Division of Water Resources
Macroinvertebrate Results for Big Harris Creek
Broad River Basin, Cleveland County – Spring 2013
Watershed Assessment Team
January 27, 2014

This memorandum represents work completed for Task 7 (Biological Assessments) in the Big Harris Creek Scope of Work dated September 20, 2012, the second version for the pre-restoration.

Background

Staff with the NC Division of Water Resources Watershed Assessment Team (NCDWR-WAT) and Division of Water Resources Biological Assessment Branch (BAB) collected benthic macroinvertebrate samples at 14 sites within the Big Harris and Little Harris watersheds on May 28 and 29, 2013. During May 2009, NCDWR and NC State University biologists collected macroinvertebrate samples from the same 14 sites. The NC Ecosystem Enhancement Program (NCEEP) is restoring or enhancing stream reaches in the upper portion of the Big Harris watershed and these two sampling events (2009 and 2013) serve as pre-restoration information. The 2009 Big Harris benthic data was summarized in two previous WAT reports dated August 2009 (NCDWQ 2009b) and February 2011 (NCDWQ 2011a). The benthic sites sampled in 2009 and 2013 were a subset of 20 water quality sites that were monitored monthly for fecal coliform, total suspended solids, and nutrients (ammonia, Total Kjeldahl Nitrogen, nitrite+nitrate, and total phosphorus) from April 2009 through September 2010. This data is summarized in a WAT report prepared for NCEEP dated December 2013 (NCDWR 2013a). The benthic site numbers (map numbers) in this report are within the context of the larger watershed quality assessment.

Bioclassifications were not derived for the 2009 benthic sampling and the results were not entered into the BAB database since the lead agency in the benthic field collection effort, NC State University, was not considered a certified lab by NCDWR. The 2009 ratings mentioned in this report reflect bioclassifications that could have been assigned and small stream ratings were retroactively applied to the 2009 biotic index.

The 2013 sampling results were entered into the BAB database and can be used for use support. Small stream criteria for Piedmont streams were applied to determine classification for the 2013 sites less than three square miles. At present, small stream criteria apply to benthic samples collected in the months April, May, and June (NCDWQ 2009a). Macroinvertebrate sample sites for this study are listed in Table 1 and are shown on Figure 1.

Methods

The sites were sampled for macroinvertebrates using BAB's Qual 4 sampling protocol (NCDWR 2013b). The Qual 4 method is typically used for streams that have a drainage area of three square miles or less. The collection method is comprised of four samples including one riffle-kick, one bank/root mat sweep, one leaf pack, and visual collections. These collections are used to inventory the aquatic fauna and produce an indication of the relative abundance for each taxon. Organisms are identified to the lowest possible taxon and enumerated as Rare (1-2 specimens, denoted by "R" on taxa tables), Common (3-9 specimens, "C"), or Abundant (≥10 specimens, "A"). Several data analysis summaries (metrics) are calculated from the benthic data to facilitate the detection of physical habitat and/or water quality problems. These metrics are based on a long history of observations and studies that show unstressed streams and rivers have higher invertebrate diversity and a relatively high proportion of intolerant species. Taxa within the three EPT insect orders (Ephemeroptera, Plecoptera and Trichoptera) are generally intolerant of many kinds of pollution. Therefore, higher EPT taxa richness values indicate better water quality. Conversely, polluted streams have lower invertebrate diversity and are dominated by tolerant species.

Table 1. Macroinvertebrate sample sites in the Big Harris Creek watershed. May 2009 and 2013.

Map Number	*Site Location*	*Drainage area (square miles)*	*Latitude*	*Longitude*
0	UT Big Harris Creek upper end of goat farm	0.1	35.4032	81.6228
1	UT Big Harris Creek downstream goat farm at Fletcher Rd (SR 1820)	0.3	35.4012	81.6158
4	UT Big Harris Creek at Stick Elliot Rd (SR 1819)	0.8	35.3986	81.6077
5	Big Harris Creek below N. Royster Road	2.7	35.4068	81.6014
6	UT Big Harris Creek below N. Royster Road	1.5	35.4058	81.6026
8	UT Big Harris Creek above N. Royster Road	0.2	35.4076	81.6048
9	Big Harris Creek above N. Royster Road	0.9	35.4074	81.6049
13	Big Harris Creek at Stick Elliot Road (SR 1819)	0.7	35.4096	81.6116
14	Big Harris Creek at Kernohan property off Harris Creek Rd (SR 1817)	3.9	35.3996	81.5896
16	UT Big Harris Creek near horse pasture off Harris Creek Rd (SR 1817)	0.4	35.4034	81.5923
17	Little Harris Creek at Yates Road (SR 1821)	1.1	35.3804	81.5964
18	Little Harris Creek off Frank Grigg Road	0.7	35.3824	81.6024
19	Little Harris Creek at Bowen property	2.3	35.3789	81.5782
20	UT Little Harris Creek at Bowen property	0.5	35.3798	81.5782

The diversity of the invertebrate fauna is evaluated using taxa richness (i.e. the total number of distinct taxa present); the tolerance of the stream community is evaluated using a Biotic Index (derived from the general response of each taxon to the presence of stressors). Both tolerance values for individual taxon and the final biotic index values for the sample have a range of 0-10 with higher numbers indicating more tolerant taxa and more polluted conditions respectively.

