

2009 Monitoring Summary



Hester Creek at Beth Road (Madison County) (34.91080/-86.43750)

BACKGROUND

The 7.2 mile segment of Hester Creek from Mountain Fork to the state line was placed on Alabama's 1998 Clean Water Act (CWA) §303(d) list of impaired waters. The segment was added to the list based on the results of macroinvertebrate and fish assessments conducted in 1995 by the Tennessee Valley Authority (TVA), which rated biological conditions at the site as *fair* and *very poor/poor*, respectively. Water quality data collected in 1997 by TVA suggested nutrients, siltation and organic enrichment/low dissolved oxygen (OE/DO) as potential causes of the biological impairment. More intensive monitoring conducted by the Alabama Department of Environmental Management (ADEM), the US Geological Survey (USGS), and TVA, 1997-2004, indicated pathogens, turbidity, and nutrients from pasture grazing to be the causes of degraded biological conditions at the site.

The pathogens TMDL for Hester Creek was approved by EPA in January 2007. In 2009, the ADEM monitored Hester Creek to collect data in support of the turbidity and nutrient TMDLs.



Figure 1. Hester Creek at HESM-1, August 12, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Hester Creek is a *Fish & Wildlife (F&W)* stream located west of the city of New Market in Madison County north of Huntsville. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily pasture (39%) and cultivated crops (28%). ADEM has issued one NPDES discharge permit in this watershed.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Tennessee River	
Drainage Area (mi ²)	40	
Ecoregion ^a	71g	
% Landuse		
Open water		<1
Wetland	Woody	3
	Emergent herbaceous	<1
Forest	Deciduous	21
	Evergreen	<1
	Mixed	1
Shrub/scrub		3
Grassland/herbaceous		1
Pasture/hay		39
Cultivated crops		28
Development	Open space	5
	Low intensity	1
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km ^{2b}		8
# NPDES Permits ^c	TOTAL	1
	401 Water Quality Certification	1

- a. Eastern Highland Rim
- b. 2000 US Census
- c. #NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Hester Creek at HESM -1, June 11, 2009.

Physical Characteristics		
Width (ft)	35	
Canopy Cover	Shaded	
Depth (ft)		
	Riffle	0.5
	Run	1.0
	Pool	1.5
% of Reach		
	Riffle	15
	Run	75
	Pool	10
% Substrate		
	Bedrock	20
	Boulder	5
	Cobble	25
	Gravel	40
	Sand	5
	Silt	3
	Organic Matter	2

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Hester Creek at HESM-1 is a shallow, high-gradient stream reach characterized by gravel, cobble, and bedrock substrates (Figure 1). Overall habitat quality was categorized as *sub-optimal* due to narrow riparian buffer zones.

Table 3. Results of the habitat assessment conducted on Hester Creek at HESM-1, June 11, 2009.

Habitat Assessment	%Max Score	Rating
Instream Habitat Quality	77	Optimal >70
Sediment Deposition	73	Optimal >70
Sinuosity	73	Sub-optimal (65-84)
Bank and Vegetative Stability	69	Sub-optimal (60-74)
Riparian Buffer	53	Marginal (50-69)
Habitat Assessment Score	166	
% Maximum Score	69	Sub-optimal (59-70)

MACROINVERTEBRATE BIOASSESSMENT

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *fair* condition (Table 4).

FISH COMMUNITY BIOASSESSMENT

The Geological Survey of Alabama (GSA) conducted a fish community bioassessment of Hester Creek at HESM-1 using their Fish Index of Biotic Integrity (F-IBI) for the Tennessee River Basin. Like the WMB-I, the F-IBI uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the fish community. Each metric is scored on a five point scale. The final score is the sum of all individual metric scores. Metric results indicated the fish community to be in *fair* condition (Table 5).

Table 4. Results of the macroinvertebrate community bioassessment conducted at HESM-1 on June 11, 2009.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	12	35
Shannon Diversity	2.94	11
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	25	55
% Non-insect taxa	12	52
Functional feeding group		
% Predator Individuals	2	0
Community tolerance		
% Tolerant taxa	33	45
WMB-I Assessment Score	---	33
WMB-I Assessment Rating		Fair (29-43)

Table 5. Results of the fish community bioassessment conducted at HESM-1 on September 29, 2009.

Fish Community Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-60)
Total native species	22	3
Number of shiner species	3	3
Number of sucker species	1	1
Number of darter + madtom species	6	3
Taxonomic composition measures		
% Lepomis	8	5
Trophic composition measures		
% omnivores	41	1
% invertivores	7	5
% top carnivores	2	3
Community tolerance		
Number of intolerant species	1	3
% tolerant species	21	3
Abundance-condition-reproduction measures		
Catch per unit effort	16	5
Percent simple lithophilic spawners	18	1
WF-I Assessment Score	---	36
WF-I Assessment Rating		Fair (29-40)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, atrazine, and semi-volatile organics), March through October of 2009 to identify any stressors to the biological community. Median conductivity, nutrient (total nitrogen and dissolved reactive phosphorus), and chloride concentrations were higher than 90th percentile of verified reference reach data collected in subecoregion 71g. In March, stream pH was 8.8 su, above *F&W* use class criteria of 8.5 su. Dissolved copper exceeded criteria applicable to Hester Creek's *F&W* use classification in October.

