

Eastern Band of Cherokee Indians WQO Comments for NC Water Quality Public Hearing
7/2/2018.

Thank you for the opportunity to comment on our shared watersheds.

There are two specific locations that I would like to draw your attention to:

1. Oconaluftee River downstream from the Reservation Boundary near Goose Creek.

The current NC classification of this water as an HQW is incorrect. An appropriate classification would be class "C" only, as also NCWRC does not manage this water as a trout fishery.

The water immediately upstream of this location on tribal land is correctly not classified as an HQW.

Further, within the current incorrectly classified "HQW" there is a hydropower impoundment and dam, which to continue in operation receives 401 water quality certification from NC- which it surely would not if it were truly an HQW!

2. Hanging Dog Creek arm of Hiwassee Lake near Bates Creek.

This water is on tribal land adjacent to Joe Brown Highway outside of Murphy, NC., and continues downstream off tribal land to the confluence with the Hiwassee River.

NC evaluates this water as being in good condition- as a lake. Unfortunately, the water may only be a lake between Memorial Day and Labor Day if there is sufficient rainfall.

Therefore, for the best part of 9 months a year it is a creek. But the lingering effects of the 3 months of mostly full pond are that the creek banks are mud flats without vegetation. Biological Assessment of this water conducted by the tribe during the winter months has revealed poor EPT taxa richness scores- basically all that can survive are black flies.

Unless the water is a lake for most of the year it should not be classified as a lake but as a stream and if so it is a stream impaired by hydropower operations downstream.

Respectfully,



Michael Bolt, EBCI Water Quality Office, Cherokee NC.

**Benthic Macroinvertebrate Evaluation of Hanging Dog Creek.
Cherokee County, North Carolina. 22 November 2010**

Overview. Benthic insect samples were collected from three locations on Hanging Dog Creek to assess the ecological effects of winter drawdown at Hiwassee Reservoir. An upper site of Hanging Dog Creek was selected above any potential effects of the winter drawdown; a middle site was selected in a reach that is minimally affected by the drawdown (some flow is maintained for most of the year) and a lower site within the embayment of Hiwassee Reservoir. The lower site is part of the reservoir until Labor Day each year when the Tennessee Valley Authority (TVA) begins the drawdown process and then becomes lotic, or flowing stream, system until Memorial Day when TVA again begins to refill the reservoir. Water quality and habitat information was collected at each location during this investigation, Table 1 summarizes these data. Minor differences were noted in the water quality of these three locations; although it is interesting to see slightly lower water temperature values at the middle and lower locations. This may be related to water depth as Hanging Dog Creek at the lower site has a very narrow channel with deep pools, whereas the upstream locations are much wider and shallower. Significant differences were noted in the habitat scores. Clearly bank stability and vegetation, light penetration and riparian vegetative zone width were all much reduced at the lower location.

Table 1. Water Quality and Habitat Evaluations from three Hanging Dog locations. Cherokee County, North Carolina. 22 November 2010.			
Parameter/Station	Upper	Middle	Lower
Coordinates	N35.1124,W84.0676	N35.1179,W84.0661	N35.1317,W84.0677
Water Quality¹			
Water Temperature (°C)	11.2	10.5	10.2
Dissolved Oxygen (mg/l)	11.25	11.09	11.25
Conductivity (umhos/cm)	23	22	23
pH (units)	7.42	7.90	7.78
Habitat²			
1. Channel Modification	4	4	2
2. Instream Habitat	20	16	14
3 Bottom Substrate	15	12	8
4. Pool Variety	10	10	10
5. Riffle Habitats	14	14	14
6. Bank Stability and Vegetation	14	14	0
7. Light Penetration	10	10	2
8. Riparian Veg. Zone Width	8	8	2
Total Habitat Score	95	88	52

1. Water quality information was collected by the EPA field team.
2. NC Division of Water Quality habitat assessment form for mountain systems.

