

# 2012 Monitoring Summary



Reference Reach Site

Bear Creek at “Oregonia Road” Crossing SE of Sterling in Tuscaloosa County (33.54245/-87.56167)

## BACKGROUND

The Alabama Department of Environmental Management (ADEM) monitors Bear Creek as a “best attainable condition” reference watershed, based on land use, road density, and population density for comparison with streams throughout the Southwestern Appalachian ecoregion. Data collected at these reaches are used as the basis of comparison for streams in same ecoregion and to develop water quality criteria.

Additionally, Bear Creek was selected for biological and water quality monitoring as part of the 2012 Assessment of the Black Warrior and Cahaba (BWC) River Basins. The objectives of the BWC Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the BWC basin group.



Figure 1. Bear Creek at BERT-4, May 2, 2012.

## WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Bear Creek is a small *Fish & Wildlife (F&W)* stream located in the Shale Hills ecoregion (68f) near Sterling, Alabama. This creek drains fifteen square miles in Tuscaloosa County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily forest (75%) followed by shrub/scrub. Population density is relatively low. As of September 1, 2012, ADEM has issued four construction permits in this watershed.

## 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.

Bear Creek at BERT-4 is a riffle-run stream with bedrock, cobble, boulder, gravel, and sand substrates (Figure 1). Overall habitat quality was categorized as *optimal* due to the habitat created by snags, leaf packs and root banks within the reach.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Black Warrior River	
Drainage Area (mi <sup>2</sup> )	15	
Ecoregion <sup>a</sup>	68f	
% Landuse		
Wetland	Woody	2
Forest	Deciduous	28
	Evergreen	35
	Mixed	12
Shrub/scrub		18
Grassland/herbaceous		4
Pasture/hay		<1
Cultivated crops		
Development	Open space	1
Barren		<1
Population/km <sup>2b</sup>	1	
# NPDES Permits <sup>c</sup>	TOTAL	4
Construction Stormwater		3
Municipal Individual		1

a. Shale Hills

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Bear Creek at BERT-4, May 2, 2012.

Physical Characteristics	
Canopy Cover	Estimate 50/50
Width (ft)	10
Depth (ft)	
Riffle	0.4
Run	1.0
Pool	1.5
% of Reach	
Riffle	10
Run	60
Pool	30
% Substrate	
Bedrock	35
Boulder	10
Cobble	20
Gravel	10
Sand	10
Silt	10
Organic Matter	5

Table 3. Results of the habitat assessment conducted on Bear Creek at BERT-4, May 2, 2012.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	78	Optimal >70
Sediment Deposition	80	Optimal >70
Sinuosity	85	Optimal >84
Bank and Vegetative Stability	59	Marginal (35-59)
Riparian Buffer	81	Sub-optimal (70-89)
<b>Habitat Assessment Score</b>	<b>179</b>	
<b>% Maximum Score</b>	<b>75</b>	<b>Optimal &gt;70</b>

## BIOASSESSMENT RESULTS

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. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *good* community condition (Table 4).

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Bear Creek at BERT-4, May 2, 2012.

Macroinvertebrate Assessment			
	Results	Scores (0-100)	
<b>Taxa richness measures</b>			
# EPT taxa	20	70	
<b>Taxonomic composition measures</b>			
% Non-insect taxa	11	58	
% Dominant taxon	26	60	
% EPC taxa	33	63	
<b>Functional feeding group measures</b>			
% Predators	11	42	
<b>Tolerance measures</b>			
% Taxa as Tolerant	24	73	
<b>WMB-I Assessment Score</b>	---	<b>61</b>	
<b>WMB-I Assessment Rating</b>		<b>Good (59-79)</b>	

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. *In situ* measurements and water samples were collected monthly, and semi-monthly (metals) from April through December of 2012 to help identify any stressors to the biological communities. Stream flows were generally lower than normal during 2012. Stream pH was below the *F&W* use classification criterion in April. Median concentration of specific conductivity and hardness were higher than the median concentration of all verified reference reach data collected in ecoregion 68. The median concentration of total iron was also higher than expected.

## SUMMARY

As part of assessment process, ADEM will review the monitoring information presented in this report along with all other available data.

Bioassessment results indicated the macroinvertebrate community to be in *good* condition. Habitat quality and availability was assessed as *optimal* for supporting macroinvertebrate communities, despite lower than normal stream flows during 2012. However, median concentrations of specific conductivity and hardness were higher than expected in this ecoregion. Monitoring should continue to ensure that biological and water quality conditions remain stable.

