

**UT to Hominy Creek Stream Mitigation Site
TIP No. I -5402
Water Sampling and Benthic Macroinvertebrate Survey**

Haywood County, North Carolina

Monitoring Year 3 Report (MY-03)



**The North Carolina Department of Transportation
Project Development and Environmental Analysis Unit
Natural Environment Section**

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1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT) is monitoring benthic macroinvertebrate (BMI) communities at the Unnamed Tributary (UT) to Hominy Creek Stream Mitigation Site, related to impacts associated with TIP No. I-5402 in Haywood County, North Carolina. The project includes two sites, SA and SE, where stream mitigation has been performed through riparian buffer plantings and stream channel design (Figure 1). NCDOT personnel conducted the baseline BMI data collection in the summer of 2012 (Appendix C). Stream enhancement and restoration construction was completed in 2014. Three Oaks Engineering (Three Oaks) personnel conducted the MY-03 water sampling and benthic macroinvertebrate surveys on July 20, 2016. UT to Hominy Creek is a tributary to Hominy Creek and is located within U.S. Geological Survey (USGS) Hydrologic Unit (HU) 0610105, of the French Broad River Basin.

2.0 SITE DESCRIPTIONS

Collections of benthic macroinvertebrates were made from two sampling locations: Site SA, Site SE (Appendix A, Figure 1). See Appendix C for MY-03 site photos.

Site SA. Site SA is the most downstream site located on UT to Hominy Creek. The stream had a steep gradient with riffle pool sequence throughout. The top of bank width ranged from 1 to 3 meters (m) with a bank height of 1 m from the deepest part of the channel to the top of bank. At the time of the survey, the wetted width of the channel was approximately 1 m, with a water depth ranging from 0.2 to 0.5 m. Flow conditions were normal and the channel was wetted with little to no substrate exposed. Substrate was composed of boulder, cobble, gravel, sand, and silt. Very little aquatic vegetation was present in the channel. The riparian buffer was narrow with some mature trees in the lower portion of the reach and more shrubs and grasses in the upper portion of the reach.

Site SE. Site SE is located approximately 200 m upstream of Site SA on a separate tributary flowing into UT to Hominy Creek. In contrast to Site SA, this site had a riparian buffer composed mainly of grasses and herbaceous vegetation (i.e. *Impatiens capensis*). Canopy tree species planted in 2014 within the stream buffer were observed. Stream wetted width ranged from 0.5 to 0.75 m. The water depth was very shallow throughout the site ranging from approximately 0 to 1 inches. Bank height from the deepest part of the channel to the top of bank was approximately 0.5 to 1 m. Flow conditions were normal and the channel was wetted with little to no substrate exposed. Stream habitat consisted of a shallow run throughout with no pools. The stream gradient was very steep just before a culvert near the confluence with UT to Hominy Creek. The substrate was mainly small gravel, sand, and silt underlain with bedrock.

3.0 METHODOLOGY

3.1 BMI Sampling

The BMI and water quality MY-03 surveys were conducted for Site SA and SE on July 20, 2016, by Chris Sheats and Nathan Howell of Three Oaks Engineering.

3.1.1 Field Methods

Water quality monitoring programs have been implemented by North Carolina Department of Environmental Quality (NCDEQ, formerly the NC Department of Environment and Natural Resources, NCDENR) Division of Water Resources (NCDWR) to assess water quality trends in North Carolina. One method used is the monitoring of BMI, or benthos, to assess water quality by sampling for selected organisms. The species richness and overall biomass, as well as the presence of various benthic groups intolerant of water quality degradation, are reflections of water quality.

Due to the extremely small size of the stream, benthic samples were collected by visual methods and sweep netting where possible. Each monitoring station was sampled utilizing methods described in the NCDWR's *Standard Operating Procedures for Benthic Macroinvertebrates, Biological Assessment Branch, Version 5.0* (NCDEQ 2016). Samples were preserved in the field with 90% ethyl alcohol and delivered to Pennington & Associates, Inc. Benthos Collection Cards and Habitat Assessment Field Data Sheet for Mountain/Piedmont Streams were completed for each sampling site (Appendix D). Additionally, each monitoring station was assessed according to the Army Corps of Engineers (ACOE) Stream Quality Assessment Worksheet (Appendix E).

3.1.2 Water Chemistry

Water chemistry was measured at each site in conjunction with BMI sampling. Parameters measured were temperature, dissolved oxygen (DO), specific conductivity, and pH (Tables 3-4).

3.1.3 Sample Processing

BMI were sorted from debris, counted, and identified to the lowest taxonomic level with macroscopic techniques and taxonomic keys (Tables 4-5, Appendix B). Specimens are maintained by Pennington & Associates, Inc. Please note that a different company was used to determine benthic species for MY-03, therefore, the results are presented in a slightly different format from MY-01 and MY-02.

3.1.4 Data Analysis

Analysis of, and comparison between, the BMI communities at each site were determined with established indices and metrics described in the *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0*. (NCDEQ 2016). The metrics used in this evaluation included the total taxa richness, and Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa richness. Other information used in the analysis included Habitat Assessment Field Data Sheet scores, benthos collection cards, ACOE Stream Quality Assessment Worksheet, observations, and best professional judgment (Table 3). The primary output was a taxa list, with some indication of relative abundance for each taxon.

Several data-analysis summaries (metrics) can be produced from such samples to evaluate biological conditions. These metrics are based on the idea that unstressed streams and rivers have

many invertebrate taxa and are dominated by intolerant species. Conversely, polluted or otherwise stressed streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts. The tolerance of the stream community is evaluated using a BI.

Total taxa, EPT taxa richness, were compared between preconstruction and post construction and between sites. A BI was derived from post construction survey data for Site SA. In general, higher EPT taxa richness values and lower BI values usually indicate better stream quality. BI ratings range from 1-10 with a score of 1 generally reflecting high stream quality based on benthic macroinvertebrate diversity and habitat availability while a higher score generally reflects lower stream quality.

4.0 RESULTS

4.1 BMI Community Analysis

The taxa list, analysis metrics, and additional laboratory data for MY-01, MY-02, and MY-03 are presented in Appendix B. The taxa list and Table 1 compiles the analysis metrics created from data collected.

Table 1. BMI Analysis Metrics

Sampling Year	MY-00 (2012) *		MY-01 (2014)		MY-02 (2015)		MY-03 (2016)	
	SA	SE	SA	SE	SA	SE	SA	SE
Total Taxa Richness	18	-	19	13	21	17	48	27
EPT Taxa Richness	11	-	14	7	13	7	19	9
Biotic Index Value**	-	-	1.8	2.2	1.9	1.9	2.66	3.86

*Due to the small nature of the stream only Total Taxa Richness and EPT Taxa Richness were determined

**Biotic Index values were determined to compare between sites SA and SE

4.2 Physicochemical Analysis

Water chemistry data measured are listed in Table 2.

