Final Project Report (9/5/26)

Grass Roots Activities Focused on Protecting Aquatic Biodiversity in the Hunting Creek Watershed, Calvert County, Maryland

by the Friends of Hunting Creek
Prince Frederick, Maryland

Introduction

Thanks to a grant from the Cove Point Natural Heritage Trust, the Friends of Hunting Creek (FOHC) were able to continue several water quality monitoring tasks in 2025 that were previously funded by donations from FOHC volunteers. FOHC was also able to conduct a new crayfish pilot study and purchase exhibit materials that are being used in public education/outreach events.

All five project objectives were completed. Methods and results for each objective are described below.

Objective 1. Quarterly (Seasonal) Water Quality Monitoring

We collected two bottles of stream water samples at each of these six sites:

HC-3: Little Lyons Creek	HC-5: Mill Creek	HC-6: Fox Run
HC- 8a: Sewell Branch	HC-13: Hunting Creek	HC-20: Mill Creek

Appendix A includes a map of the Hunting Creek watershed that shows the six sampling site locations (light blue dots) and their lat/long coordinates. Quarterly samples were collected on these dates:

Summer 2025 (8/9/25)

Fall 2025 (11/24/25)

Winter 2026 (1/14/26)

Spring 2026 (5/27/26)

One water sample from each site was filtered, frozen, and delivered to the Nutrient Analytical Services Laboratory (NASL) at the Chesapeake Biological Laboratory, where they were analyzed for Nitrogen (NO23), Ammonium (NH4), Phosphate (PO4), and Total Suspended Solids (TSS). The second grab sample was analyzed for turbidity and pH by FOHC volunteers using an Apera TN400 Turbidimeter and an Apera Premium Series PH60 Tester. We also measured air/water temperature, dissolved oxygen (DO), percent dissolved oxygen saturation, and conductivity *in situ* at each of the six sites using a YSI ProSolo ODO/CT handheld meter.

Results of our Summer 2025, Fall 2025, Winter 2026, and Spring 2026 sampling events are presented in Appendix B, Tables B-1, B-2, B-3, and B-4.

For the nine[1] water quality parameters measured during four Quarterly events at our six stream sites (see watershed map in Appendix A for site locations), the following "yellow" (of concern) and "red" (of most concern) flags were raised:

- Red flag for NO23 at HC-3 on 8/9/25
- Yellow flag for NO23 at HC-3 on 11/24/25, 1/14/26, and 5/27/26.

FOHC's participation in annual Water Quality Blitzes since 2021 has also shown somewhat elevated baseflow NO23 concentrations at HC-3, Little Lyons Creek, as discussed in a recent report (Klauda and Hoover 2025). The nitrogen sources are not known with certainty and identifying them was not a project objective. However, nearly one-third (31.3%) of the Little Lyons Creek catchment/subwatershed (1,577 acres) is classified as agricultural land use, including farm fields and pasture. Numerous studies have shown a strong positive relationship between agricultural land use and nitrogen concentrations in downslope streams. Nitrogen levels are often several times higher in agriculture-dominated watersheds than in forested areas (Clune et al. 2020). Therefore, fertilizers and livestock manure are likely major sources of NO23 at HC-3.

- Red flag for turbidity at all sites except HC-3 (a yellow flag) on 8/9/25
- Red flag for turbidity at all six sites on 11/24/25
- Red flag for turbidity at sites HC-6 and HC-8a on 5/27/26
- Yellow flag for turbidity at all six sites on 1/14/26
- Yellow flag for turbidity at HC-3 and HC-13 on 5/27/26

Why elevated turbidity levels were common at our six Quarterly stream sites is unclear at this time. Calvert County's highly erodible soils[2], steep slopes, and land clearing/construction upstream from HC-6 are probable factors. FOHC will be exploring turbidity dynamics at HC-3 and HC-6 in 2026 using additional funding from CPNHT.

- Among all six sites, conductivity was highest at HC-5 on 8/9/25 and 5/27/25 (both yellow flags) and at HC-20 on 1/14/26 (yellow flag) and 5/27/26 (red flag).

One plausible explanation for the elevated conductivity levels is runoff of salt deicers from the Prince Frederick Town Center, a highly urbanized area that is drained by Mill Creek. Our sampling sites HC-5 and HC-20 are both located in Mill Creek, downstream from the Town Center. By comparison, conductivity at HC-3, in Little Lyons Creek that

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[1] While we recorded two measures of DO from the YSI meter at each site (concentration in mg/L and percent saturation), for the purposes of this report, we will focus on DO concentration.

[2] (https://www.calvertcountymd.gov/DocumentCenter/View/53409/Stormwater-FAQ-20260128?bidId=),

drains a catchment (sub watershed) that is less developed than Mill Creek, conductivity ranged from 125-178 mg/L during the four Quarterly monitoring events.