Habitat Evaluation

Habitat evaluations were conducted at the 14 monitoring locations using the NCDWR BAB Habitat Assessment method for Mountain/Piedmont Streams (NCDWR 2013b) in 2009 and 2013. The habitat assessment assigns a numerical score from 1-100 for the reach of stream sampled, based on channel modification, instream habitat, bottom substrate, pool variety, riffle habitats, bank stability and vegetation, light penetration, and width of the riparian zone. More specifically, these habitat evaluations assess the quality and quantity of instream habitat, the quality and quantity of the stream's riparian zone, and also evaluate detrimental impacts on stream habitat such as bank erosion and substrate embeddedness. No criteria have been developed to rate habitat scores, but the higher the score, the better the overall habitat. Habitat submetrics for 2013 are depicted in Table 2.

Since no restoration work has begun at Big Harris, the habitat scores are similar for 2009 and 2013. In 2013, site #14 was evaluated for habitat at a location approximately 200 feet upstream from the 2009 location due to landowner pre-restoration repairs and may reflect some habitat differences.

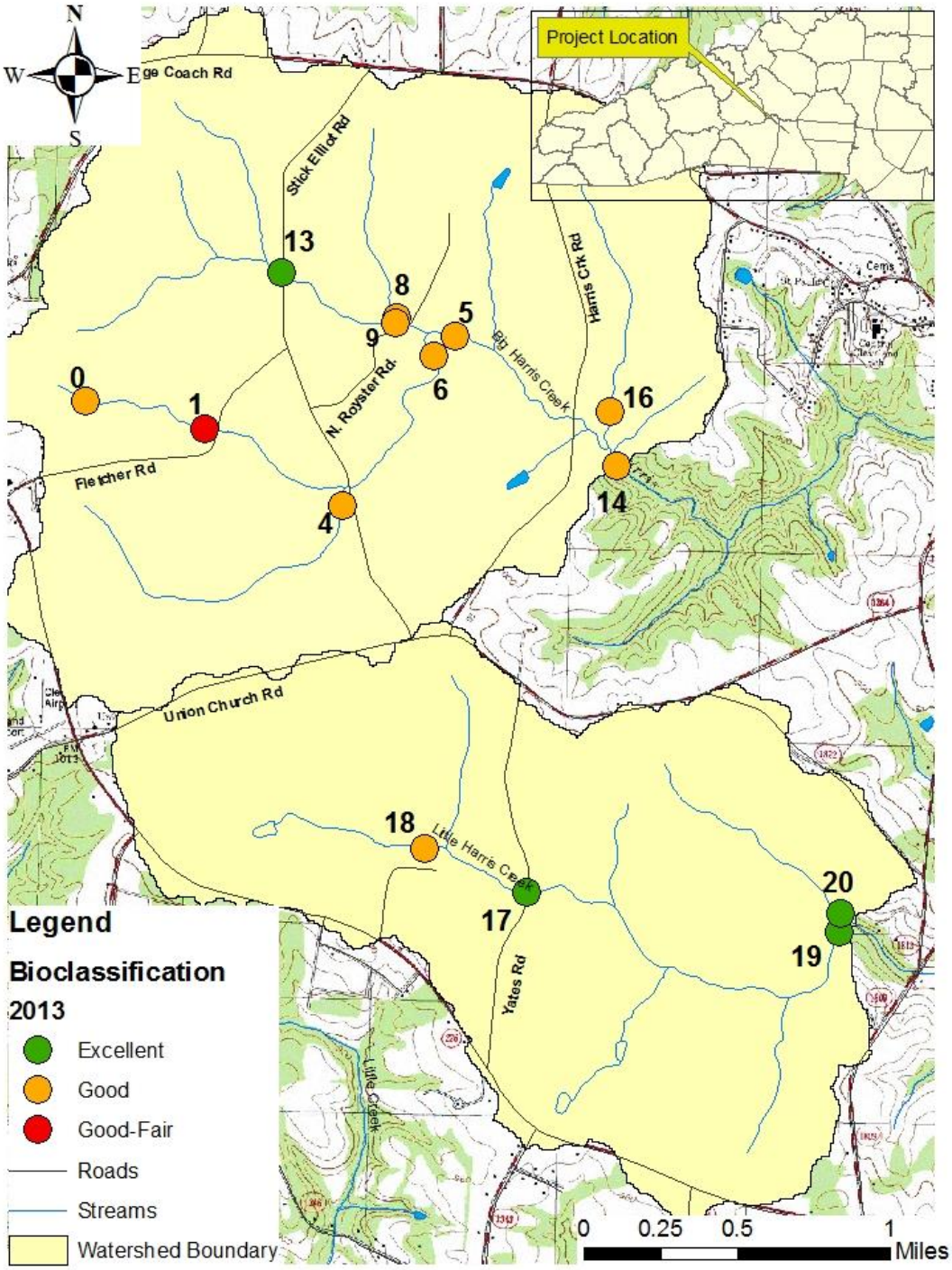

Figure 1. Map of benthic sample locations in the Big Harris Creek watershed 2009 and 2013.

Table 2. 2013 Habitat Results Big Harris Creek watershed, Broad River Basin, Cleveland Co.

