

2013 Monitoring Summary



Aldridge Creek at Green Cove Road SE (Madison County) (32.59490/-86.54580)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Aldridge Creek watershed for biological and water quality monitoring as part of the 2013 Tennessee (TN) River Basin Assessment Monitoring Program. The objectives of the TN River Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the TN basin. Accordingly, water samples were collected from April-October, and macroinvertebrates were sampled June 24, 2013.

The 11.34 mile segment of Aldridge Creek, from its source to its confluence with the Tennessee River, was placed on Alabama's Clean Water Act (CWA) 1996 §303(d) list of impaired waters for not meeting its *Fish and Wildlife (F&W)* water use classification. It was listed for organic enrichment/low dissolved oxygen (OE/DO) impairment from nonpoint sources. In an effort to improve DO concentrations, Total Maximum Daily Loads (TMDLs) were approved for Aldridge Creek in 2002 that established maximum allowable daily inputs of organic carbon and nitrogen, the primary pollutants responsible for low DO conditions.



Figure 1. Aldridge Creek at ALDM-230, June 24, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Aldridge Creek is a *Fish and Wildlife (F&W)* stream located in Madison County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily development (~51%) and forest (35%), with some areas of pasture and shrub/scrub. There are seven permitted discharges located within the watershed as of September 1, 2012.

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. Aldridge Creek at ALDM-230 is a low-gradient stream reach characterized by bedrock, cobble, and gravel substrates (Figure 1). Overall habitat quality was rated as *marginal* for supporting the macroinvertebrate community.

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 *very poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics			
Basin	Tennessee River		
Drainage Area (mi ²)	19		
Ecoregion ^a	71g		
% Landuse			
Wetland	Woody	<1	
Forest	Deciduous	32	
	Evergreen	1	
	Mixed	2	
Shrub/scrub		3	
	Grassland/herbaceous	1	
	Pasture/hay	8	
	Cultivated crops	1	
	Development	Open space	21
		Low intensity	28
		Moderate intensity	2
	High intensity	<1	
Population/km ^{2b}	534		
# NPDES Permits ^c	7		
Construction Stormwater	7		

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 Aldridge Creek at ALDM-230, June 24, 2013.

Physical Characteristics		
Width (ft)	50	
Canopy Cover	Open	
Depth (ft)		
	Riffle	0.5
	Run	1.5
	Pool	1.0
% of Reach		
	Riffle	10
	Run	80
	Pool	10
% Substrate		
	Bedrock	50
	Cobble	22
	Mud/Muck	1
	Gravel	22
	Sand	2
	Silt	2
	Organic Matter	1

Table 3. Results of the habitat assessment conducted on Aldridge Creek at ALDM-230, June 24, 2013.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	55	Marginal (41-58)
Sediment Deposition	57	Marginal (41-58)
Sinuosity	40	Poor (<45)
Bank and Vegetative Stability	54	Marginal (35-59)
Riparian Buffer	35	Poor (<50)
Habitat Assessment Score	122	
% Maximum Score	51	Marginal (41-58)

Table 4. Results of macroinvertebrate bioassessment conducted in Aldridge Creek at ALDM-230, June 24, 2013.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	5	4
Shannon Diversity	1.73	0
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	0	0
% Non-insect taxa	33	0
Functional feeding group		
% Predator Individuals	4	8
Community tolerance		
% Tolerant taxa	42	18
WMB-I Assessment Score	---	5
WMB-I Assessment Rating		Very Poor (0-14)

WATER CHEMISTRY

Results of water chemistry analyses are summarized in Table 5. In situ measurements and water samples were collected in April, June, August, and October 2013 to help identify any stressors to the biological community. Water temperature, alkalinity, chlorides, total dissolved solids, conductivity, hardness, and aluminum were higher than expected based on reference reach data for streams in ecoregion 71. Turbidity was very high on August 6, 2013 (189 NTU), coinciding with a flood event, but was otherwise relatively low. The *E. coli* sample collected on the same date exceeded the *F&W* human health criterion, as did the summer geometric mean. Dissolved arsenic concentrations were higher than expected for *F&W* streams based on human-health criteria for fish consumption on June, August, and October sampling dates. Dissolved chromium concentrations were also higher than expected for *F&W* streams on the same dates.

SUMMARY

Bioassessment results indicated the macroinvertebrate community in Aldridge Creek at ALDM-230 to be in *very poor* condition. Overall habitat quality was categorized as *marginal* for supporting the biological community. Water chemistry analyses concluded that water temperature, alkalinity, chlorides, total dissolved solids, conductivity, hardness, and aluminum were all higher than expected for the ecoregion. *E. coli* counts exceeded *F&W* human health criterion during a high flow event in August, as did the summer geometric mean. Dissolved arsenic and chromium concentrations were also higher than expected for *F&W* streams. These elevated parameters indicate a need for further monitoring to identify causes and sources of the degraded biological conditions.