- PO4 concentrations were low at all six sites during the Quarterly events when PO4 was measured, with one exception. We had a yellow flag for PO4 at HC-8a during the 11/24/25 event.

The values of other water quality parameters measured at FOHC's six sites during the four Quarterly events do not raise any red or yellow flags of concern.

Objective 2. Benthic Macroinvertebrate Community Assessment

FOHC volunteers collected benthic macroinvertebrates (macros) on 4/16/25 in Fox Point Creek (site HC-10b) and on 4/26/25 in Barberry Branch (site HC-15) using a D-net and Maryland Biological Stream Survey (MBSS) methods (Stranko et al. 2019). The Hunting Creek watershed map in Appendix A shows the two macros sampling locations (black dots) and their lat/long coordinates. Macros samples were preserved/stored in 95% ethanol and delivered to Dr. John Cooper (Cooper Environmental Research, Constantia, NY) for sorting and identification of organisms to family and genus.

Dr. Cooper also calculated a Benthic Index of Biotic Integrity (BIBI) score for each stream using the method described in Southerland et al. 2007. BIBI scores enabled us to rate the ecological health of each stream from Very Poor to Good.

FOHC volunteers also scored the condition of the in-stream physical habitat and adjacent riparian area at each macros collection site based on ten parameters using a *Habitat Assessment Field Data Sheet - Low Gradient Streams*. Each parameter was scored from 0 points (Poor) to 20 points (Optimal). A description of the ten parameters and scoring criteria is presented along with a sample datasheet in Appendix C. We also measured the wetted width and thalweg depth at zero meters(m), 25m, 50m, and 75m transects along each 75-m long stream segment where macros were collected.

The genus-level BIBI scores were 3.9 (Fair) and 4.1 (Good) at HC-10b (Fox Point Creek) and HC-15 (Barberry Branch), respectively (Table 1). These high BIBI scores indicate the presence of healthy macros communities in both streams—good news. One probable explanation is the high Total Physical Habitat Score at both sites (Table 1).

For those readers who want more details on the macros taxa that were collected at HC-10b and HC-15 in 2025, see Appendix C, Tables C-1 and C-2.

Table 1. Macros metric values, Benthic Index of Biotic Integrity (BIBI) scores, and physical habitat information at two stream sites in the Hunting Creek watershed sampled in 2025.

Genus Level Metrics Physical Habitat Parameters	HC-10b Fox Point Creek	HC-15 Barberry Branch
No. of Taxa	46	55
No. of EPT * Taxa	7	8
No. of Ephemeroptera Taxa	2	2
Percent Intolerant Taxa	1.4	3.6
Percent Ephemeroptera Taxa	0.3	0.6
No. of Scraper Taxa	8	8
Percent Climbers	8.5	19.9
BIBI Score	3.9 (Fair) 3	4.1 (Good)
Total Physical Habitat Score (max.= 200)	160	154
Average Wetted Width (m)	1.51	2.53
Average Thalweg Depth (cm)	26.1	17.3

E = Ephemeroptera (mayflies), P = Plecoptera (stoneflies), Trichoptera (caddisflies)

Objective 3. eDNA-based Description of Fish Species Richness

FOHC volunteers collected environmental DNA (eDNA) samples in Fox Point Creek and Barberry Branch on 8/23/25, in the same 75-m long segments (sites) where macros were collected in April 2025. Three water samples were collected in each stream (at the 25m, 50m, and 75m transects) using a Smith-Root eDNA Citizen Scientist sampling pump and their Self-Preserving Filter Packs (with 5-micron pore size). We achieved our goal of pumping 2-L of water through each of the three filters collected at each of the two stream sites. We collect three replicate eDNA samples from each stream site to ensure the capture of adequate amounts of DNA and, hopefully, enhance the laboratory’s ability to accurately identify the fish species inhabiting both streams.

Our proposal to CPNHT stated that we would collect two eDNA samples from each of the two stream sites. We decided to increase the sample number to three per stream site for the reasons stated above and absorb any cost overrun this change could cause. See Appendix E for our cost accounting summary.

The filter packs were shipped to Jonah Ventures in Boulder, CO, for DNA analysis. They used metabarcoding methods and the MiFishu primer to identify fish DNA sequences in our samples. To reduce the number of base pair mismatches per DNA sequence, the Jonah Venture spreadsheets were censored to remove lines of detected sequences with less than 99% match to a known fish species in Jonah Venture's DNA reference library. In addition, Rob Aguilar, a Research Technician at the Smithsonian Environmental Research Center (SERC) in Edgewater, MD, kindly BLASTED the spreadsheet from Jonah Ventures using SERC's private reference sequence library (CBBI: Chesapeake Bay Barcode Initiative) and increased percent match values for many lines of detected sequences. BLAST refers to Basic Local Alignment Search Tool and is a technique used to match a particular DNA sequence in a water sample with sequences in a reference library. Rob's contribution refined/improved the fish species identifications we received from Jonah Ventures.