	UT BHC upper end Goat Farm	UT BHC below Goat Farm	UT BHC Stick Elliot Rd	BHC below N Royster Rd	UT BHC below N Royster Rd	UT BHC above N Royster Rd	BHC above N Royster Rd	BHC at Stick Elliot Rd	BHC at Kernohan property	UT BHC nr horse pasture	L HC at Yates Rd	L.HC off Frank Grigg Rd	LHC at Bowen property	UT LHC at Bowen property
Map number (site number)	0	1	4	5	6	8	9	13	14	16	17	18	19	20
Sub-metric Habitat Scores														
Channel modification (5)	5	4	0	4	5	4	4	4	3	5	4	4	5	5
In-stream habitat (20)	12	12	12	14	14	16	12	12	12	14	14	14	16	16
Bottom substrate (15)	3	6	4	6	14	6	6	3	6	6	6	6	11	12
Pool variety (10)	4	8	4	6	8	8	10	6	8	8	8	6	8	10
Riffle habitats (16)	3	7	3	7	10	13	14	7	12	10	14	12	14	12
Bank stability/vegetation (14)	5	5	7	7	7	7	7	5	7	8	11	9	11	10
Light penetration (10)	7	7	7	5	10	7	10	10	10	10	7	7	7	10
Riparian zone width (10)	4	0	2	4	9	0	2	10	10	9	10	2	4	8
Total Habitat Score (range 0 to 100)	**43**	**55**	**39**	**53**	**77**	**61**	**65**	**57**	**68**	**70**	**74**	**60**	**76**	**83**
Average stream width (m)	1	5	3	3	4	2	3	3	4	1.5	5	2	5	2
Average stream depth (m)	2	6	3	5	6	4	5	8	4	2.5	6	3	7	6
Canopy (%)	60	70	70	70	75	70	60	90	60	70	80	0	80	70
Substrate (%)														
Boulder	10	15	5	10	10	0	10	15	5	0	40	10	15	20
Cobble	35	20	25	20	20	15	10	20	20	15	10	30	30	20
Gravel	50	20	30	25	20	40	20	30	25	35	40	20	20	25
Sand	5	35	30	30	20	35	30	30	45	40	10	40	30	35
Silt	0	10	10	15	15	10	15	10	5	10	0	0	5	0
Other	0	0	0	0	15	0	15	0	0	0	0	0	0	0
Physicochemical														
Temperature (ºC)	18.5	18.7	18.7	19.3	19.0	18.1	19.1	17.3	20.8	18.8	17.1	16.9	16.9	16.8
Dissolved oxygen (mg/L)	6.6	8.2	8.8	7.6	8.7	7.3	7.7	8.5	8.5	8.5	9.1	7.3	8.7	8.0
Specific conductance(µmhos/cm)	77	62	42	62	53	28	70	33	64	62	44	38	47	42
pH	5.9	5.7	5.8	6.6	5.9	6.3	6.2	6.0	6.0	6.2	5.7	5.9	5.6	5.5

Physical Chemical

Physical/chemical assessments were conducted during the macroinvertebrate sampling in 2013 and are shown in Table 2. All measurements were made in accordance with standard operating procedures (NCDWQ 2011b).

Site Descriptions and Results

A summary of the number of intolerant (EPT) taxa and the biotic index is provided in Table 3 for 2013. The BI's ranged from 3.77 to 5.71. Higher BI values indicate more tolerant benthic communities. Appendix 1. provides the relative abundances of each taxon.

Table 3. 2013 Macroinvertebrate Results. Big Harris Creek watershed (BHC), Broad River Basin, Cleveland Co.

	UT BHC upper end Goat Farm	UT BHC below Goat Farm	UT BHC ups Stick Elliot Rd	BHC below N Royster Rd	UT BHC below N Royster Rd	UT BHC above N Royster Rd	BHC above N Royster Rd	BHC ups Stick Elliot Rd	BHC below Harris Creek Road at Kernohan property	UT BHC off Fletcher Road nr horse pasture	L HC ups Yates Rd	L.HC off Frank Grigg Rd	LHC off Shelby Rd at Bowen property	UT LHC off Shelby Rd at Bowen property
Map number (site number)	0	1	4	5	6	8	9	13	14	16	17	18	19	20
Ephemeroptera (# taxa)	3	3	3	10	9	10	9	8	11	4	10	6	10	10
Plecoptera (# taxa)	1	0	3	5	2	2	4	3	4	2	5	3	5	4
Trichoptera (# taxa)	2	3	3	6	5	6	8	8	6	3	3	6	7	8
Total EPT	6	6	9	21	16	18	21	19	21	9	18	15	22	22
Odonata	3	3	3	4	5	5	6	5	7	6	4	4	7	5
Megaloptera	1	1	2	2	3	1	1	1	2	1	2	2	3	2
Coleoptera	3	3	3	4	4	5	4	3	8	2	4	2	7	3
Chironomidae	9	14	14	15	15	15	16	11	9	12	9	13	17	10
Non-Chironmidae diptera	5	7	3	5	4	10	6	2	5	3	7	5	7	6
Oligochaeta	1	2	2	3	2	1	2	1	0	1	1	1	2	1
Mollusca	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Other taxa	0	0	0	0	0	1	0	1	0	0	1	0	1	0
Total taxa richness	28	36	36	54	49	56	56	44	52	34	46	42	66	49
EPT abundance	8	8	22	68	30	35	103	67	61	19	73	66	83	67
EPT Biotic Index	2.09	5.06	3.60	4.23	3.90	4.59	3.34	3.25	3.62	3.59	3.07	3.64	3.13	3.04
NCBI 2013	4.88	5.71	4.84	4.71	4.95	5.18	4.35	4.09	4.67	4.73	3.89	4.44	4.11	3.77
2013 Bioclassification	Good	Good-Fair	Good	Good	Good	Good	Good	Excellent	Good	Good	Excellent	Good	Excellent	Excellent
NCBI 2009 *	4.60	5.75	4.45	4.94	4.17	4.61	5.65	4.70	4.29	3.82	4.15	4.14	4.30	3.84

* 2009 BI not for use support. For comparison only.

All sites were sampled in May for 2009 and 2013 for the taxa descriptions below.

UT Big Harris Creek off Fletcher Road (upper end of goat farm) Map# 0

Only six EPT taxa were collected at this site in 2013 as compared to twelve in 2009. The taxa that were collected in 2013 were fairly intolerant, but were very low in diversity and abundance. The EPT taxa were *Habrophlebia vibrans*, *Habrophlebiodes*, *Maccaffertium modestum*, *Eccoptura xanthenes*, *Diplectrona*, and *Lepidostoma*. Only one individual stonefly (*E. xanthenes*) was collected in 2013 and in 2009 (*Leuctra*). The largest decline from 2009 to 2013 was in the number of mayfly taxa from eight to three. The 2013 BI was 4.88 and the 2009 BI was 4.60, indicating a decline in the benthic community. Based on small stream criteria, this site rated Good in 2009 and 2013.

