

# 2010 Monitoring Summary



## Crooked Creek at County Road 818 in Cullman County (34.12332/-87.04863)

### BACKGROUND

Crooked Creek, from Smith Lake to its source, was placed on Alabama's 1996 Clean Water Act (CWA) §303(d) list of impaired waters for only partially meeting its *Fish & Wildlife (F&W)* use classification. The causes of impairment were listed as organic enrichment/low dissolved oxygen (OE/DO), pathogens, and ammonia from pasture grazing and intensive animal feeding operations.

The Alabama Department of Environmental Management (ADEM) developed Total Maximum Daily Load (TMDLs) to address the OE/DO and ammonia impairments. Both TMDLs were approved by US Environmental Protection Agency Region 4 (USEPA) in 2002. The pathogens TMDL was developed and approved by USEPA in 2003.

A watershed management plan (WMP) will be developed to help address the sources of impairment identified in the three TMDLs. It will be implemented in part using a Clean Water Act (CWA) §319(h) nonpoint source grant provided by USEPA through ADEM's §319 grant program.

Crooked Creek was monitored in 2010 to document water quality conditions before the implementation of the Crooked Creek WMPs.



Figure 1. Crooked Creek at CROC-50, May 27, 2010.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Crooked Creek is a *Fish & Wildlife (F&W)* stream located north of the city of Crane Hill in Cullman County west of Cullman. Based on the 2000 National Land Cover Dataset, landuse within the watershed is primarily forest (43%) and pasture/hay. ADEM has issued 14 NPDES discharge permit 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. Crooked Creek at CROC-50 is a shallow, high-gradient stream reach characterized by bedrock, boulders, cobble, and gravel, substrates and organic matter (Figure 1). Overall habitat quality was categorized as *optimal*.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Black Warrior River
<b>Basin</b>		Black Warrior River
<b>Drainage Area (mi<sup>2</sup>)</b>		46
<b>Ecoregion<sup>a</sup></b>		68e
<b>% Landuse</b>		
Open water		<1
Wetland	Woody	<1
	Emergent herbaceous	<1
	Forest	Deciduous
		Evergreen
		Mixed
		10
Shrub/scrub		6
Grassland/herbaceous		2
Pasture/hay		39
Cultivated crops		4
Development	Open space	5
	Low intensity	1
	Moderate intensity	<1
	High intensity	<1
Barren		<1
<b>Population/km<sup>2b</sup></b>		32
<b># NPDES Permits<sup>c</sup></b>	<b>TOTAL</b>	14
	Construction Stormwater	8
	Industrial General	1
	Municipal Individual	2
	Underground Injection Control	3

a. Dissected Plateau

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011.

Table 2. Physical characteristics of Crooked Creek at CROC-50, May 27, 2010.

Physical Characteristics		
<b>Width (ft)</b>		35
<b>Canopy Cover</b>		Mostly Open
<b>Depth (ft)</b>		
	Riffle	0.4
	Run	1.0
	Pool	2.5
<b>% of Reach</b>		
	Riffle	50
	Run	30
	Pool	20
<b>% Substrate</b>		
	Bedrock	30
	Boulder	25
	Cobble	20
	Mud/Muck	1
	Gravel	10
	Sand	1
	Silt	1
	Organic Matter	12

**Table 3.** Results of the habitat assessment conducted on Crooked Creek at CROC-50, May 27, 2010.

Habitat Assessment	%Maximum score	Rating
Instream Habitat Quality	88	Optimal >70
Sediment Deposition	85	Optimal >70
Sinuosity	90	Optimal >84
Bank and Vegetative Stability	86	Optimal >74
Riparian Buffer	86	Sub-optimal (70-89)
<b>Habitat Assessment Score</b>	<b>206</b>	
<b>% Maximum Score</b>	<b>86</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 in comparison to reference reaches in the same ecoregion. The final score is the average of all individual metric scores. The caddisfly, *Ceratopsyche spp* (Hydropsychidae) comprised 23% of the total organisms collected. Metric results indicated the macroinvertebrate community to be in *fair* condition (Table 4).

Macroinvertebrate Assessment		
	Results	Scores
<b>Taxa richness measures</b>		<b>(0-100)</b>
# EPT taxa	20	70
<b>Taxonomic composition measures</b>		
% Non-insect taxa	10	62
% Dominant taxon	23	69
% EPC taxa	26	0
<b>Functional feeding group measures</b>		
% Predators	11	41
<b>Tolerance measures</b>		
% Taxa as Tolerant	29	58
<b>WMB-I Assessment Score</b>	<b>---</b>	<b>50</b>
<b>WMB-I Assessment Rating</b>		<b>Fair (39-58)</b>

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples were collected semi-monthly, from July through November of 2010 to identify any stressors to the biological community. In situ parameters were also measured in May during the macroinvertebrate bioassessment. Stream flow was 14.2 cfs in May, 1.7 cfs in July, and too low to be measured in September and November. During the macroinvertebrate assessment in May, stream width was recorded as 35 ft. In September, the flow in the stream was reduced to 1 ft wide, and 1 inch deep.