For those readers who are interested in more details about what eDNA is, definitions of DNA sequencing key words, metabarcoding details, and other related topics, we suggest you go to the informative Jonah Ventures website (https://jonahventures.com/).

Jonah Ventures analyzed our eDNA samples collected at HC-10b and HC-15 in August 2025 to identify fish species present(Table 2). All fish species revealed by eDNA analysis of water samples collected from our two streams are native to some portion of Maryland. None are rare, threatened, endangered, or Species of Greatest Conservation Need (SGCN) in Maryland. The fish species found were all "the usual suspects" for Coastal Plain Maryland streams.

HC-10b (Fox Point Creek) had 12 or 13 fish species and HC-15 (Barberry Branch) had 8 or 9 species. Because they are closely related, Chain Pickerel and Redfin Pickerel could not be differentiated by DNA analysis. These are good numbers for fish species richness in Calvert County freshwater streams. The presence of Mummichog and Banded Killifish, two euryhaline (salt-tolerant) species, in Fox Point Creek was not surprising since it confluences with the tidal portion of Hunting Creek about 1-1/2 miles downstream from the Rts. 2/4 bridge. Conversely, Barberry Branch, a tributary to Sewell Branch located in the northeast corner of the Hunting Creek watershed, is located 3-4 miles upstream from tidal waters.

The number of sequence reads can approximate relative abundance or rank-based categories such as rare or common (Di Muri et al. 2020, Shu et al. 2021, Littlefair et al.

2026). However, the number of sequence reads is not a direct or precise linear measure of absolute population size.

So, looking at the sum of the number of DNA sequence reads for each line of base pair sequences for a given fish species in the Jonah Ventures spread sheet (Table 2), we suggest that the five most common fishes found at HC-10b were Tessellated Darter, Mummichog, American Eel, Eastern Mudminnow, and Creek Chubsucker. At HC-15, Blacknose Dace, Eastern Mudminnow, Chain Pickerel or Redfin Pickerel, American Eel, and Eastern Mosquitofish appeared to be the five most common fishes.

Table 2. Fish species revealed by eDNA sampling in two streams in the Hunting Creek watershed in 2025, with number of sequence reads for each species.

HC-10b Fox Point Creek	HC-15 Barberry Branch
American Eel (6177)	American Eel (4073)
Banded Killifish (145)	Blacknose Dace (8410)
Blacknose Dace (1100)	Bluegill (590)
Brown Bullhead (128)	Chain Pickerel and/or Redfin Pickerel (4977)
Chain Pickerel and/or Redfin Pickerel (125)	Creek Chubsucker (278)
Creek Chubsucker (1643)	Eastern Mosquitofish (2176)
Eastern Mosquitofish (220)	Eastern Mudminnow (7931)
Eastern Mudminnow (5191)	Tessellated Darter (257)
Golden Shiner (121)	
Green Sunfish (29)	
Mummichog (33,593)	
Tessellated Darter (34,573)	

Objective 4. Crayfish Pilot Study

Maryland is home to nine native crayfish species and five non-natives. Maryland Biodiversity Project records indicate that three native crayfishes: Devil Crawfish (*Cambarus diogenes)*, Spinycheek Crayfish (*Orconectes limosus*), and White River Crawfish (*Procambarus acutus acutus*) plus one non-native, invasive species: Red Swamp Crayfish (*Procambarus clarkii*) have been found in Calvert County.

In 2025, FOHC volunteers conducted a Pilot Study to begin the process of documenting crayfish species richness throughout the watershed. Crayfish are viewed as a "keystone species" and widely considered to be "ecosystem engineers" (like beavers) because they modify their habitats by foraging, restructuring the substrate, and burrowing. Crayfish also serve as important scavengers and predators.

Our study addressed three basic questions:

1. Can baited cylindrical coated-wire crayfish traps (16 inches long X 9 inches in diameter with a 2-inch diameter entrance hole at each end) catch crayfish in non-tidal streams?
2. Which of two baits (canned cat food and Atlantic Menhaden) are most effective?
3. Which stream habitat type, runs or pools, yielded more crayfish numbers?

Two streams that are also being monitored for water quality by FOHC (Fox Run at site HC-6 and middle Sewell Branch at site HC-8b) were selected for the Crayfish Pilot Study. Two of the four traps deployed in each stream were baited with canned cat food with perforated lids and two with Menhaden.

Four traps were deployed at four different locations in Fox Run for four consecutive days (9/15-9/19/25), yielding a total of 96 trap hours per site multiplied by four sites, which equaled 384 total trap hours. All traps were checked and emptied every 24 hours.

Four traps were deployed at four different locations in Sewell Branch for four consecutive days (10/13-10/17/25), yielding a total of 101.25 trap hours per site multiplied by four sites, equaling 405 total trap hours. All traps were checked and emptied every 24 hours.