UT Big Harris Creek ups Fletcher Road (lower end of goat/cow farm) Map# 1

Six EPT taxa were collected in 2013 as compared to none in 2009. No stoneflies were collected in 2013, but three mayfly taxa (*Baetis flavistriga*, *Maccaffertium modestum*, *Acerpenna macdunnoughi*) and three caddisfly taxa (*Pycnopsyche, Cheumatopsyche, Neophylax oligius*) were collected. The taxa were moderately tolerant and Rare in abundance. The 2013 BI was 5.71 and the 2009 BI was 5.75. This site had the highest BI of all the sampling locations in both years and rated Good-Fair in 2009 and 2013.

UT Big Harris Creek ups Stick Elliot Road Map# 4

Nine EPT taxa were collected in 2013 as compared to fifteen EPT taxa in 2009. The number of mayfly, stonefly, and caddisfly taxa all decreased, with the most notable decreases in the number of stonefly and mayfly taxa. The predominant taxa in 2013 were the high number of midge taxa (14) as compared to other less tolerant taxa. The 2013 BI was 4.84 and the 2009 BI was 4.45, indicating that the benthic community was slightly more tolerant in 2013. This site rated Good in both sampling years.

Big Harris Creek below N. Royster Road Map# 5

Twenty-one EPT taxa were collected in 2013 including mostly moderately tolerant taxa and some intolerant taxa. The most abundant taxa at this site included the mayflies *Teloganopsis deficiens, Baetis flavistriga, and Maccaffertium modestum*. Twenty-four EPT taxa were collected at this site in 2009. In 2009, the benthic community at this site was better than the upstream community on Big Harris Creek, but this did not hold true for the 2013 sample. The BI was 4.71 in 2013 and was 4.94 in 2009. This site rated Good for both years.

UT Big Harris Creek below N. Royster Road Map# 6

The number of EPT taxa declined to 16 in 2013 from 27 in 2009. Although the number of mayfly and caddisfly taxa declined, the most significant decline was in the number of stonefly taxa. In 2009, six stonefly taxa were collected and in 2013, two (*Isoperla holochlora* and *Perlesta*) were collected. The BI was 4.17 in 2009 and increased to 4.95 in 2013. This increase was enough to lower the bioclassification from Excellent to Good.

UT Big Harris Creek above N. Royster Road Map# 8

The number of EPT taxa remained fairly constant in this small tributary. Eighteen EPT taxa were collected in 2013 and nineteen were collected in 2009. Ten mayfly taxa, two stonefly taxa, and six caddisfly taxa were collected in 2013. Most of the taxa were moderately tolerant to tolerant. The 2013 biotic index was 5.18, higher than in 2009 (4.61). The rating remained the same; Good. Although the specific conductance was not elevated at the time of sampling in 2013, this site has demonstrated chronic elevated conductance and nitrite-nitrate levels (NCDWR 2013a).

Big Harris Creek above N. Royster Road Map# 9

There were 21 EPT taxa collected in 2013 as compared to 15 in 2009. Staff noted abundant worms at this site and the substrate and macroinvertebrates were coated in fine sediment and filamentous strands of plant material. The 21 EPT included nine mayfly taxa, four stonefly, and eight caddisfly taxa. The community was moderately tolerant with more intolerant taxa than in 2009. 2013 intolerant taxa included *Habrophlebiodes*, *Habrophlebia vibrans*, *Eccoptura xanthenes*, *Isoperla holochlora*, *Dolophilodes, and Neophylax atlanta*. The 2013 BI was 4.35 which was much lower than the 2009 BI of 5.65. The lower BI in 2013 improved the bioclassification from Good-Fair to Good.

Big Harris Creek ups Stick Elliot Road Map# 13

Nineteen EPT taxa were collected in 2013 and 2009. Both years, the EPT taxa included eight mayfly taxa, 3 stonefly taxa, and 8 caddisfly taxa both years. The abundant taxa at this location were the mayflies, *Maccaffertium terminatum, Habrophlebiodes, the stonefly Lectra, and the caddisfly, Neophylax atlanta*. The long-lived stonefly, *Eccoptura xanthenes*, was collected again as in 2009, indicating year round water flow. The 2013 BI at this site was 4.09, which was lower than the 2009 BI (4.70). The rating improved from Good to Excellent.

Big Harris Creek at Kernohan property Map# 14

Twenty-one EPT taxa were collected at this most downstream site on Big Harris in 2013. Twenty-five EPT taxa were collected in 2009. In both years, the benthic community was a mixture of intolerant and moderately tolerant taxa. Although Rare in abundance, several taxa were collected at this site that were not collected at the other sites. These included *Danella simplex, Serratella serrata*, and *Tiaenodes ignitus*. The drainage area is 3.9 square miles and this is the only site that is too large for small stream criteria. Based on the total EPT taxa, the bioclassification in 2013 and 2009 was Good.

UT Big Harris Creek near horse pasture Map# 16

The number of EPT taxa declined at this small tributary from 23 in 2009 to 9 in 2013. This was a significant decline in the number of taxa. Decreases occurred in the number of mayfly, stonefly, and caddisfly taxa. *Ephemerella invaria*, *E. dorothea*, *Ameletus lineatus*, and *Isoperla namata*, were all Abundant in 2009, but were not collected in 2013. The 2013 BI was 4.73 and the 2009 BI was 3.82. This was the lowest BI of the 14 sites in 2009 and was considered to have to most intolerant benthic community of all the sites. The bioclassification declined to Good in 2013 from an Excellent rating in 2009.