Table 2. Physicochemical Data

Sampling Year	MY-00 (2012)		MY-01 (2014)		MY-02 (2015)		MY-03 (2016)	
	SA	SE	SA	SE	SA	SE	SA	SE
Water Temp (°C)	19.8	20.2	17.3	17.2	19.3	18.2	19.3	17.3
pH	6.4	-	7.26	8.45	7.41	7.8	7.62	8.0
Dissolved Oxygen (DO) (mg/L)	8.1	8	8.35	7.07	7.51	8.07	9.03	8.4
Specific Conductivity (uS/cm)	147	292*	161	334*	181	401*	155.7	465.3

*May be due to smaller stream size and/or runoff from I-40

4.3 Habitat Assessment Scores

Habitat scores were determined using the Habitat Assessment Field Data Sheet for Mountain/Piedmont Streams and are shown in Table 3. These visual-based habitat evaluation scores consist of eight parameters that rate channel modification, instream habitat, bottom

substrate, pool variety, riffle habitat, bank stability and vegetation, light penetration, and riparian vegetation zone width for each sampling reach. A numerical score is used to rate each parameter and the total score gives a relative measure of overall habitat quality (Appendix D). ACOE Stream Quality Assessment Worksheets were completed resulting in a Total Score of 73 and 50 for Site SA and SE, respectively. These scores reflect the presence of similar conditions during MY-01 and MY-02. The scores are based on a 100-point scale with a higher score generally reflecting higher stream quality.

Table 3. Habitat Assessment Scores

Sampling Year	MY-00 (2012)		MY-01 (2014)		MY-02 (2015)		MY-03 (2016)		Maximum Points
	SA	SE	SA	SE	SA	SE	SA	SE	
Channel Modification	5	5	3	3	3	3	4	3	5
Instream Habitat	7	7	15	15	12	15	20	15	20
Bottom Substrate	3	3	8	8	8	8	8	15	15
Pool Variety	4	0	10	0	10	0	10	4	10
Riffle Habitats	14	0	16	16	16	16	16	16	16
Bank Stability and Vegetation	6	5	12	9	12	12	12	2	14
Light Penetration	8	10	7	2	7	2	7	2	10
Riparian Vegetation Zone Width	4	6	8	10	8	10	8	10	10
Total	51	36	79	63	76	66	85	75	100

5.0 DISCUSSION/CONCLUSIONS

The benthic macroinvertebrate fauna, physiochemical properties, and habitat were analyzed to produce total taxa richness and EPT taxa richness. These values are very similar to those from last year and indicate high stream quality for both sites.

Water quality parameters measured were temperature, pH, DO, and specific conductivity. According to the NCDENR and U.S. Environmental Protection Agency (EPA) Water Quality Standards Table, all sites have pH and DO levels within the appropriate range for freshwater aquatic life. The pH range for freshwater aquatic wildlife is between 6 and 9 (NCDENR 2013). The DO levels for all sites were above the minimum standard of 5.0 mg/L ranging from 8.4-9.03 mg/L (NCDENR 2013). Specific conductivity readings within rivers in the United States generally range from 50 to 1500 $\mu\text{S}/\text{cm}$ (EPA 2012). Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a specific conductivity range between 150 and 500 $\mu\text{S}/\text{cm}$ (EPA 2012). Site SA and SE had results between 155-465 $\mu\text{S}/\text{cm}$. Overall water chemistry is within similar range as previous years.

Habitat assessment scores continue to reflect higher quality habitats in Site SA with lower quality habitat in Site SE. Site SE has very little shading and lacks habitat that provides structure for benthic colonization. The taxa richness for Site SA is the highest to date with an

EPT taxa richness of 19. Although Site SE had a lower EPT taxa richness than Site SA, Site SE had a higher taxa richness of 9 as compared to previous sampling years. These streams contain intolerant species, as evidenced by the low biotic index values.

For the 2016 sampling, additional macroscope and hand lens search efforts were conducted in the laboratory to find and identify the smaller taxa that would likely be missed with the naked eye during field picks. Taxa such as most of the small Oligochaetes and many of the chironomids were found and identified. Although the number of individuals was greater in 2016 as compared to the field picks from 2014 and 2015, the biotic index remains in the same range as previous sampling years.

This data provides MY-00, MY-01, and MY-02 post construction conditions for aquatic community parameters in the project area that can be used to monitor changes in water quality over time.

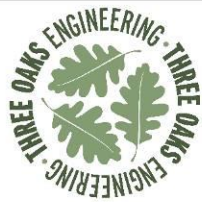
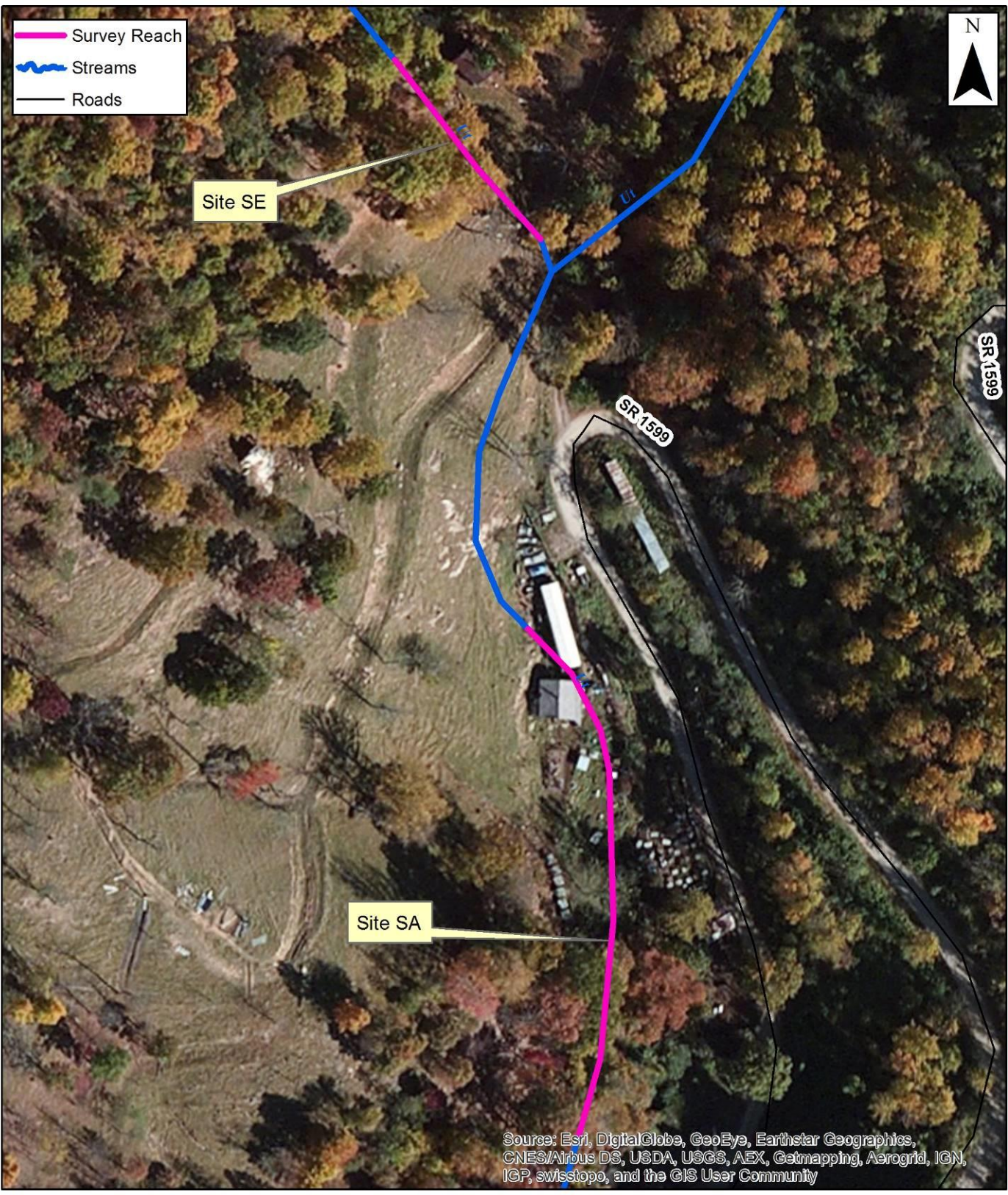
6.0 LITERATURE CITED