Although samples of total dissolved arsenic were above expected values in Aldridge Creek, ADEM criteria for arsenic are expressed as dissolved trivalent arsenic (arsenite—As III). Presently, studies are being conducted in order to provide a better understanding of the prevalence and areal distribution of dissolved trivalent arsenic to total arsenic in the State of Alabama. Upon conclusion of the studies, Aldridge Creek will be reassessed for potential arsenic violations.

Table 5. Summary of water quality data collected April-October, 2013. 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	Q	E
Physical								
Temperature (°C)	5	14.2	27.7	22.9 ^M	22.5	5.3		
Turbidity (NTU)	5	1.5	189.0 ^T	1.8	39.2	83.7		1
Total Dissolved Solids (mg/L)	4	101.0	240.0	194.0 ^M	182.2	58.6		
Total Suspended Solids (mg/L)	4	< 1.0	166.0	2.5	42.9	82.1		
Specific Conductance (µmhos)	5	79.6	398.5	332.9 ^G	302.1	128.6		
Hardness (mg/L)	4	44.8	210.0	159.0 ^G	143.2	70.8		
Alkalinity (mg/L)	4	35.5	196.0	161.0 ^M	138.4	70.6		
Stream Flow (cfs)	3	9.3	40.6	11.1	20.3	17.6		
Chemical								
Dissolved Oxygen (mg/L)	5	6.9	15.4	12.7	12.1	3.5		
pH (su)	5	7.4	8.0	7.8	7.7	0.2		
Ammonia Nitrogen (mg/L)	4	< 0.004	0.065	0.006	0.020	0.030		
Nitrate+Nitrite Nitrogen (mg/L)	4	0.353	0.605	0.477	0.478	0.104		
Total Kjeldahl Nitrogen (mg/L)	4	0.218	1.260	0.426	0.583	0.463		
Total Nitrogen (mg/L)	4	0.823	1.613	0.904	1.061	0.372		
^J Dissolved Reactive Phosphorus (mg/L)	4	< 0.004	0.138	0.006	0.038	0.067		
^J Total Phosphorus (mg/L)	4	0.009	0.250	0.014	0.072	0.119		
CBOD-5 (mg/L)	4	< 2.0	2.5	1.0	1.4	0.7		
Chlorides (mg/L)	4	1.3	14.2	5.7 ^M	6.7	5.4		
^J Atrazine (µg/L)	1				0.09			
Total Metals								
^J Aluminum (mg/L)	4	< 0.076	7.250	0.068	1.856	3.596		
^J Iron (mg/L)	4	0.044	6.100	0.072	1.572	3.019		
^J Manganese (mg/L)	4	< 0.009	0.301	0.014	0.084	0.145		
Dissolved Metals								
Aluminum (mg/L)	4	< 0.076	0.411	0.038 ^M	0.131	0.186		
Antimony (µg/L)	4	< 0.1	< 2.6	0.1	0.4	0.6		
^J Arsenic (µg/L)	4	0.6	1.7 ^A	1.0	1.1	0.5	3	
Cadmium (µg/L)	4	< 0.046	< 0.170	0.085	0.070	0.031		
^J Chromium (µg/L)	4	1.040	< 32.000 ^S	1.170	4.845	7.437	3	
^J Copper (mg/L)	4	< 0.0003	< 0.031	0.001	0.004	0.007		
^J Iron (mg/L)	4	< 0.018	0.247	0.024	0.076	0.115		
^J Lead (µg/L)	4	< 0.1	< 1.1	0.1	0.2	0.2		
Manganese (mg/L)	4	< 0.009	0.020	0.004	0.008	0.008		
Mercury (µg/L)	1				< 0.057			
^J Nickel (mg/L)	4	0.0004	< 0.016	0.0007	0.002	0.004		
Selenium (µg/L)	4	< 0.2	< 1.4	0.1	0.3	0.3		
Silver (µg/L)	4	< 0.215	< 2.120	1.060	0.822	0.476		
Thallium (µg/L)	4	< 0.1	< 1.1	0.1	0.2	0.2		
^J Zinc (mg/L)	4	0.002	< 0.017	0.004	0.005	0.003		
Biological								
Chlorophyll a (ug/L)	4	0.27	2.67	0.94	1.20	1.08		
^J E. coli (col/100mL)	4	11	2420 ^H	104	660	1175	2	

E=# samples that exceeded criteria; J=estimate; N=# samples; Q=# of uncertain exceedances; M=value > 90% of ADEM's verified reference reaches collected in ecoregion 71; T=individual turbidity value > 50 NTU above 90th percentile for ecoregion 71; G=value higher than median of all verified ecoregional reference reach data collected in ecoregion 71; A=metals not adjusted for hardness; S=metals adjusted for hardness; H=*F&W* human health criterion exceeded.

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