Little Harris Creek at Yates Road Map# 17

Eighteen EPT taxa were collected in 2013 as compared to twenty-five EPT taxa in 2009. The number of caddisfly taxa declined from ten to five in 2013. The caddisflies *Chimarra*, *Diplectrona modesta, Lepidostoma, Ironoquia punctissima, Pycnopsyche gentilis*, and *Rhycophila carolina* were collected in 2009, but not in 2013. Although the number of EPT taxa declined, the BI decreased from 4.15 in 2009 to 3.89 in 2013. This site rated Excellent in both years.

Little Harris Creek off Frank Grigg Road Map# 18

Fifteen EPT taxa were collected at this small site as compared to twenty five in 2009. The number of mayfly taxa decreased from ten to six and caddisfly taxa declined from eleven to six. *Eccoptura xanthenes* and *Maccaffertium modestum* were abundant in both years, indicating year round flow. The BI was 4.44 in 2013 and 4.14 in 2009. This increase in BI caused the bioclassification to decline from Excellent to Good.

Little Harris Creek at Bowen property Map# 19

In 2013, 22 EPT taxa were collected as compared to 30 EPT taxa in 2009. The most notable decline in taxa was the decrease in mayflies from 16 to 10. In 2009, this site had the highest number of EPT taxa for all of the 14 sites. As in 2009, *Acroneuria abnormis* and *Eccoptura xanthenes* which are both long lived stoneflies and indicators of good, stable water quality were both collected in 2013. Although the number of EPT taxa declined, the BI was lower in 2013 (4.11) than in 2009 (4.30). The rating was Excellent for both sampling years.

UT Little Harris Creek at Bowen property Map# 20

The number of EPT taxa collected at this site remained fairly constant from 2009 to 2013. Twenty-two EPT taxa were collected in 2013 and twenty-three EPT taxa were collected in 2009. In both years the BI was low; 3.77 in 2013 and 3.84 in 2009. The macroinvertebrate community rated Excellent in 2009 and 2013.

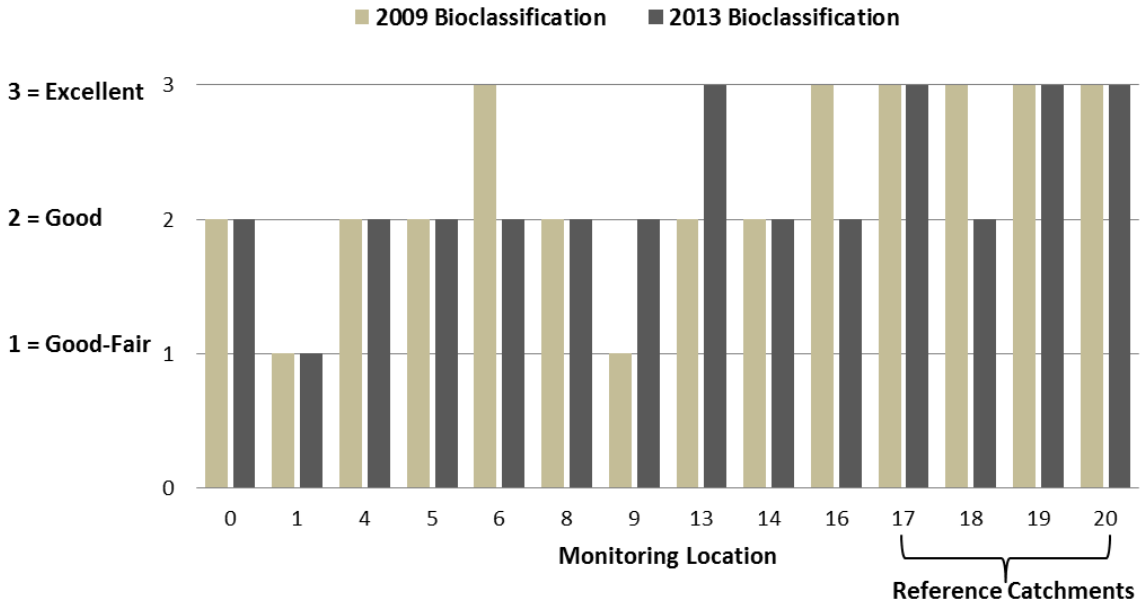

Figure 2. 2009 and 2013 Bioclassifications for the Big Harris macroinvertebrate sites.