SUMMARY

Results of macroinvertebrate and fish community bioassessments conducted during 2009 indicated Hester Creek at HESM-1 to be in *fair* condition. However, intensive water quality monitoring indicated elevated metal, nutrient, chloride, and conductivity levels relative to data collected from ADEM's reference reaches in the Interior Plateau ecoregion. Monitoring should continue to ensure biological conditions remain stable.

Table 5. Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N	Min	Max	Med	Avg	SD	Q	E
Physical								
Temperature (°C)	9	11.8	25.7	22.5	20.5	5.0		
Turbidity (NTU)	9	1.3	5.4	3.3	3.6	1.4		
Total Dissolved Solids (mg/L)	8	20.0	130.0	77.0	79.5	32.0	J	
Total Suspended Solids (mg/L)	8	<	0.3	5.0	0.8	1.3	1.6	J
Specific Conductance (µmhos)	9	109.4	145.5	119.7 ^G	121.3	11.9		
Hardness (mg/L)	4	46.5	56.5	50.5	51.0	4.2		
Alkalinity (mg/L)	8	29.3	98.5	45.7	50.0	20.9		
Stream Flow (cfs)	9	3.3	41.0	7.0	15.9	14.3		
Chemical								
Dissolved Oxygen (mg/L)	9	7.1	12.8	8.6	9.4	2.0		
pH (su)	9	7.0	8.8 ^C	7.5	7.6	0.5		1
Ammonia Nitrogen (mg/L)	8	<	0.006	<0.014	0.005	0.005	0.002	B
Nitrate+Nitrite Nitrogen (mg/L)	8	0.364	4.268	1.406	1.695	1.224		B
Total Kjeldahl Nitrogen (mg/L)	8	<	0.089	2.364	0.338	0.664	0.861	B
Total Nitrogen (mg/L)	8	<	0.599	5.899	1.939 ^M	2.358	1.739	B
Dissolved Reactive Phosphorus (mg/L)	8	0.015	0.411	0.030 ^M	0.109	0.146		BJ
Total Phosphorus (mg/L)	8	0.009	0.419	0.031	0.078	0.138		J
CBOD-5 (mg/L)	8	<	1.0	< 2.0	1.0	0.9	0.2	
Chlorides (mg/L)	8	3.1	8.0	4.6 ^M	5.0	1.8		
Atrazine (µg/L)	2	<	0.06	0.47	0.25	0.25	0.31	
Total Metals								
Aluminum (mg/L)	4	0.052	0.167	0.084	0.097	0.052		J
Iron (mg/L)	4	0.137	0.215	0.182	0.179	0.040		J
Manganese (mg/L)	4	<	0.001	0.035	0.022	0.020	0.014	J
Dissolved Metals								
Aluminum (mg/L)	4	<	0.024	0.089	0.020	0.036	0.035	J
Antimony (µg/L)	4	<	0.7	< 6.0	0.4	1.0	1.3	
Arsenic (µg/L)	4	<	0.4	< 0.4	0.2	0.2	0	
Cadmium (mg/L)	4	<	0.002	<0.003	0.002	0.001	0.000	
Chromium (mg/L)	4	<	0.007	<0.013	0.006	0.006	0.002	
Copper (mg/L)	4	<	0.013	0.200 ^S	0.014	0.034	0.045	J 1
Iron (mg/L)	4	<	0.026	0.094	0.042	0.048	0.034	J
Lead (µg/L)	4	<	1	< 2	1	1	0	
Manganese (mg/L)	4	<	0.001	0.025	0.016	0.014	0.010	J
Mercury (µg/L)	4	<	0.1	0.1	0.0	0.0	0.0	J
Nickel (mg/L)	4	<	0.004	<0.019	0.007	0.006	0.004	
Selenium (µg/L)	4	<	0.4	< 0.4	0.2	0.2	0.0	
Silver (mg/L)	4	<	0.001	<0.002	0.001	0.001	0.000	
Thallium (µg/L)	4	<	0.4	< 0.4	0.2	0.2	0.0	
Zinc (mg/L)	4	<	0.003	<0.060	0.008	0.012	0.014	
Biological								
Chlorophyll a (ug/L)	8	<	0.53	2.67	0.98	1.14	0.70	
Fecal Coliform (col/100 mL)	8	23	380	79	124	121	J	

A=*F&W* aquatic life use criteria exceeded; B=one or more samples excluded from calculations because they did not meet laboratory QC requirements; C=*F&W* criteria violated; E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 71g; H=*F&W* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 71g; N=# samples

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