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Appendix A.
BMI Survey Site Location Map



UT to Hominy Creek Stream Mitigation Site (TIP I -5402)

Water Sampling and Benthic Macroinvertebrate Survey
Haywood County, North Carolina

Date:	August 2016
Scale:	0 45 90 Feet
Job No.:	3364

Figure

1

Appendix B.
BMI Survey Results

Table 4. MY01 and MY02 Taxa list with indications of relative abundance for sites SE and SA. R=Rare (1-2), C=Common (3-9), A=Abundant (>9)

Taxa	Sites:	8/14		7/15	
		SE ¹	SA	SE ¹	SA
EPHEMEROPTERA					
<i>Maccaffertium meririvulanum</i>		-	A	-	A
<i>Epeorus dispar</i>		-	A	-	C
<i>Eurylophella</i> sp (very small)		-	R	-	-
<i>Baetis tricaudatus</i>		-	R	-	R
<i>B. pluto</i>		-	R	-	R
PLECOPTERA					
<i>Tallaperla</i> sp		R	-	C	-
<i>Eccoctura xanthenes</i> (very small)		-	R	-	R
<i>Acroneuria abnormis</i>		-	C	-	R
<i>Paracapnia angulata</i>		R	R	-	-
<i>Malirekus hastatus</i>		-	R	-	A
<i>Leuctra</i> sp		A	C	A	C
<i>Amphinemura</i> sp		R	R	R	-
TRICHOPTERA					
<i>Diplectrona modesta</i> (2 morphs)		A	A	A	A
<i>Parapsyche cardis</i>		-	R	-	-
<i>Pycnopsyche gentilis</i>		C	-	-	-
<i>Glossosoma</i> sp (pupae)		-	R	-	C
<i>Lepidostoma</i> sp		C	-	A	-
<i>Neophylax</i> sp		-	-	-	R
<i>Lype diversa</i>		-	-	R	-
COLEOPTERA					
<i>Ectopria nervosa</i>		R	C	C	R
<i>Anchytarsus bicolor</i>		-	-	R	R
ODONATA					
<i>Lanthus</i> sp		R	R	R	R
<i>Cordulegaster</i> sp		-	-	C	-
DIPTERA					
<i>Dixa</i> sp		C	R	C	R
<i>Tipula</i> spp		R	-	-	C
<i>Pedicia</i> sp		R	-	R	-
<i>Pseudolimnophila</i> sp		R	-	-	-
<i>Thaumalea Americana</i>		-	-	R	-
<i>Rheopelopia</i> sp		-	-	R	-
MOLLUSCA					
<i>Elimia</i> sp		-	R	R	C
CRUSTACEA					
<i>Cambaridae</i> (very small)		-	R	R	C

¹Limited sampling due to small stream size

Total Taxa Richness	13	19	17	21
EPT Taxa Richness	7	14	7	13
NC Biotic Index	2.2	1.8	1.9	1.9
Width (m)	0.3	1	0.3	2

Notes

- DOT data from July 2012 (at the downstream site) produced an EPT taxa richness of 11.
- These streams contain very intolerant species, as evidenced by the low biotic index values.
- One rare taxa was recorded at the upstream site in July 2015: *Thaumalea* sp. This rarely collected dipteran is associated with thin films of water running over rock.
- There were no significant changes between years.

Table 5. MY-03 Taxa list with numbers found for sites SE and SA

PAI ID NO.			PA48826	PA48827
STATION			STA. SA	STA. SE
SPECIES	T.V.	F.F.G.		
PLATYHELMINTHES				
Turbellaria				
Tricladida				
Dugesidae				
<i>Cura foremanii</i>	5.5		1	
NEMATODA		CG	1	
MOLLUSCA				
Gastropoda				
Mesogastropoda				
Pleuroceridae	2.7			
<i>Elimia cf. simplex</i>	2.7	SC	3	1
ANNELIDA				
Clitellata				
Oligochaeta		CG		
Tubificida				
Enchytraeidae		CG	1	
Pristiniinae				
<i>Pristina sp.</i>	7.7	CG	2	
Lumbriculida				
Lumbriculidae		CG	2	
ARTHROPODA				
Crustacea				
Decapoda				
Cambaridae				
<i>Cambarus sp.</i>	7.5	CG		1
<i>Cambarus bartonii</i>	7.5		1	
Insecta				
Collembola				
Isotomidae			5	6
Ephemeroptera				
Baetidae		CG		
<i>Baetis tricaudatus</i>	1.5	CG	33	
<i>Dipheter hageni</i>	1.1		1	
Ephemerellidae		SC		
<i>Eurylophella sp.</i>	4	SC	3	
Heptageniidae		SC	9	
<i>Epeorus sp.</i>	1.6	CG	3	
<i>Epeorus punctatus</i>	1.5	CG	30	
<i>Maccaffertium merivulatum</i>	0.5		7	

PAI ID NO.			PA48826	PA48827
STATION			STA. SA	STA. SE
SPECIES	T.V.	F.F.G.		
Odonata				
Cordulegastridae		P		
<i>Cordulegaster erronea</i>	5.7		3	2
Gomphidae		P	1	
Plecoptera				
Leuctridae		SH		
<i>Leuctra sp.</i>	1.5	SH	23	17
Nemouridae		SH		7
<i>Amphinemura sp.</i>	3.8	SH		2
Peltoperlidae		SH		
<i>Peltoperla sp.</i>			8	2
Perlidae		P	2	
<i>Acroneuria sp.</i>		P	1	
<i>Eccopectura xanthenes</i>	4.7	P	2	
Perlodidae		P		
<i>Malirekus hastatus</i>	1	P	4	
Trichoptera				
Glossosomatidae		SC		
<i>Glossosoma nigror</i>	1.4	SC	3	
Hydropsychidae		FC	8	1
<i>Diplectrona modesta</i>	2.3	FC	82	17
Limnephilidae				
<i>Pycnopsyche gentilis</i>	1.8		1	
Philopotamidae		FC		2
<i>Wormaldia sp.</i>	2.4	FC		1
Polycentropodidae				
<i>Plectrocnemia sp.</i>				1
Rhyacophilidae		P		
<i>Rhyacophila carolina</i>	0.4	P	3	
Uenoidae				
<i>Neophylax mitchelli</i>	0		1	
Coleoptera				
Carabidae			1	
Elmidae		CG		
<i>Oulimnius nitidulus</i>			4	
<i>Oulimnius sp.</i>			5	
<i>Stenelmis sp.</i>	5.6	SC	1	1
Psephenidae		SC		
<i>Ectopria nervosa</i>	4.3	SC	4	7
Diptera				
Blephariceridae		SC		
<i>Blepharicera sp.</i>	0	SC	5	

