
N
Scale
1" = 1000'
0
1000
2000
3000
4000
Data Sources:
Chester County GIS Department
Clauser Environmental, LLC
www.pasda.psu.edu
Brandywine
Red Clay Alliance
CLAUSER
environmental llc
© 2025 CLAUSER ENVIRONMENTAL, LLC

APPENDIX J
PROFESSIONAL QUALIFICATIONS

Aaron S. Clauser, Ph.D., CPESC
At Clauser Environmental, LLC, he serves as Vice President and the technical/production lead on scientific projects. Dr. Clauser has 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 has experience as an environmental regulator with the Berks and Schuylkill Conservation Districts where he has served at both the technician and managerial levels. Dr. Clauser began consulting 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 Clauser Quesenberry, M.B.A.
Kora works as a biologist with Clauser Environmental, LLC. She has experience with stream and watershed studies, wetland delineation, scientific field investigations, and project delivery. She completed her bachelor's degree in Biological Science with a minor in Psychology at Rowan University and has her Master of Business Administration degree from Lehigh University.

Krista S. Clauser, Ed.D.
Dr. Krista S. Clauser serves as President of Clauser Environmental, LLC, where she oversees client satisfaction, quality assurance, educational outreach, and project management. She earned her EdD in Leadership and Management with a concentration in Creativity and Innovation from Drexel University. Dr. Clauser also holds a bachelor's degree in Special Education and Elementary Education from Kutztown University of Pennsylvania and a Master of Education in Learning, Leadership, and Organization Development from the University of Georgia. Her teaching background includes positions as a special education instructor at the Schuylkill Intermediate Unit and as a homeschool educator at the elementary, middle, and high school levels. Dr. Clauser is a certified yoga teacher, breathwork coach, reiki teacher, and qi gong teacher. She specializes in incorporating environmental and outdoor curricula into diverse educational settings, reflecting her commitment to holistic learning experiences.