Because both study streams had relatively shallow stream depths during the Pilot Study, we were unable to find many areas where the crayfish traps could be effectively deployed and completely submerged. Therefore, the traps were placed in areas that were more pool-like than runs, so we could not address the runs versus pools habitat preference question.

A total of 11 crayfish representing two native species were captured in the two Pilot Study streams.

<u>Fox Run</u>: 4 Spinycheek Crayfish (5.5-8.4 cm long) and 3 Devil Crawfish (9.0-9.8 cm long).

<u>Sewell Branch</u>: 3 Spinycheek Crayfish (6.0-10.0 cm long) and 1 Devil Crawfish (12.0 cm long).

We did not capture the third native species (White River Crawfish) nor the non-native invasive species (Red Swamp Crayfish) that have been reported in Calvert County.

The 2025 crayfish Pilot Study focused on four sites in each of two tributaries in mid-September and mid-October when water temperature was cooling (53-64 F) and crayfish were probably less active. Nevertheless, the cylindrical wire traps caught two of the four expected crayfish species. Traps baited with canned cat food caught 6 crayfish, while traps baited with Menhaden caught 5 crayfish. A total of only 11 captured crayfish is a small sample size upon which to address the bait effectiveness question. So, we'll simply conclude that canned cat food and Atlantic Menhaden were about equally effective.

FOHC volunteers will continue crayfish sampling in 2026 with a second pilot study in two additional tributaries. We will deploy traps in August and September, when water temperatures are warmer and crayfish are most active. This timing may increase catches and improve our chances of capturing all crayfish species currently inhabiting the Hunting Creek watershed.

Objective 5. Public Education and Outreach

To help our organization communicate information about the Hunting Creek watershed to County agency staff, elected officials, and the public, our grant from CPNHT enabled FOHC to print two large posters that were designed by Ron Klauda (FOHC) and Mary Hoover (American Chestnut Land Trust): one on crayfish species collected in our watershed and a second focused on the degraded status of upper Mill Creek. These two posters are shown in Appendix D. We also printed/bound five copies of the report titled "Baseflow Nitrogen Concentrations in Hunting Creek Tributaries, 2021-2025: Mostly Good News!" (Klauda and Hoover 2025)[3] and purchased two large easels for displaying posters at tabling events.

We displayed these two posters and the bound report at three public educational or outreach events in 2025-2026: Patuxent River Appreciation Days in Solomons, MD (10/11/15), Calvert County STEM Expo in Prince Frederick, MD (2/21/26), and the Patuxent River Wade-In at Jefferson Patterson Park (6/14/26).

After checking FOHC's inventory of exhibit materials, we discovered we had several ballpoint pens inscribed with "Friends of Hunting Creek" on hand for giveaways at public events. Accordingly, we did not purchase more pens with money from this grant.

[3] https://www.acltweb.org/_files/ugd/5ef86e_9117c5db3c824103976a2aa822413992.pdf

Conclusions

With support from the Cove Point Natural Heritage Trust, the Friends of Hunting Creek (FOHC) were able to continue and expand our grass roots activities focused on protecting aquatic biodiversity. In addition to our grant funding, FOHC volunteers also contributed $63.28 in matching funds and 112 hours of their time, worth $ 4,002.90[4], to complete all five project objectives. Use of grant funds for the project are detailed in Appendix E.

FOHC completed four Quarterly monitoring efforts between 8/9/25 and 5/27/26 at six sites that captured the major subwatersheds. Of the nine water quality parameters measured, "yellow' (some concern) and "red" (most concern) flags were raised for NO23, PO4, and conductivity at some but not all sites. Yellow and red flags for turbidity were raised at all six sites during one or more Quarterly monitoring events. Agricultural and urban land uses, Calvert County's highly erodible soils, steep slopes, and upstream land clearing/grading/construction activities are the most plausible contributing factors.

Our benthic macroinvertebrate collections with a D-net in Fox Point Creek and Barberry Branch indicated ecologically healthy conditions. Genus level Benthic Index of Biotic Integrity (BIBI) scores were 3.9 (Fair) and 4.1 (Good) in Fox Point Creek and Barberry Branch, respectively. Other encouraging news was the large number of macros genera collected (46 and 55) plus the relatively high physical habitat scores (160 and 154) in Fox Point Creek and Barberry Branch, respectively.

Environmental DNA (eDNA) sampling revealed 12 or 13 fish species in Fox Point Creek and 8 or 9 fish species in Barberry Branch. These are good numbers of fish species for freshwater streams in Calvert County. All species revealed in these two streams in 2025 are native to some portions of Maryland. None are rare, threatened, endangered, or Species of Greatest Conservation Need (SGCN) in Maryland. The larger number of fish species found in Fox Point Creek could be explained by the fact that it confluences with the tidal portion of Hunting Creek, thereby providing easy access by euryhaline (salt-tolerant) species like Mummichog and Banded Killifish, that were both revealed by eDNA to be present in Fox Point Creek. The number of sequence reads suggested that the most common species found in Fox Point Creek was Tessellated Darter. The most common species found in Barberry Branch was Blacknose Dace. The most common fish species found in both streams was Eastern Mudminnow.