Benthic Macroinvertebrates. Benthic insect samples were also collected from each of these locations using the protocols defined by the NC Division of Water Quality. (DWQ 2006). A summary of these data are listed in Table 2 and a complete list of all taxa collected can be seen in Appendix 1 of this report.

- **Upper Reach.** This location was selected above the influence of winter drawdown and to act as reference condition. The overall habitat score from this location was very high (97 points). The stream at this point is very productive with prolific growths of river weed (*Podostemum* spp). *Podostemum* is common in many mountain stream systems and offers a unique habitat for many benthic insects. Thirty four EPT taxa were collected from this location and 11 intolerant



taxa (Biotic index of 1.0 or less) were collected here as well. These data resulted in a Good bioclassification using the criteria developed by the NC Division of Water Quality. Many taxa were only collected from this upstream location which is very likely related to the fact

that this is not affected by lack of flow during full reservoir capacity. Note that many taxa within the mayfly family Ephemerelellidae are common or abundant at his upper location, but are reduced in abundance at the middle location and completely eliminated at the lower site. This is also evident for many stonefly taxa as well. Most EPT taxa are rheophilic organisms needing flow for their entire life cycles, once flow is reduced or eliminated these taxa cannot survive. The field team collected several specimens of *Ephemerella bernerii* at this location. *E. bernerii* is listed by the NC Natural Heritage Program as significantly rare and listed as “vulnerable to extirpation” by Morse *et al.* (1997).

- **Middle Reach.** Data were also collected from a reach of Hanging Dog Creek that maintains some flow during each season. There are no flow records from this reach; therefore it is difficult to determine flow patterns however it is assumed that water does back up to this point during high flow periods (i.e. water retainment within the reservoir). The field team noted the presence of excessive fine sediments within low flow areas (especially stream banks), but clean riffle habitats. In addition we also noted the presence of an incredible number of burrowing mayfly tubes, all empty. The deposition of fine particulate organic material because of reduced flow at this location created a microhabitat favorable to these taxa. The overall habitat score from this location was also very high (88 points). EPT taxa richness and the number of intolerant taxa are very similar to the upstream reference reach and these data also resulted in a

Good bioclassification using the DWQ protocols. However EPT abundance



declined substantially and the number of dominant taxa in common (common and abundant taxa) was only 53%. Interestingly the number of Trichoptera increased at this location to 17 taxa. Apparently the reduced, or inconsistent, flow pattern within this reach of Hanging Dog Creek

does not impact these taxa as severely as mayfly or stonefly taxa.

Table 2. Summary of Benthic insect taxa collected from three Hanging Dog Creek locations. Cherokee County NC. 22 November 2010			
Taxa/Location	Upper	Middle	Lower
Ephemeroptera	12	10	1
Plecoptera	10	6	5
Trichoptera	12	17	5
Misc. Diptera	3	5	2
Chironomidae	8	7	5
Coleoptera	3	3	0
Odonata	1	6	0
Oligochaeta	1	1	1
Megaloptera	2	1	0
Crustacea	0	0	0
Mollusca	2	1	0
Other Miscellaneous tax	1	1	0
Total # Taxa	55	56	19
Total # EPT taxa	34	33	11
Seasonal Correction ¹	32	31	9
EPT Abundance	168	111	35
No. of intol taxa (BI = 1.0 or less)	11	10	3
Dominant Taxa in Common ²	-	53%	13%/18%
Bioclassification	Good	Good	Poor

1. DWQ seasonal correction essentially is to remove winter/spring stonefly taxa from results prior to assigning a bioclassification.
2. DIC is a measure of the abundant and common taxa in common between locations. The DIC at the lower reach was calculated for both the upper and middle reaches.