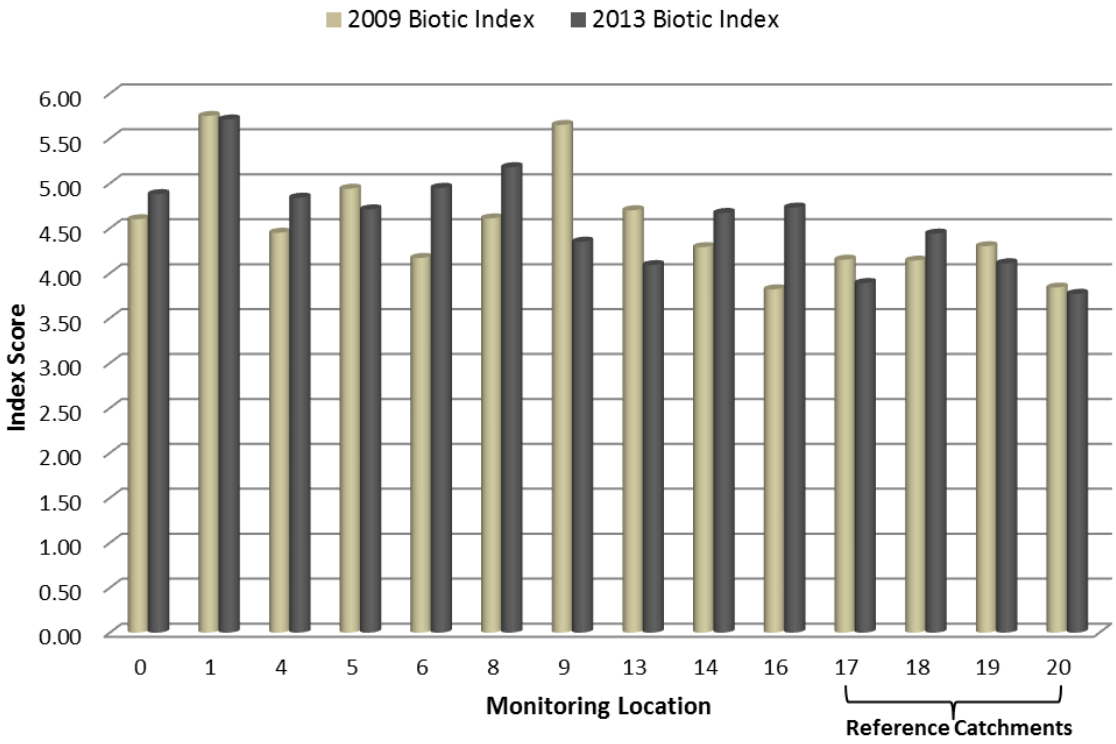

Figure 3. Figure 3. 2009 and 2013 Biotic Index for the Big Harris macroinvertebrate sites.

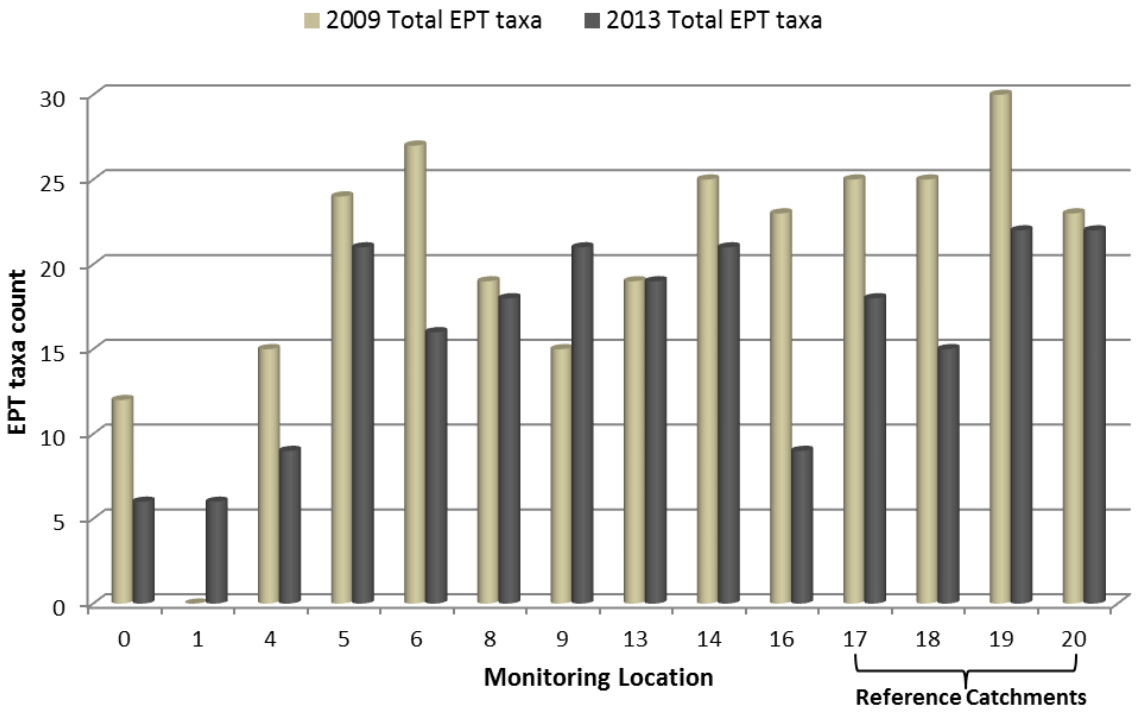

Figure 4. 2009 and 2013 Total EPT Taxa for the Big Harris macroinvertebrate sites.

Conclusions

Note: The 2009 ratings that were mentioned throughout this report and used for comparison to the 2013 ratings are not intended for Use Support. The 2009 ratings were derived by applying the small stream criteria retroactively.

For 2013, nine sites were rated as Good, one was Good-Fair, and four were Excellent.

Nine of the fourteen sites retained the same bioclassification from 2009 to 2013 (sites 0, 1, 4, 5, 8, 14, 17, 19, and 20). Three sites declined in rating (sites 6, 16, and 18) and two sites improved (sites 9 and 13).

Overall, the nutrient levels in the Little Harris watershed were lower than in the Big Harris watershed (NCDWR 2013a). Site 18, located in the upper portion of Little Harris Creek, demonstrated higher nutrient levels than the other water quality monitoring locations in the Little Harris watershed (NCDWR 2013a).

The most impacted macroinvertebrate community in 2013 and 2009 was found at site 1, below the goat/cow farm on UT Big Harris Creek. Site 1 had the highest BI (5.71 and 5.75) for both years. It appears that the farm is having a negative effect on the water quality of UT Big Harris Creek. The Pre-Construction Water Quality Monitoring Report identified this UT Big Harris as an area where nutrients were comparatively higher relative to other sites in this study (NCDWR 2013a).