Our Pilot Study in Fox Run and Sewell Branch captured two of the four crayfish species that have been reported in Calvert County: Spinycheek Crayfish and Devil Crawfish, both native species, but only a total of 11 individuals. FOHC did not capture the third native species, White River Crawfish, nor the non-native invasive species, Red Swamp

[4] Based on Maryland's estimated value of volunteer time ($35.53/hour in 2025 and $36.14/hour in 2026)

Crayfish. Traps baited with canned cat food and Atlantic menhaden chunks were about equally effective during the brief study, but we cannot conclude that decisively given the small catch numbers.

For our Public Education and Outreach project objective, FOHC printed two large posters, printed/bound five copies of a report on baseflow nitrogen trends in Hunting Creek tributaries, and purchased two large easels for displaying posters at tabling events. Our volunteers staffed an exhibit table at three public education/outreach events where these materials were displayed.

Literature Cited

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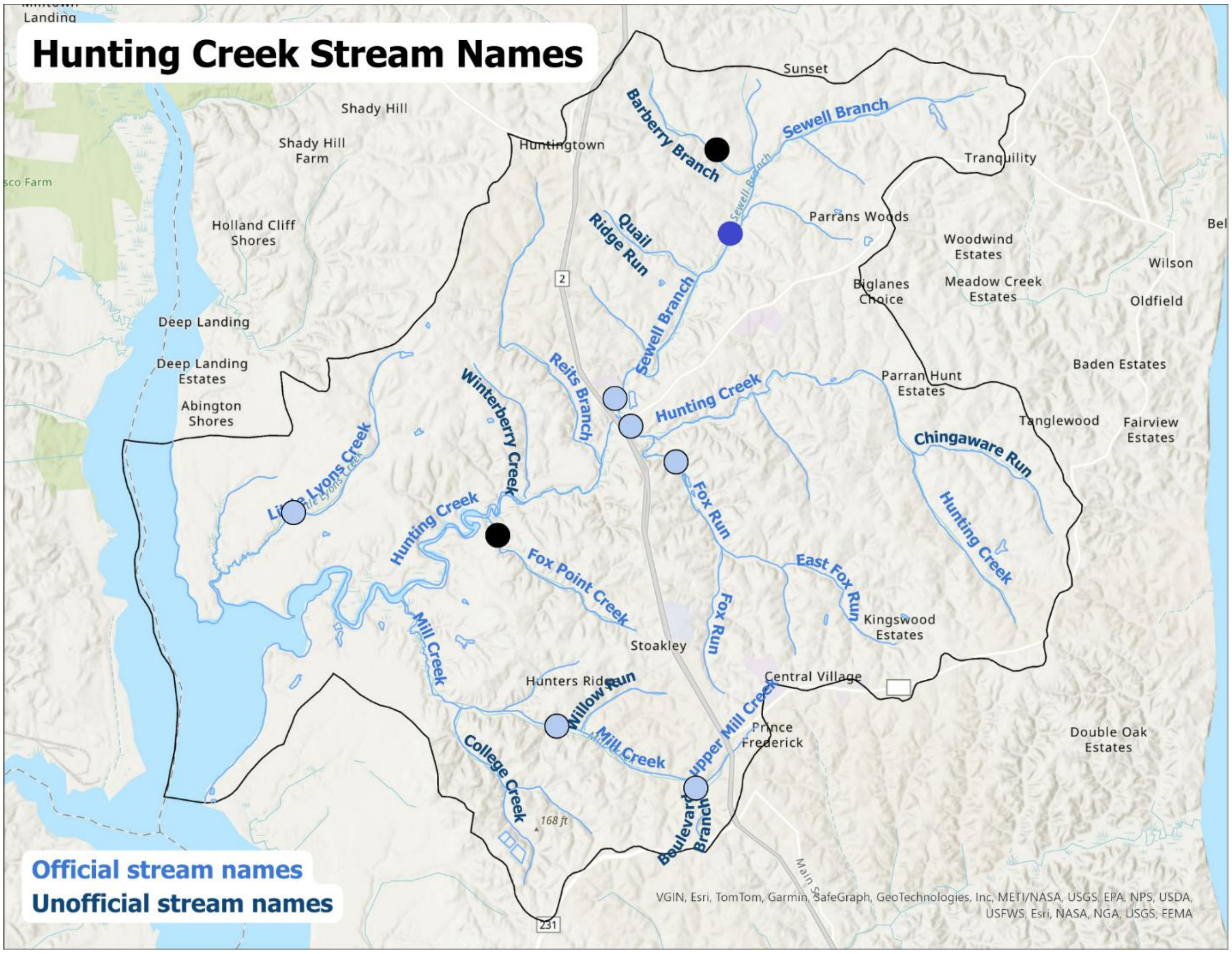
Appendix A. Watershed Map, Sampling Site Locations, and Coordinates

The six Quarterly monitoring sites are shown on this map of the Hunting Creek watershed as light blue dots. The two stream sites where macros and eDNA samples were collected are shown as black dots. The crayfish pilot study was conducted in Fox Run (light blue dot) and in middle Sewell Branch (purple dot).