PAI ID NO.			PA48826	PA48827
STATION			STA. SA	STA. SE
SPECIES	T.V.	F.F.G.		
Ceratopogonidae		P	2	1
<i>Atrichopogon sp.</i>	6.1	P	3	1
Chironomidae				
<i>Conchapelopia sp.</i>	8.4	P		3
<i>Parachaetocladius abnobaesus</i>	0.7	CG	8	
<i>Parametriocnemus sp.</i>	3.9	CG	33	5
<i>Robackia demeijerei</i>	4.3	CG	1	
<i>Stempellinella fimbriata</i>	5.6	CG		2
<i>Tanytarsus sp.</i>	6.6	FC	1	
<i>Tribelos jucundum</i>	5.7			1
Dixidae		CG		
<i>Dixa sp.</i>	2.5	CG	8	8
Empididae		P		
<i>Neoplasta sp.</i>		P	1	2
<i>Trichoclinocera sp.</i>			3	
Sciaridae				1
Simuliidae		FC		
<i>Simulium tuberosum</i>	4.9	FC	2	
Tipulidae		SH		
<i>Antocha sp.</i>	4.4	CG	1	
<i>Ormosia sp.</i>	6.5	CG	1	
<i>Limnophila sp.</i>		P		2
<i>Pseudolimnophila sp.</i>	6.2	P	7	9
<i>Tipula sp.</i>	7.5	SH		5
TOTAL NO. OF ORGANISMS			335	108
TOTAL NO. OF TAXA			48	27
EPT TAXA			19	9
NCBI Assigned Values			2.66	3.86

Appendix C.
2016 Site Photos



Photo 1. Upstream facing view of Site SA.



Photo 2. Downstream facing view of UT to Hominy Creek valley where Site SA is located.



Photo 3. Upstream facing view Site SE.



Photo 4. View of Site SE.

Appendix D.
Benthos Collection Cards and Habitat Assessment Field Data Sheet
for Mountain/Piedmont Streams

11/13 Revision 8

Habitat Assessment Field Data Sheet SA
Mountain/ Piedmont Streams

Biological Assessment Branch, DWR

TOTAL SCORE 75

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT to Hominy Creek Location/road: SR-1999 (Road Name Holder Brand Rd County Haywood)

Date 07/20/2016 CC# — Basin French Broad Subbasin Hominy Creek

Observer(s) CMS, NDH Type of Study: Fish Benthos Basinwide Special Study (Describe) _____

Latitude 35.53877 Longitude -82.795323 Ecoregion: MT P Slate Belt Triassic Basin

Water Quality: Temperature 19.3 °C DO 9.03 mg/l Conductivity (corr.) 155.7 µS/cm pH 7.62

Physical Characterization; Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 40 %Forest 20 %Residential _____ %Active Pasture _____ % Active Crops 40 %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : Forest Agriculture Urban Animal operations upstream (3-12%)

Width: (meters) Stream 1 Channel (at top of bank) 3 Stream Depth: (m) Avg .05 Max .1
 Width variable Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 1.5-1

Bank Angle: 45 ° or NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

- Channelized Ditch
- Deeply incised-steep, straight banks Both banks undercut at bend Channel filled in with sediment
- Recent overbank deposits Bar development Buried structures Exposed bedrock

SA

- Excessive periphyton growth Heavy filamentous algae growth Green tinge Sewage smell
- Manmade Stabilization: N Y: Rip-rap, cement, gabions Sediment/grade-control structure Berm/levee
- Flow conditions : High Normal Low
- Turbidity: Clear Slightly Turbid Turbid Tannic Milky Colored (from dyes)
- Good potential for Wetlands Restoration Project?? YES NO Details _____

Channel Flow Status

Useful especially under abnormal or low flow conditions.

- A. Water reaches base of both lower banks, minimal channel substrate exposed
- B. Water fills >75% of available channel, or <25% of channel substrate is exposed.....
- C. Water fills 25-75% of available channel, many logs/snags exposed.....
- D. Root mats out of water.....
- E. Very little water in channel, mostly present as standing pools.....

Weather Conditions: Partly Cloudy; Sunny Photos: N Y Digital 35mm

Remarks: _____

I. Channel Modification

- | | <u>Score</u> |
|---|--------------|
| A. channel natural, frequent bends..... | 5 |
| B. channel natural, infrequent bends (channelization could be old)..... | 4 ✓ |
| C. some channelization present..... | 3 |
| D. more extensive channelization, >40% of stream disrupted..... | 2 |
| E. no bends, completely channelized or rip rapped or gabioned, etc..... | 0 |

- Evidence of dredging Evidence of desnagging=no large woody debris in stream Banks of uniform shape/height

Remarks _____ Subtotal 4

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **Rare**, **Common**, or **Abundant**.

A Rocks R Macrophytes R Sticks and leafpacks R Snags and logs R Undercut banks or root mats

SA

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	5
No types present.....	0			

No woody vegetation in riparian zone Remarks _____ Subtotal 20 24

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders).....	15
2. embeddedness 20-40%.....	12
3. embeddedness 40-80%.....	8
4. embeddedness >80%.....	3
B. substrate gravel and cobble	
1. embeddedness <20%.....	14
2. embeddedness 20-40%.....	11
3. embeddedness 40-80%.....	6
4. embeddedness >80%.....	2
C. substrate mostly gravel	
1. embeddedness <50%.....	8
2. embeddedness >50%.....	4
D. substrate homogeneous	
1. substrate nearly all bedrock.....	3
2. substrate nearly all sand.....	3
3. substrate nearly all detritus.....	2
4. substrate nearly all silt/ clay.....	1

Remarks _____ Subtotal 2 32

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes.....	10
b. pools about the same size (indicates pools filling in).....	8

SA

- 2. Pools Infrequent (<30% of the 200m area surveyed)
 - a. variety of pool sizes..... 6
 - b. pools about the same size..... 4
- B. Pools absent..... 0**

Subtotal 10 46

Pool bottom boulder-cobble=hard Bottom sandy-sink as you walk Silt bottom Some pools over wader depth

Remarks _____

Page Total 42

V. Riffle Habitats

Definition: Riffle is area of reactivation-can be debris dam, or narrow channel area. Riffles **Frequent** Riffles **Infrequent**

- | | <u>Score</u> | <u>Score</u> |
|---|--------------|--------------|
| A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream.... | <u>16</u> | 12 |
| B. riffle as wide as stream but riffle length is not 2X stream width | 14 | 7 |
| C. riffle not as wide as stream and riffle length is not 2X stream width | 10 | 3 |
| D. riffles absent..... | 0 | |