- **Lower Reach.** This embayment reach of Hanging Dog Creek is within the normal capacity of Hiawassee Reservoir and was flowing only during this survey because of the winter drawdown policy of TVA. The riparian canopy was eliminated during construction and maintenance of the reservoir; therefore habitat scores for bank stability and vegetation, light penetration and riparian vegetative zone width were extremely low at this point. During full capacity of the reservoir deposition of fine material from upstream sources occurs at this point. Subsequently during the drawdown periods this fine material is eroded and resuspended. Erosion of this material from newly exposed banks is severe. If drawdown was initiated at Labor Day this reach has been exposed for only 11 weeks. Drift from upstream sources is the only form of recolonization for the benthos within this reach. Taxa richness and EPT abundance values were reduced at this location and dominant in common analyses resulted in only 13% in common with the upper reach and 18% with the middle reach. These data resulted in a Poor bioclassification following a seasonal correction of the data.



Significant Observations.

Benthic insects were collected from three locations in Hanging Dog Creek to assess the ecological effects of winter drawdown of the Hiawassee Reservoir. The lower most site in the investigation is within the embayment of the reservoir and newly exposed only because of the drawdown policy of TVA. Taxa richness, EPT abundance and the number of intolerant benthic insect taxa were all reduced at the lower reach of this feature. Bioclassification ratings were reduced from Good at both upstream locations to Poor at the downstream reach within the embayment.

Taxa richness values and Good bioclassifications were recorded from both upstream locations. Many intolerant taxa were also collected from both of these locations. In addition *Ephemerella berneri* was also collected at both of these locations. This taxa is listed by the NC Natural Heritage Program as significantly rare and listed as vulnerable to extirpation.

References

- NC Division of Water Quality (DWQ). 2006. Standard Operating Procedures for Benthic Macroinvertebrates. NC Department of Environment and Natural Resources. Environmental Sciences Section, Biological Assessment Unit. Raleigh, NC.
- Morse, J.C., B.P. Stark, W.P. McCafferty and K.J. Tennessen. 1997. Southern Appalachian and Other Southeastern Streams at Risk: Implications for Mayflies, Dragonflies and Damselflies, Stoneflies and Caddisflies. In: Aquatic Fauna in Peril: Southeastern Perspective (Benz, G.W. and D.E. Collins, editors), Special publication 1, Southeast Aquatic Research Institute. Lenz Design & Communications, Decatur, GA. 554pp.

**Appendix 1. Benthic macroinvertebrates collected from three
Hanging Dog Creek locations. Cherokee County, NC.
22 November 2010**

Location	Upper	Middle	Lower
Taxa Name (Biotic Index value)			
Ephemeroptera			
Family Baetidae			
Baetis pluto (4.3)	A	C	R
Plauditus dubius group (5.8)	C		
Family Baetiscidae			
Baetisca carolina (3.5)		C	
Family Ephemerellidae			
Ephemerella berneri (0)	C	R	
Ephemerella dorothea (6.0)	A		
Ephemerella rossi group (0)	R		
Serratella deficiens (2.8)	C	R	
Family Heptageniidae			
Epeorus dispar (1.0)	C	R	
Heptagenia marginalis (2.3)	C		
Stenacron pallidum (2.7)	C	C	
Maccaffertium modestum (5.5)	A	A	
Maccaffertium pudicum (2.0)	C	C	
Family Leptophebiidae			
Paraleptophlebia spp (0.9)		R	
Family Oligoneuridae			
Isonychia spp (3.5)	C	C	
Plecoptera			
Family Chloroperlidae			
Sweltsa spp (0)	R		
Family Leuctridae			
Leuctra spp (2.5)	A	A	A
Family Peltoperlidae			
Tallaperla spp (1.2)	C	R	
Family Perlidae			
Acroneuria abnormis (2.1)	A		
Paragnetina media (1.0)	C	C	
Perlesta placida (4.7)	R		
Family Perlodidae			
Isoperla spp (too small to ID)			R
Heliopicus subvarians (0.8)	A	A	C
Family Pteronarcyidae			
Pteronarcys spp (1.7)	R		
Family Taeniopterygidae			
Strophopteryx spp (2.7)	R	R	R
Taeniopteryx spp (5.4)	C	C	C
Trichoptera			
Family Apataniidae			
Apatania sp (0.6)	C		
Family Brachycentridae			
Brachycentrus appalachia (0.1)	A	R	
Micrasema charonis (0.8)	C		
Family Glossosomatidae			