Lat/long coordinates for the stream sites sampled and discussed in this report are:

<u>Quarterly (Seasonal) Water Quality Monitoring</u>

HC-3 (Little Lyons Creek): 38.573407, -76.656031
HC-5 (middle Mill Creek): 38.548495, -76.618217
HC-6 (Fox Run): 38.579123, -76.596507
HC-8a (lower Sewell Branch): 38.587877, -76.605287
HC-13 (Hunting Creek): 38.584250, -76.604804
HC-20 (upper Mil Creek): 38.541126, -76.594114

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HC-10b (Fox Point Creek): 38.570806, -76.623676
HC-15 (Barberry Branch): 38.615396, -76.590811

Crayfish Pilot Study

HC-6 (Fox Run): see above
HC-8b (middle Sewell Branch); 38.607776, -76.587049

Appendix B. Quarterly Water Monitoring Data

Tables B-1 through B-4 include the results of FOHC's Quarterly (season) water quality sampling at six non-tidal stream sites in 2025 and 2026.

Table B-1. Summer 2025 Water Monitoring Results in the Hunting Creek Watershed (8/9/25)

Site No.	NO23 mg/L	NH4 Mg/L	PO4 mg/L	DO mg/L	% DO	pH	Conductivity uS/cm	TSS mg/L	Turbidity NTU
HC-3	2.240	0.039	NM	8.44	92.1	7.35	179	9.0	14.38
HC-5	0.411	0.077	NM	8.76	97.6	7.94	340	4.0	26.30
HC-6	0.192	0.089	NM	8.60	93.0	7.83	229	7.6	39.15
HC-8a	0.227	0.081	NM	5.90	66.6	7.30	238	39.5	33.85
HC-13	0.182	0.063	NM	7.50	81.6	7.53	260	74.7	43.83
HC-20	0.429	0.079	NM	8.20	89.0	7.41	6	2.5	21.08

NM = not measured

Table B-2. Fall 2025 Water Monitoring Results in the Hunting Creek Watershed (11/24/25)

Site No.	NO23 mg/L	NH4 Mg/L	PO4 mg/L	DO mg/L	% DO	pH	Conductivity uS/cm	TSS mg/L	Turbidity NTU
HC-3	1.070	0.048	0.008	9.03	76.2	6.95	130	2.4	21.88
HC-5	0.120	0.078	0.003	10.72	91.2	7.10	262	2.4	25.43
HC-6	0.031	0.112	0.003	10.76	88.0	7.10	NM	5.6	28.85
HC-8a	0.047	0.053	0.045	6.87	58.0	7.03	157	5.6	33.73
HC-13	0.029	0.064	0.003	9.50	77.3	7.13	NM	6.0	30.70
HC-20	0.101	0.114	0.003	9.88	84.0	7.03	NM	2.4	22.40

NM = not measured

Table B-3. Winter 2026 Water Monitoring Results in the Hunting Creek Watershed (1/14/26)

Site No.	NO23 mg/L	NH4 Mg/L	PO4 mg/L	DO mg/L	% DO	pH	Conductivity uS/cm	TSS mg/L	Turbidity NTU
HC-3	1.090	0.102	0.006	11.47	90.8	7.06	125	3.0	8.13
HC-5	0.264	0.201	0.003	11.72	93.5	7.08	240	2.4	10.59
HC-6	0.272	0.153	0.003	11.84	90.2	7.04	167	4.0	15.17
HC-8a	0.308	0.057	0.007	7.25	80.6	7.08	139	2.4	14.99
HC-13	0.152	0.104	0.004	11.40	87.1	7.14	142	3.0	13.44
HC-20	0.216	0.234	0.003	11.46	92.2	7.02	389	2.4	8.86

Table B-4. Spring 2026 Water Monitoring Results in the Hunting Creek Watershed (5/27/26)

Site No.	NO23 mg/L	NH4 Mg/L	PO4 mg/L	DO mg/L	% DO	pH	Conductivity uS/cm	TSS mg/L	Turbidity NTU
HC-3	1.298	0.224	0.011	7.18	75.4	7.24	178	24.0	19.70
HC-5	0.334	0.130	0.004	8.25	88.5	7.31	389	4.5	9.95
HC-6	0.237	0.136	0.006	7.79	83.6	7.81	283	10.7	24.75
HC-8a	0.338	0.124	0.004	4.82	51.9	7.28	218	12.7	31.43
HC-13	0.193	0.103	0.006	7.18	76.6	7.50	238	10.7	19.56
HC-20	0.217	0.111	0.003	7.85	83.2	7.76	548	5.3	7.81