Channel Slope: Typical for area Steep=fast flow Low=like a coastal stream

Subtotal 16 57

VI. Bank Stability and Vegetation

A. Erosion

- 1. No, or very little, erosion present 1
- 2. Erosion mostly at outside of meanders 6
- 3. Less than 50% of banks eroding..... 3
- 4. Massive erosion..... 0

Erosion Score 7

B. Bank Vegetation

- 1. Mostly mature trees (>12" DBH) present..... 7
- 2. Mostly small trees (<12" DBH) present, large trees rare 5
- 3. No trees on bank, can have some shrubs and grasses 3
- 4. Mostly grasses or mosses on bank..... 2
- 5. Little or no bank vegetation, bare soil everywhere..... 0

Vegetation Score 5

Remarks _____

Subtotal 12 70

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

- | | <u>Score</u> |
|--|--------------|
| A. Stream with good canopy with some breaks for light penetration | 10 |
| B. Stream with full canopy - breaks for light penetration absent..... | 8 |
| C. Stream with partial canopy - sunlight and shading are essentially equal..... | <u>7</u> |
| D. Stream with minimal canopy - full sun in all but a few areas..... | 2 |
| E. No canopy and no shading..... | 0 |

SA

Remarks _____

Subtotal 7 29

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

		FACE UPSTREAM		Lft. Bank	Rt. Bank
				Score	Score
Dominant vegetation: <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Weeds/old field <input type="checkbox"/> Exotics (kudzu, etc)					
A. Riparian zone intact (no breaks)					
1. width > 18 meters.....				5	<u>5</u>
2. width 12-18 meters.....				4	4
3. width 6-12 meters.....				<u>3</u>	3
4. width < 6 meters.....				2	2
B. Riparian zone not intact (breaks)					
1. breaks rare					
a. width > 18 meters.....				4	4
b. width 12-18 meters.....				3	3
c. width 6-12 meters.....				2	2
d. width < 6 meters.....				1	1
2. breaks common					
a. width > 18 meters.....				3	3
b. width 12-18 meters.....				2	2
c. width 6-12 meters.....				1	1
d. width < 6 meters.....				0	0

Remarks road within 10 m. of stream on LDB.

Subtotal 8

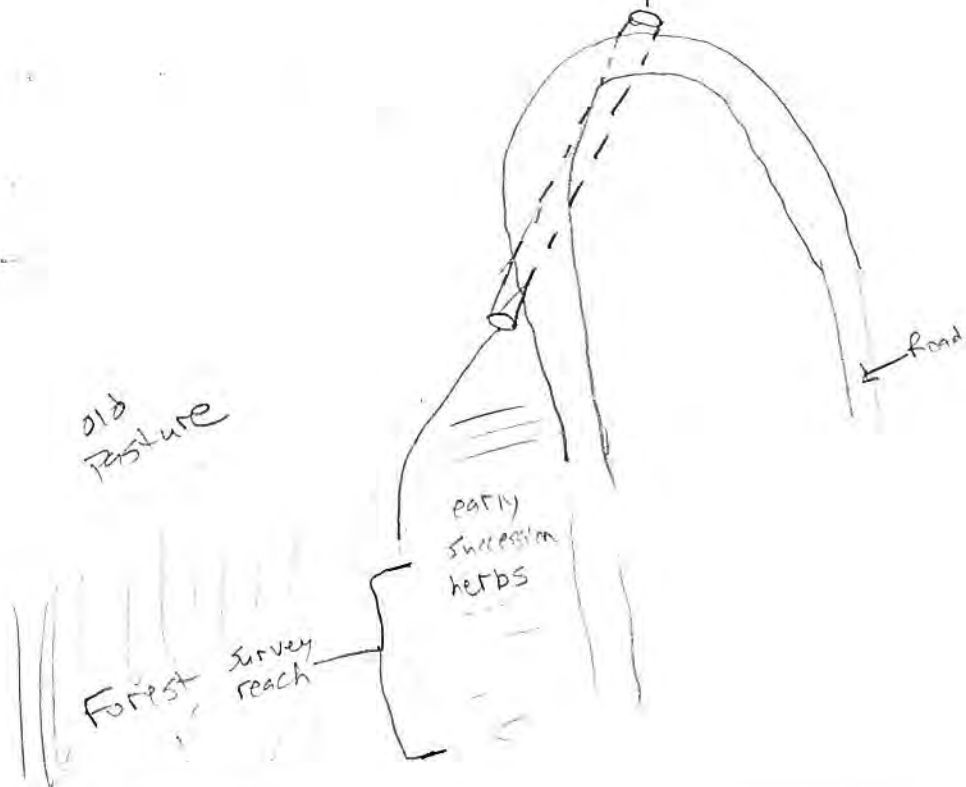
Page Total 43

Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

TOTAL SCORE 85

SP

Site Sketch:



Other comments: _____

SE

11/13 Revision 8

Habitat Assessment Field Data Sheet Mountain/ Piedmont Streams

Biological Assessment Branch, DWR

TOTAL SCORE 75

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT TO Hominy Creek Location/road: SR-1999 (Road Name Holder Branch Rd. County Haywood)

Date 07/20/2016 CC# - Basin French Broad Subbasin Hominy Creek

Observer(s) GMS, NDH Type of Study: Fish Benthos Basinwide Special Study (Describe) _____

Latitude 35.540010 Longitude -82.795022 Ecoregion: MT P Slate Belt Triassic Basin

Water Quality: Temperature 17.3 °C DO 6.4 mg/l Conductivity (corr.) 465.3 µS/cm pH 8

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 40 %Forest _____ %Residential _____ %Active Pasture _____ % Active Crops 40 %Fallow Fields _____ % Commercial _____ %Industrial 20 %Other - Describe: Highway

Watershed land use : Forest Agriculture Urban Animal operations upstream (0-4")

Width: (meters) Stream 0.3-1 Channel (at top of bank) 1-2 Stream Depth: (m) Avg. 0.025 Max 0.05
 Width variable Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 0.5-1

Bank Angle: 75-90 ° or NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

- Channelized Ditch
- Deeply incised-steep, straight banks Both banks undercut at bend Channel filled in with sediment
- Recent overbank deposits Bar development Buried structures Exposed bedrock

SE

Excessive periphyton growth Heavy filamentous algae growth Green tinge Sewage smell
 Manmade Stabilization: N Y: Rip-rap, cement, gabions Sediment/grade-control structure Berm/levee
 Flow conditions: High Normal Low
 Turbidity: Clear Slightly Turbid Turbid Tannic Milky Colored (from dyes)
 Good potential for Wetlands Restoration Project?? YES NO Details Steep gradient

Channel Flow Status

Useful especially under abnormal or low flow conditions.

- A. Water reaches base of both lower banks, minimal channel substrate exposed
- B. Water fills >75% of available channel, or <25% of channel substrate is exposed.....
- C. Water fills 25-75% of available channel, many logs/snags exposed.....
- D. Root mats out of water.....
- E. Very little water in channel, mostly present as standing pools.....

Weather Conditions: Partly cloudy, sunny Photos: N Y Digital 35mm

Remarks: Channel goes underground and upstream appears. Veg is filling in channel
Linear within reach area.

