

# 2012 Monitoring Summary



## Warrior Creek in Cullman County at County Road 56 (34.27813/-86.47058)

### BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Warrior Creek watershed for biological and water quality monitoring as part of the 2012 Cahaba and Black Warrior (CBW) River Basin Assessment Plan. The 2012 data will be used to assess the biological integrity of the site and estimate overall water quality within the Black Warrior River Basin.



Figure 1. Warrior Creek at WARB-2, April 24, 2012.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Warrior Creek at WARB-2 is a small *Fish & Wildlife (F&W)* creek located within the Southern Table Plateaus ecoregion in Cullman County. Based on the 2006 National Land Cover Dataset, land use within the watershed is composed primarily of pasture-land. Population density is low and there is very little development. As of May 13, 2013, ADEM's NPDES Management System database does not show any active outfalls within the 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. Warrior Creek at WARB-2 is a high-gradient, riffle-run stream. Instream substrates were dominated by boulders and cobble, with some gravel, silt and sand (Figure 1). Habitat quality and availability within the reach were rated *sub-optimal* for supporting macroinvertebrate communities.

### 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. The final score indicated the biological community at WARB-2 to be in *fair* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Black Warrior River
<b>Basin</b>		
<b>Drainage Area (mi<sup>2</sup>)</b>		3
<b>Ecoregion<sup>a</sup></b>		68d
<b>% Landuse</b>		
Open water		<1
Wetland	Woody	1
Forest	Deciduous	18
	Evergreen	2
	Mixed	4
Shrub/scrub		8
Grassland/herbaceous		1
Pasture/hay		52
Cultivated crops		6
Development	Open space	6
	Low intensity	1
	Moderate intensity	<1
Barren		<1
<b>Population/km<sup>2b</sup></b>		67

a. Southern Table Plateaus

b. 2000 US Census

Table 2. Physical characteristics of Warrior Creek at WARB-2, May 8, 2012.

Physical Characteristics		
<b>Width (ft)</b>		12
<b>Canopy Cover</b>		Mostly Shaded
<b>Depth (ft)</b>		
	Riffle	0.4
	Run	1.0
	Pool	1.5
<b>% of Reach</b>		
	Riffle	35
	Run	50
	Pool	15
<b>% Substrate</b>		
	Boulder	25
	Cobble	30
	Mud/Muck	1
	Gravel	15
	Sand	10
	Silt	12
	Organic Matter	7

**Table 3.** Results of the habitat assessment conducted on Warrior Creek at WARB-2, May 8, 2012.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	67	Sub-optimal (59-70)
Sediment Deposition	56	Marginal (41-58)
Sinuosity	83	Sub-optimal (65-84)
Bank and Vegetative Stability	60	Sub-optimal (60-74)
Riparian Buffer	53	Marginal (50-69)
<b>Habitat Assessment Score</b>	<b>150</b>	
<b>% Maximum Score</b>	<b>63</b>	Sub-optimal (59-70)

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Warrior Creek at WARB-2, May 8, 2012.

Macroinvertebrate Assessment			
	Results	Scores	
		(0-100)	
<b>Taxa richness measures</b>			
	# EPT taxa	22	78
<b>Taxonomic composition measures</b>			
	% Non-insect taxa	10	62
	% Dominant taxon	45	5
	% EPC taxa	23	42
<b>Functional feeding group measures</b>			
	% Predators	11	44
<b>Tolerance measures</b>			
	% Taxa as Tolerant	29	57
	<b>WMB-I Assessment Score</b>	---	<b>48</b>
	<b>WMB-I Assessment Rating</b>		<b>Fair (39-58)</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) during April through November of 2012 to help identify any stressors to the biological communities.

The median concentration of specific conductance and hardness was higher than expected based on reference data collected in the Southern Table Plateaus ecoregion. Total suspended solids, nutrients, chlorides, manganese, and copper were higher than expected based on the 90th percentile of all samples collected at reference reaches in ecoregion 68d. No organics samples were collected.

## SUMMARY

ADEM monitored Warrior Creek as part of the Black Warrior River Basin Assessment in 2012. Overall habitat quality was categorized as *sub-optimal*. Although physical parameters, nutrients, chlorides, manganese, and copper were greater than expected for this ecoregion, bioassessment results indicated the macroinvertebrate community to be in *fair* condition.