Appendix C. Benthic Macroinvertebrates

Tables C-1 and C-2 include benthic macroinvertebrate (macros) families, genera (with common names) and available Tolerance Values for those organisms that were collected by FOHC volunteers with a D-net at two stream sites in the Hunting Creek watershed in 2025. Tolerance Values can range from 1.0 (least tolerant/most sensitive to pollution) to 10.0 (most tolerant). Macros taxa considered to be intolerant of urbanization (development) in a stream catchment have Tolerance Values between 0-3.

Table C-1. Macros taxa collected with a D-net at HC-10b in 2025.

Family	Genus (Common Name)	Tolerance Value
Gammaridae	Gammarus (scud)	6.7
Dryopidae	Helichus (water beetle)	6.4
Dytiscidae	Hydroporus (predaceous diving beetle)	4.6
Elmidae	Ancyronyx (spider water beetle)	1
Elmidae	Dubiraphia (riffle beetle)	5.7
Elmidae	Macronychus (riffle beetle)	6.8
Elmidae	Stenelmis (riffle beetle)	1
Gyrinidae	Gyrinus (whirligig beetle)	4
Hydrophilidae	Tropistemus (water scavenger beetle)	4.1
Certopogonidae	Bezzia (biting midge)	3.3
Chironomidae	Alotanypus (non-biting midge)	6.6
Chironomidae	Brillia (non-biting midge)	7
Chironomidae	Chaetocladius (non-biting midge)	7
Chironomidae	Corynoneura (non-biting midge)	4.1
Chironomidae	Diplocladius (non-biting midge)	5.9
Chironomidae	Eukiefferiella (non-biting midge)	6.1 - 8
Chironomidae	Odontomesa (non-biting midge)	6.6
Chironomidae	Polypedium (non-biting midge)	6.6
Chironomidae	Potthastia (non-biting midge)	2
Chironomidae	Rheotanytarsus (non-biting midge)	7.2
Chironomidae	Sublettea (non-biting midge)	10
Chironomidae	Tanypus (non-biting midge)	6.6
Chironomidae	Tvetenia (non-biting midge)	5.1

Ephydridae	no genus identified (shorefly)	--
Simullidae	Simulium (blackfly)	5.7
Tabanidae	Tabanus (horsefly)	2.8
Tipulidae	Hexatoma (cranefly)	1.5
Baetidae	Baetis (mayfly)	3.9
Heptageneidae	Stenonema (flatheaded mayfly)	4.6
Lymnaeidae	Stagnicola (freshwater snail)	7.8
Saldidae	no genus identified (shore bug)	--
Asellidae	Caecidotea (waterslater)	2.6
Asellidae	Cassidinidea (isopod)	--
Physidae	Physa (freshwater snail)	7
Pisididae	Pisidium (pill clam or pea clam)	5.7
Aeshnidae	Boyeria (dragonfly)	6.3
Gomphidae	Angomphus (clubtailed dragonfly)	2.2
Gompnidae	Gomphus (clubtailed dragonfly)	2.2
Naididae	Nais (aquatic worm)	9.1
Nemouridae	Amphineura (stonefly)	3
Brachycentridae	Micrasema (humpless casemaker caddisfly)	2.3
Limnephilidae	Ironoquia (northern caddisfly)	4.9
Phryganeidae	Oligostomus (giant casemaker caddisfly)	2
Phryganeidae	Ptilostomus (giant casemaker caddisfly)	4.3
Chrysomelidae	no genus identified (leaf beetle)	--
Dolichopodidae	no genus identified (long-legged fly)	--
Lumbriculidae	no genus identified (aquatic worm)	--
Nematoda	no genus identified (roundworm)	--

Total number of organisms collected/identified = 1082.

Table C-2. Macros taxa collected with a D-net at HC-15 in 2025.