I. Channel Modification

- | | Score |
|---|-------|
| A. channel natural, frequent bends..... | 5 |
| B. channel natural, infrequent bends (channelization could be old)..... | 4 |
| C. some channelization present..... | (3) |
| D. more extensive channelization, >40% of stream disrupted..... | 2 |
| E. no bends, completely channelized or rip rapped or gabioned, etc..... | 0 |

Evidence of dredging Evidence of desnagging=no large woody debris in stream Banks of uniform shape/height

Remarks Former pasture in drainage area

Subtotal 3

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

C Rocks C Macrophytes R Sticks and leafpacks ___ Snags and logs ___ Undercut banks or root mats

SE

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70%	40-70%	20-40%	<20%
	Score	Score	Score	Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	5
No types present.....	0			

No woody vegetation in riparian zone Remarks Riparian zone planted with 2-3 yr old Platanus, Salix, Cornus Subtotal 15 15

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders).....	15
2. embeddedness 20-40%.....	12
3. embeddedness 40-80%.....	8
4. embeddedness >80%.....	3
B. substrate gravel and cobble	
1. embeddedness <20%.....	14
2. embeddedness 20-40%.....	11
3. embeddedness 40-80%.....	6
4. embeddedness >80%.....	2
C. substrate mostly gravel	
1. embeddedness <50%.....	8
2. embeddedness >50%.....	4
D. substrate homogeneous	
1. substrate nearly all bedrock.....	3
2. substrate nearly all sand.....	3
3. substrate nearly all detritus.....	2
4. substrate nearly all silt/ clay.....	1

Remarks Good mix of sand, gravel, cobble, and exposed bedrock Subtotal 15 15

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes.....	10
b. pools about the same size (indicates pools filling in).....	8

SE

- 2. Pools Infrequent (<30% of the 200m area surveyed)
 - a. variety of pool sizes.....
 - b. pools about the same size.....

6
4
0

B. Pools absent.....

Subtotal 4 37

Pool bottom boulder-cobble=hard Bottom sandy-sink as you walk Silt bottom Some pools over wader depth

Remarks Pool substrate a mix of sand & gravel

Page Total 37

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area. Riffles **Frequent** Riffles **Infrequent**

- | | <u>Score</u> | <u>Score</u> |
|---|--------------|--------------|
| A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream.... | <u>16</u> | 12 |
| B. riffle as wide as stream but riffle length is not 2X stream width | 14 | 7 |
| C. riffle not as wide as stream and riffle length is not 2X stream width | 10 | 3 |
| D. riffles absent..... | 0 | |

Channel Slope: Typical for area Steep=fast flow Low=like a coastal stream

Subtotal 16 53

VI. Bank Stability and Vegetation

A. Erosion

- 1. No, or very little, erosion present 7
- 2. Erosion mostly at outside of meanders..... 6
- 3. Less than 50% of banks eroding..... 3
- 4. Massive erosion..... 0

Erosion Score 7

B. Bank Vegetation

- 1. Mostly mature trees (>12" DBH) present..... 7
- 2. Mostly small trees (<12" DBH) present, large trees rare 5
- 3. No trees on bank, can have some shrubs and grasses..... 3
- 4. Mostly grasses or mosses on bank..... 2
- 5. Little or no bank vegetation, bare soil everywhere..... 0

Vegetation Score 3

Remarks Most vegetation on banks & in riparian zone is herbaceous. Some shrubs & trees have been planted along the creek. Juglans, Liquidambar, Quercus, & Carya in riparian zone in lower portions of survey reach.

Subtotal 10 63

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

- | | <u>Score</u> |
|--|--------------|
| A. Stream with good canopy with some breaks for light penetration | 10 |
| B. Stream with full canopy - breaks for light penetration absent..... | 8 |
| C. Stream with partial canopy - sunlight and shading are essentially equal..... | 7 |
| D. Stream with minimal canopy - full sun in all but a few areas..... | <u>2</u> |
| E. No canopy and no shading..... | 0 |

SE

Remarks Only a few canopy trees in lower portion of survey reach.

Subtotal 2 65

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM		Lft. Bank	Rt. Bank
		Score	Score
Dominant vegetation: <input checked="" type="checkbox"/> Trees <input checked="" type="checkbox"/> Shrubs <input checked="" type="checkbox"/> Grasses <input checked="" type="checkbox"/> Weeds/old field <input type="checkbox"/> Exotics (kudzu, etc)			
A. Riparian zone intact (no breaks)			
1. width > 18 meters.....		5 ✓	5 ✓
2. width 12-18 meters.....		4	4
3. width 6-12 meters.....		3	3
4. width < 6 meters.....		2	2
B. Riparian zone not intact (breaks)			
1. breaks rare			
a. width > 18 meters.....		4	4
b. width 12-18 meters.....		3	3
c. width 6-12 meters.....		2	2
d. width < 6 meters.....		1	1
2. breaks common			
a. width > 18 meters.....		3	3
b. width 12-18 meters.....		2	2
c. width 6-12 meters.....		1	1
d. width < 6 meters.....		0	0

Subtotal 10 75

Remarks Riparian zone immediately adjacent to stream in both shrubs & some trees. Forest directly abuts the stream in the upper reach.