Median conductivity, hardness, dissolved copper, and chloride concentrations were above background concentrations based on the 90th percentile of reference reach data collected in ecoregion 68e. The estimated concentration of dissolved arsenic exceeded human health criterion of 0.3030 µg/L during low flow conditions in September. The estimated concentration of dissolved mercury exceeded the Aquatic Life Use and Human Health Criteria in September.

**Table 5.** Summary of water quality data collected May– November, 2010. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value for non-metals parameters. 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)	5	12.8	26.3	24.8	22.4	5.5	
Turbidity (NTU)	5	1.6	10.5	2.9	4.1	3.7	
Total Dissolved Solids (mg/L)	3	48.0	70.0	65.0	61.0	11.5	
Total Suspended Solids (mg/L)	3	< 0.3	< 3.0	2.0 <sup>G</sup>	1.7	1.4	
Specific Conductance (µmhos)	5	66.0	106.0	86.0 <sup>G</sup>	86.3	15.1	
Hardness (mg/L)	3	25.3	33.3	28.8	29.1	4.0	
Alkalinity (mg/L)	3	21.9	36.8	32.9	30.5	7.7	
Stream Flow (cfs)	2	1.7	14.2	8.0	8.0	8.8	
<b>Chemical</b>							
Dissolved Oxygen (mg/L)	5	5.4	8.5	7.8	7.2	1.3	
pH (su)	5	7.2	7.4	7.3	7.3	0.1	
<sup>J</sup> Nitrate+Nitrite Nitrogen (mg/L)	3	< 0.007	0.049	0.023	0.025	0.023	
<sup>J</sup> Dissolved Reactive Phosphorus (mg/L)	3	< 0.003	< 0.003	0.002	0.002	0.000	
<sup>J</sup> CBOD-5 (mg/L)	3	< 1.0	1.0	0.5	0.5	0.0	
Chlorides (mg/L)	3	3.5	12.6	4.0 <sup>M</sup>	6.7	5.1	
<b>Total Metals</b>							
<sup>J</sup> Aluminum (mg/L)	3	0.023	0.208	0.130	0.120	0.093	
<sup>J</sup> Iron (mg/L)	3	0.126	0.464	0.231	0.274	0.173	
<sup>J</sup> Manganese (mg/L)	3	0.035	0.099	0.046	0.060	0.034	
<b>Dissolved Metals</b>							
Aluminum (mg/L)	3	< 0.020	< 0.020	0.010	0.010	0.000	
Antimony (µg/L)	3	< 0.5	< 0.5	0.2	0.2	0.0	
<sup>J</sup> Arsenic (µg/L)	3	< 1.0	1.5 <sup>H</sup>	0.5	0.8	0.6	1
<sup>J</sup> Cadmium (mg/L)	3	< 0.0004	< 0.0004	0.0004	0.0004	0.000	
Chromium (mg/L)	3	< 0.002	< 0.002	0.001	0.001	0.000	
Copper (mg/L)	3	< 0.200	< 0.200	0.100 <sup>M</sup>	0.100	0.000	
<sup>J</sup> Iron (mg/L)	3	0.073	0.185	0.111	0.123	0.057	
<sup>J</sup> Lead (µg/L)	3	< 2.0	< 2.0	1.0	1.0	0.0	
<sup>J</sup> Manganese (mg/L)	3	0.020	0.082	0.036	0.046	0.032	
<sup>JB</sup> Mercury (µg/L)	2	< 0.200	0.464 <sup>AH</sup>	0.282	0.282	0.257	1
Nickel (mg/L)	3	< 0.005	< 0.005	0.002	0.002	0.000	
Selenium (µg/L)	3	< 1.2	< 1.2	0.6	0.6	0.0	
Silver (mg/L)	3	< 0.001	< 0.001	0.000	0.000	0.000	
Thallium (µg/L)	3	< 0.7	< 0.7	0.4	0.4	0.0	
Zinc (mg/L)	3	< 0.030	< 0.030	0.015	0.015	0.000	
<b>Biological</b>							
Chlorophyll a (ug/L)	3	< 1.00	5.61	2.14	2.75	2.61	
<sup>J</sup> E. coli (col/100mL)	3	5	517	435	319	275	

A=F&W aquatic life use criteria exceeded; B=Samples excluded due to laboratory QC concerns; E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68e; H=F&W human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68e; N=# samples.

## SUMMARY

Crooked Creek at CROC-50 was monitored in 2010 to document water quality conditions before the implementation of the Crooked Creek Watershed Management Plan. The 2010 data did not indicate impairment from nutrient enrichment, pathogens, or low dissolved oxygen concentrations, despite the extremely low flows experienced July through November. Bioassessment results indicated the macroinvertebrate community to be in *fair* condition. Overall habitat quality was rated as *optimal*. Monitoring should continue to ensure that water quality conditions remain stable and to document conditions after the Watershed Management Plan is implemented.

FOR MORE INFORMATION, CONTACT:  
Ashley Shawn La Grone, ADEM Field Operations Decatur  
2715 Sandlin Road SW Decatur, AL 35603  
(256) 353-1713 slagrone@adem.state.al.us