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**Table 5.** Summary of water quality data collected April-November, 2012. 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
<b>Physical</b>						
Temperature (°C)	4	13.690	19.400	17.600	17.090	2.600
Turbidity (NTU)	4	1.000	7.200	2.790	3.400	2.690
↓ Total Dissolved Solids (mg/L)	3	68.000	75.000	71.000	71.300	3.500
↓ Total Suspended Solids (mg/L)	3 <	1.000	55.000	11.000 <sup>M</sup>	22.190	28.900
Specific Conductance (µmhos)	4	90.000	120.000	108.300 <sup>G</sup>	106.600	13.890
Hardness (mg/L)	3	26.900	48.000	44.100 <sup>G</sup>	39.690	11.200
Alkalinity (mg/L)	3	21.700	33.900	32.400	29.300	6.600
Stream Flow (cfs)	1				0.500	
<b>Chemical</b>						
Dissolved Oxygen (mg/L)	4	7.090	8.900	7.600	7.800	0.800
pH (su)	4	6.990	7.500	7.390	7.300	0.200
↓ Ammonia Nitrogen (mg/L)	3 <	0.010	0.028	0.014	0.012	0.007
↓ Nitrate+Nitrite Nitrogen (mg/L)	3	0.695	2.650	0.816 <sup>M</sup>	1.387	1.095
Total Kjeldahl Nitrogen (mg/L)	3	0.175	0.357	0.349	0.294	0.103
↓ Total Nitrogen (mg/L)	3	0.991	2.999	1.052 <sup>M</sup>	1.681	1.142
↓ Dissolved Reactive Phosphorus (mg/L)	3	0.006	0.010	0.009	0.008	0.002
Total Phosphorus (mg/L)	3 <	0.009	0.033	0.015	0.018	0.014
CBOD-5 (mg/L)	3 <	1.000	2.000	1.000	0.800	0.290
Chlorides (mg/L)	3	3.600	4.600	3.900 <sup>M</sup>	4.090	0.490
<b>Total Metals</b>						
↓ Aluminum (mg/L)	3 <	0.030	0.094	0.049	0.053	0.040
↓ Iron (mg/L)	3 <	0.100	0.195	0.191	0.145	0.082
↓ Manganese (mg/L)	3	0.032	0.166	0.059 <sup>M</sup>	0.086	0.071
<b>Dissolved Metals</b>						
↓ Aluminum (mg/L)	3 <	0.030	0.035	0.015	0.022	0.012
↓ Antimony (µg/L)	3 <	0.800 <	0.800	0.400	0.400	0.000
↓ Arsenic (µg/L)	3 <	1.0 <	1.0	0.5	0.5	0.0
↓ Cadmium (µg/L)	3 <	0.090 <	0.090	0.045	0.045	0.000
Chromium (mg/L)	3 <	0.005 <	0.005	0.002	0.002	0.000
Copper (mg/L)	3 <	0.100	0.300	0.150 <sup>M</sup>	0.117	0.058
↓ Iron (mg/L)	3 <	0.100 <	0.100	0.050	0.067	0.029
Lead (µg/L)	3 <	1.6 <	1.6	0.8	0.8	0.0
↓ Manganese (mg/L)	3	0.032	0.112	0.046	0.063	0.043
Nickel (mg/L)	3 <	0.010 <	0.010	0.005	0.005	0.000
Selenium (µg/L)	3 <	2.000 <	2.000	1.000	1.000	0.000
↓ Silver (µg/L)	3 <	1.000 <	1.000	0.500	0.500	0.000
Thallium (µg/L)	3 <	0.400 <	0.400	0.200	0.200	0.000
↓ Zinc (mg/L)	3 <	0.009	0.020	0.010	0.008	0.003
<b>Biological</b>						
Chlorophyll a (ug/L)	3 <	1.000	3.470	1.070	1.680	1.579
↓ E. coli (col/100mL)	3	107.900	648.900	122.000	292.900	308.000

G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68d; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68d; N=# samples.