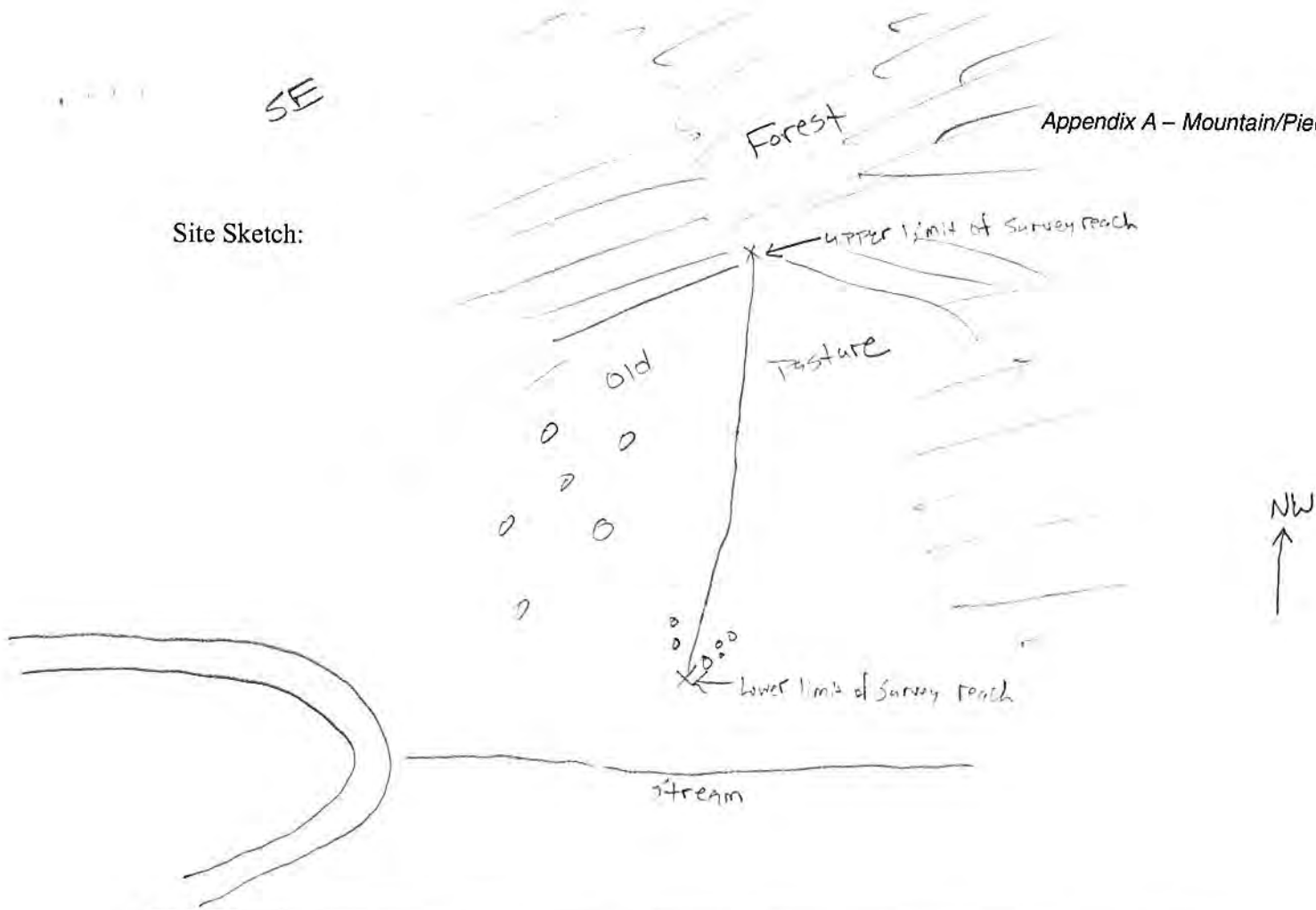
Page Total _____

Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

TOTAL SCORE 75

SE

Site Sketch:



Other comments: _____

BENTHOS COLLECTION CARD

DATE 07/20/2016 COLLECT TIME 13:30 - 14:45 COLLECTORS CMS + NDA CARD# SA

WATERBODY UT to Hominy Creek

STAT. LOC. _____ RIVER BASIN French Broad COUNTY Haywood

Substrate:

	<u>CMS</u>	<u>NDA</u>	%
Boulder (10")	<u>40</u>	<u>50</u>	<u>50</u>
Cobble (2 1/2-10")	<u>30</u>	<u>22</u>	<u>22</u>
Gravel (1/12-2 1/2")	<u>15</u>	<u>15</u>	<u>15</u>
Sand (1/12")	<u>10</u>	<u>10</u>	<u>10</u>
Silt. fine Partic.	<u>5</u>	<u>3</u>	<u>3</u>
Other			<u> </u>

River:

Mean depth	<u>4"</u>
Maxim. depth	<u>12"</u>
Width	<u>4-6'</u>
Current	<u>moderate</u>
Recent Rain?	<u>No</u>

Field Parameters:

Bank Erosion	N <input checked="" type="checkbox"/> <u>Mod</u>	Sev <u> </u>
Canopy	% <u>50</u>	Type <u>Hardwoods</u>
Aufwuchs	N <input checked="" type="checkbox"/> <u>Mod</u>	Abund. <u> </u>
Podostemum	N <input checked="" type="checkbox"/> <u>Mod</u>	Abund. <u> </u>
Tribs Present?	<u>site SE but not within reach</u>	

Photos (#) _____

Instream Habitat: (0,+,++)

Pools	<u>++</u>	Backwaters	<u>0</u>
Riffles	<u>++</u>	Detritus	<u>+</u>
Snags	<u>+</u>	Aquatic Weeds	<u>0</u>
Undercut Banks	<u>+</u>	Other	<u> </u>
Root Mats	<u>+</u>		<u> </u>

Samples: (#)

Kicks	<u>2</u>
Sweeps	<u>1</u>
Leaf Packs	<u>1</u>
Rock-Log	<u>1</u>
Sand	<u>1</u>
Visuals	<u>2</u>
Other	<u> </u>

Water Chemistry:

Temperature (°C)	<u>19.3</u>
Dissolved Oxygen (mg/L)	<u>9.03</u>
Conductivity (umhos/cm)	<u>155.7</u>
pH	<u>7.62</u>

Field Observations: _____

BENTHOS COLLECTION CARD

DATE 07/20/2016 COLLECT TIME 11:00 - 13:00 COLLECTORS CMS & NDH CARD# SE

WATERBODY UT to Hominy Creek

STAT. LOC. _____ RIVER BASIN French Broad COUNTY Haywood

Substrate:	CMS	NDH	River:	Field Parameters:
Boulder (10")	15	10	Mean depth	Bank Erosion
Cobble (2 1/2-10")	22	20	Maxim. depth	Canopy
Gravel (1/12-2 1/2")	20	30	Width	Aufwuchs
Sand (1/12")	40	35	Current	Podostemum
Silt, fine Partic.	3	5	Recent Rain?	Tribs Present?
Other			Photos (#)	

Instream Habitat: (0,+,++)	Samples: (#)	Water Chemistry:
Pools	Kicks	Temperature (°C)
Riffles	Sweeps	Dissolved Oxygen (mg/L)
Snags	Leaf Packs	Conductivity (µmhos/cm)
Undercut Banks	Rock-Log	pH
Root Mats	Sand	
	Visuals	
	Other	

Field Observations: _____

Appendix E.

Army Corps of Engineers Stream Quality Assessment Worksheet



STREAM QUALITY ASSESSMENT WORKSHEET



Provide the following information for the stream reach under assessment: SITE SA

- | | |
|---|--|
| 1. Applicant's name: <u>NCDOT</u> | 2. Evaluator's name: <u>Chris Sheets</u> |
| 3. Date of evaluation: <u>July 20, 2016</u> | 4. Time of evaluation: <u>1:30pm</u> |
| 5. Name of stream: <u>UT to Hominy Creek</u> | 6. River basin: <u>French Broad</u> |
| 7. Approximate drainage area: <u>0.50 ac</u> | 8. Stream order: <u>2nd</u> |
| 9. Length of reach evaluated: <u>200ft</u> | 10. County: <u>Haywood</u> |
| 11. Site coordinates (if known): prefer in decimal degrees. | 12. Subdivision name (if any): <u>—</u> |
| Latitude (ex. 34.872312): <u>35.5387</u> | Longitude (ex. -77.556611): <u>-82.79532</u> |
- Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other _____
13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):
See report figure
14. Proposed channel work (if any): post construction M4-03
15. Recent weather conditions: Sunny
16. Site conditions at time of visit: Similar to 2015 sampling
17. Identify any special waterway classifications known: Section 10 Tidal Waters Essential Fisheries Habitat
 Trout Waters Outstanding Resource Waters Nutrient Sensitive Waters Water Supply Watershed (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area: _____
19. Does channel appear on USGS quad map? YES NO
20. Does channel appear on USDA Soil Survey? YES NO
21. Estimated watershed land use: 10 % Residential % Commercial % Industrial 15 % Agricultural
65 % Forested % Cleared / Logged 10 % Other (Roadway)
22. Bankfull width: 4-6'
23. Bank height (from bed to top of bank): 2-3'
24. Channel slope down center of stream: Flat (0 to 2%) Gentle (2 to 4%) Moderate (4 to 10%) Steep (>10%)
25. Channel sinuosity: Straight Occasional bends Frequent meander Very sinuous Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 73 Comments: Similar conditions as 2015 sampling season.