In 2013, the second worse site for benthic macroinvertebrates was 8, the UT to Big Harris above N. Royster Road. This corresponds to the elevated nutrients (NO_2+NO_3) and specific conductivity values as reported in the Pre-Construction Water Quality Monitoring Report (NCDWR 2013a).

Two sites that appreciably improved were site13 and site 9. Site 13 is located in the headwaters of Big Harris where the nutrients and specific conductance were typically lower (NCDWR 2013a). There is no apparent reason as to why site #9 improved.

According to the NCDWR BAB sampling protocol, regardless of sampling technique, there are five major benthic macroinvertebrate community metrics that are employed in the analysis of lotic systems. These are: Total Taxa Richness (S), EPT Taxa Richness (EPTS), EPT Abundance (EPTN), Biotic Index (BI), and EPTBI (NCDWQ 2006a). Combined, these data suggest that the Biotic Index (BI) is the most powerful and precise metric (among the five metrics analyzed) for the establishment of biocriteria for streams with drainage areas less than or equal to 3.0 square miles in North Carolina's Piedmont and Mountains (NCDWQ 2009a).

Taking the above statements into consideration, the 14 Big Harris sites for 2013 are ranked in order of decreasing (best to worst) macroinvertebrate community integrity. For the most part, the sites are ranked according to the BI.

1. UT Little Harris Creek (site #20)
2. Little Harris Creek at Yates Road (site #17)
3. Big Harris Creek at Stick Elliot Road (site #13)
4. Little Harris Creek at Bowen property (site #19)
5. Big Harris Creek below N. Royster Road (site #9)
6. Little Harris Creek off Frank Grigg Road (site #18)
7. Big Harris Creek at Kernohan property (site #14)
8. Big Harris Creek below N. Royster Road (site #5)
9. UT Big Harris near horse pasture (site #16)
10. UT Big Harris Creek at Stick Elliot Road (site #4)
11. UT Big Harris Creek at upper end of goat/cow farm (site #0)
12. UT Big Harris Creek below N. Royster Road(site #6)
13. UT Big Harris Creek above N. Royster Road (site #8)
14. UT Big Harris Creek below goat/cow farm (site #1)

References

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NCDWQ. 2011b. Standard Operation Procedures Manual: Physical and Chemical Monitoring. NC Department of Envrionment and Natural Resources Division of Water Quality Environmental Sciences Section. November 2011.

NCDWR. 2013a. Pre-Construction Water Quality Monitoring report for Big Harris Creek Restoration Project-Cleveland County. Prepared by Division of Water Resources, Watershed Assessment Team. December 2013.

NCDWR. 2013b. Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates. NC Division of Water Resources – Biological Assessment Branch. December 2013. (Version 4.0)

Appendix 1. List of taxa collected in Big Harris Creek watershed, Spring 2013.

	UT Big Harris Cr off SR 1820 (0)	UT Big Harris Cr off SR 1820 dns cow/goat farm (1)	UT Big Harris Cr ups SR 1819 Stick Elliot Rd (4)	Big Harris Cr below N Royster Rd (5)	UT Big Harris Cr below N Royster Rd (6)	UT Big Harris Cr ups N Royster Rd (8)	Big Harris Cr ups N Royster Rd (9)	Big Harris Cr ups SR 1819 Stick Elliot Rd (13)	Big Harris Cr dns SR 1817 Kernohan propertyY (14)	UT Big Harris Cr off SR 1817 dns horse pasture (16)	L Harris Cr ups SR 1821 Yates Rd (17)	L Harris Cr off Frank Grigg Rd (18)	L Harris Cr off SR 1813 Shelby Rd (19)	UT L Harris Cr off SR 1813 Shelby Rd (20)
Ephemeroptera														
Acerpenna macdunnoughi		R						R						R
Baetis flavistriga		R		A	R	A	R	R		R				
Baetis intercalaris													C	
Baetis pluto			R	C	R	R	C	C	R	C	A	C		C
Diphetor hageni														R
Plauditus dubius gr				C						R	R		A	
Dannella simplex									R					
Ephemerella dorothea														R
Eurylophella bicolor											R			
Eurylophella funeralis						R	R		R		R		R	
Eurylophella verisimilis				C	C	C	A	R	A			R	A	C
Serratella serrata									R					
Telagonopsis deficiens				A	C	R	A		A		R		C	
Epeorus vitreus					R								R	R
Maccaffertium modestum	R	C	C	A	C	C		C	A	C	A	A	A	C
Maccaffertium pudicum				R			A						R	
Maccaffertium terminatum							A	A						A
Stenacron interpunctatum				C	C				R					
Stenacron pallidum				R	R	R					A	R	R	
Isonychia spp			R	R					R					
Habrophlebia vibrans	C					R	R	R			R	R		C
Habrophlebiodes spp	R				R	C	A	A	R		C	A	R	A
Paraleptophlebia spp						R			R		R			
Plecoptera														
Leuctra spp				R			A	A	R		A	C	A	C
Amphinemura spp			R											R
Acroneuria abnormis													C	R