Family	Genus (Common Name)	Tolerance Value
Gammaridae	Gammarus (scud)	6.7
Cirdulionidae	no genus identified (snout beetles)	--
Dryopidae	Helichus (water beetle)	6.4
Dytiscidae	Hydroporus (predaceous diving beetle)	4.6
Dystiscidae	Laccophilus {water beetle)	5.4
Elmidae	Ancyronyx (spider water beetle)	1
Elmidae	Dubiraphia (riffle beetle)	5.7
Elmidae	Macronychus (riffle beetle)	6.8
Elmidae	Optioservus (riffle beetle)	5.4
Elmidae	Stenelmis (riffle beetle)	1
Heterocaridae	“mud-loving beetle”—not strictly aquatic	--
Hydrochidae	Hydrochus (water scavenger beetle)	4.1
Hydrophilidae	Hydrochara (water scavenger beetle)	4.1
Hydrophilidae	Sperchopsis (water scavenger beetle)	4.1
Hydrophilidae	Tropistemus (water scavenger beetle)	4.1
Certopogonidae	Bezzia (biting midge)	3.3
Chironomidae	Alotanypus (non-biting midge)	6.6
Chironomidae	Chaetocladius (non-biting midge)	7
Chironomidae	Corynoneura (non-biting midge)	4.1
Chironomidae	Diplocladius (non-biting midge)	5.9
Chironomidae	Eukiefferiella (non-biting midge)	6.1 - 8
Chironomidae	Microtendipes (non-biting midge)	7.2
Chironomidae	Polypedium (non-biting midge)	6.6
Chironomidae	Rheotanytarsus (non-biting midge)	7.2
Chironomidae	Sublettea (non-biting midge)	10
Chironomidae	Tanypus (non-biting midge)	6.6
Chironomidae	Tvetenia (non-biting midge)	5.1
Chironomidae	Zavrelimyia (non-biting midge)	5.3
Ephydridae	no genus identified (shorefly)	--

Simullidae	Simulium (blackfly)	5.7
Stratiomyidae	Odontomyia (soldier fly)	7
Stratiomyidae	Stratiomys (soldier fly)	2.8
Tabanidae	Tabanus (horsefly)	2.8
Tipulidae	Tipula (cranefly)	6.7
Baetidae	Baetis (mayfly)	3.9
Taeniopterygidae	Strophopteryx (winter stonefly)	1.8
Corixidae	Trichocorixa (water boatman)	5.6
Saldidae	no genus identified (shore bug)	--
Asellidae	Caecidotea (water slater)	2.6
Pyraiidae	Crambus (grass-veneer moth)	5
Ancyclidae	Fossaria (freshwater snail)	7
Physidae	Physa (freshwater snail)	7
Pisididae	Pisidium (pill clam or pea clam)	5.7
Pisidiidae	Sphaerium (freshwater clam)	5.7
Aeshnidae	Boyeria (dragonfly)	6.3
Calopterygidae	Calopteryx (damselfly)	8.3
Cordulegastridae	Cordulegaster (club-tailed dragonfly)	2.4
Gompnidae	Gomphus (clubtailed dragonfly)	2.2
Libellulidae	Libellula (dragonfly)	7
Naididae	Nais (aquatic worm)	9.1
Nemouridae	Amphineura (stonefly)	3
Perlidae	Perlesta (stonefly)	1.6
Perlodidae	Isoperla (stripetail stonefly)	2.4
Leptoceridae	Oecelis (long-horned caddisfly)	4.7
Limnephilidae	Limnephilus (caddisfly)	3.4
Nematoda	no genus identified (roundworm)	--

Total number of organisms collected/identified = 1112.

A copy of the *Habitat Assessment Field Data Sheet - Low Gradient Streams* is also included in Figure C-1 below.

Figure C-1.

HABITAT ASSESSMENT FIELD DATA SHEET-LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #________	STREAM CLASS	
LAT ____________	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE ________ TIME	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET-LOW GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures 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. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ______

Appendix D. Educational Posters


UPPER MILL CREEK NEEDS HELP!
I have a bad case of Urban Stream Syndrome!
I have poor habitat for macros and fish!
Please fix me!
High flows can't reach my floodplain!
My wetland is gone!
Chesapeake Beach
Huntingtown
Calvert
Chesapeake Ranch Estates
Solomons

Appendix E. Cost Accounting Summary

Table E-1 below summarizes the expenses associated with the project for 2025-26.

Table E-1.

Date	Amount	Running Balance	Notes
8/15/2025	$1,782.00	$1,782.00	Deposit initial grant funds (75%)
8/15/2025	($200.00)	$1,582.00	Paid Cooper Environmental for eDNA analysis
9/1/2025	($214.98)	$1,367.02	Paid CBL for Spring quarterly sampling lab results
10/18/2025	($720.00)	$647.02	Paid Jonah Ventures for eDNA results
11/22/2025	($320.09)	$326.93	Reimbursement for supplies for Tasks 2, 3, 4 & 5
12/12/2025	($214.98)	$111.95	Paid CBL for Summer quarterly sampling lab results
12/23/2025	$594.00	$705.95	Deposit remaining grant funds (25%)
1/10/2026	($105.98)	$599.97	Reimburse Ron for purchase of two easels for tabling events
1/11/2026	($63.56)	$536.41	Reimbursement to Frank for purchase of four crayfish traps
1/15/2026	($41.33)	$495.08	Reimburse Ron for poster re: Upper Mill Creek restoration
4/17/2026	($558.36)	($63.28)	Pay CBL for Fall and Winter quarterly sampling lab results