Evaluator's Signature: *Chris Sheets* Date: July 20, 2016

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET SITE SA

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	Presence of flow / persistent pools in stream (no flow or saturation = 0; strong flow = max points)	0-5	0-4	0-5	3
	2	Evidence of past human alteration (extensive alteration = 0; no alteration = max points)	0-6	0-5	0-5	3
	3	Riparian zone (no buffer = 0; contiguous, wide buffer = max points)	0-6	0-4	0-5	4
	4	Evidence of nutrient or chemical discharges (extensive discharges = 0; no discharges = max points)	0-5	0-4	0-4	4
	5	Groundwater discharge (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0-3	0-4	0-4	2
	6	Presence of adjacent floodplain (no floodplain = 0; extensive floodplain = max points)	0-4	0-4	0-2	1
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0-5	0-4	0-2	1
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0-6	0-4	0-2	1
	9	Channel sinuosity (extensive channelization = 0; natural meander = max points)	0-5	0-4	0-3	2
	10	Sediment input (extensive deposition = 0; little or no sediment = max points)	0-5	0-4	0-4	4
	11	Size & diversity of channel bed substrate (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0-4	0-5	4
STABILITY	12	Evidence of channel incision or widening (deeply incised = 0; stable bed & banks = max points)	0-5	0-4	0-5	4
	13	Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0-5	0-5	0-5	4
	14	Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0-3	0-4	0-5	4
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0-5	0-4	0-5	5
HABITAT	16	Presence of riffle-pool/ripple-pool complexes (no riffles/ripples or pools = 0; well-developed = max points)	0-3	0-5	0-6	5
	17	Habitat complexity (little or no habitat = 0; frequent, varied habitats = max points)	0-6	0-6	0-6	4
	18	Canopy coverage over streambed (no shading vegetation = 0; continuous canopy = max points)	0-5	0-5	0-5	3
	19	Substrate embeddedness (deeply embedded = 0; loose structure = max)	NA*	0-4	0-4	4
BIOLOGY	20	Presence of stream invertebrates (see page 4) (no evidence = 0; common, numerous types = max points)	0-4	0-5	0-5	4
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	3
	22	Presence of fish (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	1
	23	Evidence of wildlife use (no evidence = 0; abundant evidence = max points)	0-6	0-5	0-5	3
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)					73	

* These characteristics are not assessed in coastal streams.

USACE AID# _____

DWQ # _____

Site # _____ (indicate on attached map)



STREAM QUALITY ASSESSMENT WORKSHEET



Provide the following information for the stream reach under assessment:

SITE SE

- 1. Applicant's name: NC DOT
- 2. Evaluator's name: CHRIS SHEATS
- 3. Date of evaluation: July 20, 2016
- 4. Time of evaluation: 11 am
- 5. Name of stream: UT to Homing Creek
- 6. River basin: French Broad
- 7. Approximate drainage area: 0.10
- 8. Stream order: 1st
- 9. Length of reach evaluated: 180 ft
- 10. County: Haywood
- 11. Site coordinates (if known): prefer in decimal degrees.
- 12. Subdivision name (if any): —

Latitude (ex. 34.872312): 35.54022 Longitude (ex. -77.556611): -82.79582

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other _____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): _____

See report figure

14. Proposed channel work (if any): M4-02 post-construction

15. Recent weather conditions: Sunny

16. Site conditions at time of visit: similar to previous M4-01

17. Identify any special waterway classifications known: Section 10 Tidal Waters Essential Fisheries Habitat
 Trout Waters Outstanding Resource Waters Nutrient Sensitive Waters Water Supply Watershed (I-IV)

18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area: _____

19. Does channel appear on USGS quad map? YES NO

20. Does channel appear on USDA Soil Survey? YES NO

21. Estimated watershed land use: 5 % Residential % Commercial % Industrial % Agricultural
80 % Forested % Cleared / Logged 15 % Other (roadway)

22. Bankfull width: 1-3'

23. Bank height (from bed to top of bank): 1-2'

24. Channel slope down center of stream: Flat (0 to 2%) Gentle (2 to 4%) Moderate (4 to 10%) Steep (>10%)

25. Channel sinuosity: Straight Occasional bends Frequent meander Very sinuous Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 50 Comments: Site similar to previous conditions.

Evaluator's Signature Chris Sheats Date July 20, 2016

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET SITE SE

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	Presence of flow / persistent pools in stream (no flow or saturation = 0; strong flow = max points)	0-5	0-4	0-5	1
	2	Evidence of past human alteration (extensive alteration = 0; no alteration = max points)	0-6	0-5	0-5	3
	3	Riparian zone (no buffer = 0; contiguous, wide buffer = max points)	0-6	0-4	0-5	4
	4	Evidence of nutrient or chemical discharges (extensive discharges = 0; no discharges = max points)	0-5	0-4	0-4	3
	5	Groundwater discharge (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0-3	0-4	0-4	2
	6	Presence of adjacent floodplain (no floodplain = 0; extensive floodplain = max points)	0-4	0-4	0-2	1
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0-5	0-4	0-2	1
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0-6	0-4	0-2	1
	9	Channel sinuosity (extensive channelization = 0; natural meander = max points)	0-5	0-4	0-3	1
	10	Sediment input (extensive deposition = 0; little or no sediment = max points)	0-5	0-4	0-4	3
	11	Size & diversity of channel bed substrate (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0-4	0-5	3
STABILITY	12	Evidence of channel incision or widening (deeply incised = 0; stable bed & banks = max points)	0-5	0-4	0-5	3
	13	Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0-5	0-5	0-5	4
	14	Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0-3	0-4	0-5	3
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0-5	0-4	0-5	5
HABITAT	16	Presence of riffle-pool/ripple-pool complexes (no riffles/ripples or pools = 0; well-developed = max points)	0-3	0-5	0-6	1
	17	Habitat complexity (little or no habitat = 0; frequent, varied habitats = max points)	0-6	0-6	0-6	2
	18	Canopy coverage over streambed (no shading vegetation = 0; continuous canopy = max points)	0-5	0-5	0-5	1
	19	Substrate embeddedness (deeply embedded = 0; loose structure = max)	NA*	0-4	0-4	2
BIOLOGY	20	Presence of stream invertebrates (see page 4) (no evidence = 0; common, numerous types = max points)	0-4	0-5	0-5	3
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	2
	22	Presence of fish (no evidence = 0; common, numerous types = max points)	0-4	0-4	0-4	0
	23	Evidence of wildlife use (no evidence = 0; abundant evidence = max points)	0-6	0-5	0-5	1
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						50

* These characteristics are not assessed in coastal streams.

Appendix F.
Baseline (MY-0) BMI Data