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Eccoptura xanthenes	R		C	R			R	C	C	C	C	A	R	C
Perlesta spp			R	C	R	R	R	C	A		C		A	
Isoperla holochlora					C	R	C		R		C		C	
Isoperla nr holochlora				R										
Isoperla nr namata											R			
Remenus bilobatus				R						R		R		
Trichoptera														
Cheumatopsyche spp		R		C	R	R			R		R		R	
Diplectrona modesta	R						R	R		R				R
Hydropsyche betteni				C	C	R	A	R	R			R	C	R
Lepidostoma spp	R							R				C	R	C
Triaenodes ignitus									R					
Ironoquia punctatissima			R											
Pycnopsyche spp		R		C	R	R	C	C		C		R	C	C
Psilotreta frontalis								R				R		
Chimarra spp				R			R							
Dolophilodes spp				C	C		C		R					R
Rhyacophila carolina						R	R	R	R				C	
Rhyacophila fuscula														R
Neophylax atlanta			R			C	A	A			C	A	R	C
Neophylax oligius		R	A	C	R	R	C	C	C	C	A	A	C	A
Odonata														
Aeshna spp	C													
Boyeria grafiana									R					
Boyeria vinosa				R	C	R	R		R	R			R	
Calopteryx maculata						C					R			
Calopteryx spp	C	C	C	C	R		C	C		C		R	C	C
Argia spp						C	R							
Enallagma spp									R				R	

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Cordulegaster erronea						R								
Cordulegaster spp	C							C		C		R	R	R
Erpetogomphus designatus									R					
Gomphus spp					R		R	R		R	R		R	
Hagenius brevistylus									R					
Lanthus spp		R	R	C			R	C		C		R	C	R
Lanthus vernalis						R					C			
Ophiogomphus spp		R	R	C			C	C	A	C	C	R	C	R
Progomphus obscurus					R									
Stylogomphus albistylus									R					C
Macromia spp					R									
Megaloptera														
Corydalus cornutus				R	R				C				R	
Nigronia fasciatus	R	R	R		R	R		R	R		C	C	R	R
Nigronia serricornis			R	R	C		C			R	R	C	C	
Sialis spp														R
Coleoptera														
Helichus basalis									R					
Helichus fastigiatus									C					
Helichus spp	C	R	R	R	C	R	C	C		C	C	C	A	A
Acilius spp									R					
Ilybius spp									R					
Neoporus spp		C		C		R							R	R
Ancyronyx variegatus					R									
Macronychus glabratus					R				R				C	
Stenelmis spp	R	R	R	R		C	R	C	R	R	R		R	
Dineutus spp						A								
Gyrinus spp					R								R	
Helocombus spp									R					

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Ectopria nervosa							R				R			
Psephenus herricki													R	
Anchytarsus bicolor	R		R	R		A	R	C	R		A	C	R	C
Diptera, chironomids														
Ablabesmyia mallochi	R													
Brillia spp	R	C	R	R	C		C		R	R	R	R	C	
Cardiocladius spp							R						R	
Chironomus spp	C	A	C	C	R	C	A		C		C		R	
Corynoneura sp C					R								C	
Cricotopus annulator complex					C	C		R	R					
Cricotopus bicinctus			C	R	R	A				R			R	
Cricotopus infuscatus			R		R									
Cricotopus infuscatus gr							R							
Dicrotendipes neomodestus										R				
Eukiefferiella claripennis gr	C	R	R	R		R				R				
Limnophyes spp												R		
Micropsectra spp	A	A			C		A			R		R	R	
Microtendipes pedellus gr						R			R					
Microtendipes spp		R		C									C	C
Nanocladius alternantherae							R	R		R			R	R
Nanocladius sp 5												R		
Nanocladius spp							R				R			
Nilotanypus fimbriatus						R								
Odontomesa fulva		R												
Parakiefferiella sp F								R						
Parametriocnemus spp	R	C	A	A	A	C	A	A	A	C	A	A	A	C
Paraphaenocladius spp				R										
Pentaneura inconspicua		R			R			R						
Phaenopsectra obediens gr		A	R		C	C			C		C		C	

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Polypedilum aviceps	R	R	R	C	C	A	A	C		C	C	C	C	C
Polypedilum fallax/sp A		R			R		C					R		
Polypedilum flavum						C								
Polypedilum halterale gr							R	R				R		
Polypedilum illinoense gr		C	C	R	C			R		R		C	C	
Polypedilum scalaenum gr			R						C			C		R
Polypedilum tritum							R				C			
Psectrocladius sordidellus gr				C			A							
Psectrocladius spp													R	
Psilometriocnemus triannulatus			R											
Rheocricotopus eminellobus					A				R					R
Rheocricotopus spp						A								
Rheocricotopus tuberculatus				R										
Rheotanytarsus spp				R				R		R		R	R	
Tanytarsus sp 3						R								
Tanytarsus sp C														R
Tanytarsus sp D				R									R	
Thienemaniella spp						C								
Thienemaniella xena			R				C			R				R
Thienemannimyia gr	C	A	R	C		C	C	R	C		C	C	R	R
Tribelos spp	A						R			R				
Tvetenia bavarica gr		C	C	A	R	A		C			R	R	C	R
Diptera, other														
Palpomyia complex			R	R	R	C	R				R	C	C	R
Anopheles spp						R								
Dixa spp	R	C	A	C	C	A	C		C	C	R	R	C	A
Dixella indiana	C	C				C	R						R	
Psychoda spp						R								

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Simulium spp	A	A		A	A	R	A	A	A	A	A	A	A	A
Simulium venustum						A			C		R			
Chrysops spp						R								
Antocha spp		R		R							A		C	
Dicranota spp	R	R					R	R			R	C	R	C
Hexatoma spp									R					R
Pilaria spp	C	R												
Pseudolimnophila spp						R								
Tipula spp		R	C	C	C	R	R		C	C	R	R	C	R
Oligochaeta														
Lumbriculidae			R	C		A	A	R			R		R	
Megadrile oligochaete	C	C	R	C	R		C			R			R	
Nais spp				C								R		R
Ilyodrilus templetoni					R									
Tubificidae		R												
Crustacea														
Cambaridae								R						
Cambarus (C.) bartonii bartonii											R			
Bivalvia														
Pisidium spp								R						
Other														
Placobdella multilineata						R								
Hydracarina													C	