**Table 5.** Summary of water quality data collected April-December, 2012. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). 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	E
<b>Physical</b>							
Temperature (°C)	11	9.5	28.7	19.1	19.1	5.8	
Turbidity (NTU)	11	5.2	50.2	11.7	17.9	13.6	
Total Dissolved Solids (mg/L)	9	20.0	80.0	66.0	56.7	22.4	
Total Suspended Solids (mg/L)	9	< 1.0	14.0	5.0	6.0	4.4	
Specific Conductance (µmhos)	11	44.8	81.6	65.1 <sup>G</sup>	63.9	12.6	
Hardness (mg/L)	5	12.1	18.0	15.3 <sup>G</sup>	15.0	2.4	
Alkalinity (mg/L)	9	6.5	54.7	12.0	17.3	15.0	
Stream Flow (cfs)	9	0.8	16.2	2.5	5.6	6.0	
<b>Chemical</b>							
Dissolved Oxygen (mg/L)	11	7.1	10.4	8.4	8.6	1.0	
pH (su)	11	5.7 <sup>C</sup>	8.0	6.7	6.7	0.6	1
Ammonia Nitrogen (mg/L)	9	< 0.007	0.036	0.004	0.007	0.011	
<sup>J</sup> Nitrate+Nitrite Nitrogen (mg/L)	9	< 0.005	0.280	0.055	0.111	0.108	
<sup>J</sup> Total Kjeldahl Nitrogen (mg/L)	9	< 0.041	0.303	0.051	0.103	0.102	
<sup>J</sup> Total Nitrogen (mg/L)	9	< 0.023	0.385	0.238	0.214	0.130	
<sup>J</sup> Dissolved Reactive Phosphorus (mg/L)	7	< 0.004	0.007	0.005	0.004	0.002	
<sup>J</sup> Total Phosphorus (mg/L)	9	0.008	0.031	0.012	0.016	0.008	
<sup>J</sup> CBOD-5 (mg/L)	7	< 2.0	< 2.0	1.0	1.0	0.0	
Chlorides (mg/L)	9	3.2	12.8	4.9	7.6	4.0	
<b>Total Metals</b>							
<sup>J</sup> Aluminum (mg/L)	5	< 0.043	1.370	0.165	0.533	0.619	
Iron (mg/L)	5	0.308	1.860	1.120 <sup>M</sup>	1.005	0.607	
<sup>J</sup> Manganese (mg/L)	5	0.016	0.051	0.039	0.034	0.015	
<b>Dissolved Metals</b>							
<sup>J</sup> Aluminum (mg/L)	3	< 0.043	0.046	0.022	0.030	0.014	
Antimony (µg/L)	3	< 3.6	< 3.6	1.8	1.8	0.0	
Arsenic (µg/L)	5	< 0.8	1.8	0.9	0.7	0.3	
Cadmium (µg/L)	5	< 0.000	< 0.000	0.000	0.000	0.000	
Chromium (mg/L)	5	< 0.009	0.032	0.004	0.007	0.005	
Copper (mg/L)	5	< 0.020	0.031	0.010	0.011	0.002	
<sup>J</sup> Iron (mg/L)	3	< 0.019	0.699	0.085	0.264	0.378	
Lead (µg/L)	5	< 0.9	< 0.9	0.4	0.4	0.0	
<sup>J</sup> Manganese (mg/L)	3	0.016	0.043	0.020	0.026	0.014	
Mercury (µg/L)	3	< 0.035	0.035	0.018	0.018	0.000	
Nickel (mg/L)	5	< 0.016	0.042	0.021	0.018	0.006	
Selenium (µg/L)	3	< 2.5	< 2.5	1.2	1.2	0.0	
Silver (µg/L)	5	< 0.000	< 0.000	0.000	0.000	0.000	
Thallium (µg/L)	3	< 1.4	< 1.4	0.7	0.7	0.0	
Zinc (mg/L)	5	< 0.012	0.017	0.006	0.006	0.001	
<b>Biological</b>							
Chlorophyll a (ug/L)	7	< 0.10	5.34	0.53	1.19	1.86	
<sup>J</sup> E. coli (col/100mL)	7	36	291	135	154	104	

C=(*F&W*) criterion violated; G=value > median concentration of all verified reference reach data collected in the ecoregion 68; J=estimate; M=value > 90th percentile of all verified ecoregional reference reach data collected within ecoregions 68; N=# samples.

FOR MORE INFORMATION, CONTACT:

Sreeletha Kumar, ADEM Environmental Indicators Section  
1350 Coliseum Boulevard Montgomery, AL 36110  
(334) 260-2782 skumar@adem.state.al.us