Glossosoma spp (1.6)	A	A	
Family Hydropsychidae			
Cheumatopsyche spp (6.2)	A	C	R
Hydropsyche betteni (7.8)	R		
Hydropsyche venularis (5.0)		R	
Symphitopsyche sparna (2.7)	A	A	
Symphitopsyche morose (2.8)	R	C	R
Family Lepidostomatidae			
Lepidostoma spp (0.9)		C	R
Family Leptoceridae			
Ceraclea spp (2.0)	R		
Oecetis spp (4.7)		R	
Setodes spp (0)		R	
Family Limnephilidae			
Pycnopsyche guttifer (2.6)		C	
Pycnopsyche lepida (2.7)	R	C	R
Family Philopotamidae			
Chimarra spp (2.8)	A	R	
Dolophilodes spp (0.8)	A	A	A
Family Polycentropodidae			
Nyctiophylax celta (0.7)		R	
Family Psychomyiidae			
Psychomyia flavida (2.9)		R	
Family Rhyacophilidae			
Rhyacophila fuscata (1.9)		C	
Family Uenoidae			
Neophylax spp (pupae) (2.2)		R	
Diptera: Miscellaneous families			
Family Ceratopogonidae			
Palmomyia complex (6.9)		R	
Family Empididae (7.6)	C	R	
Family Simuliidae			
Simulium spp (6.0)	C	C	A
Family Tipulidae			
Antocha spp (4.3)		R	
Tipula spp (7.3)	A	C	R
Diptera: Chironomidae			
Brillia spp (5.2)		C	
Cardiocladius spp (5.9)		R	
Conchapelopia group (8.4)	R		
Corynoneura spp (6.0)	R	R	R
Cricotopus/Orthocladius sp 51 (3.4)			A
Eukiefferiella brevicar gr (E sp 6) (2.2)	R	R	
Nanocladius spp (7.1)	C		
Orthocladius clarkei gr: C/O sp 54 (5.7)			R
Parametriocnemus lundbecki (3.7)	C	C	R
Pseudorthocladius spp (1.5)	R		
Rheotanytarsus spp (5.9)	C	R	
Tvetenia bavarica group - E sp1 (3.7)	C	C	R
Coleoptera			
Family Dytiscidae			
Hydroporus spp (8.6)		R	
Family Elmidae			

Promoresia tardella (0)	A		
Family Gyridae			
Dineutus spp (5.5)		C	
Family Psephenidae			
Ectopria nervosa (4.2)	R		
Psephenus herricki (2.4)	C	C	
Odonata			
Family Aeshnidae			
Boyeria vinosa (5.9)	R	R	
Family Calopterygidae			
Calopteryx spp (7.8)		R	
Family Gomphidae			
Gomphus spp (5.8)		R	
Gomphus spiniceps (5.1)		R	
Hagenius brevistylus (4.0)		R	
Family Macromiidae			
Maromia spp (6.2)		R	
Oligochaeta			
Family Nadidae			
Nais spp (8.9)	R	R	R
Megaloptera			
Family Corydalidae			
Nigronia serricornis (5.0)	C	C	
Corydalis cornutus (5.2)	C		
Mollusca			
Family Ancylidae			
Ferrissia spp (6.6)	A	C	
Family Pleuroceridae			
Leptoxis spp (1.8)	A		
Other Miscellaneous Taxa			
Hydracarina spp (5.5)		R	
Polyclad			
Prostoma graecens (6.1)	R		
SUMMARY STATISTICS			
EPT taxa richness	34	33	11
Total Taxa richness	55	56	19
Number of intolerant taxa (BI = 1.0 or less)	11	10	3
Dominant Taxa in Common	-	53%	13%/18%
EPT abundance	168	111	35
Bioclassification	Good	Good	Poor