

# 2015 Monitoring Summary



**Ecological Reference Reach**

## Brushy Creek at Winston County Rd 3159 (34.25300/-87.24700)

### BACKGROUND

Brushy Creek is one of the streams the Alabama Department of Environmental Management (ADEM) monitors as a “best attainable condition” reference watershed for comparison with streams throughout the Dissected Plain ecoregion (68E). This watershed was also selected for biological and water quality monitoring as part of the 2015 Black Warrior-Cahaba (BWC) River Basin Assessment Monitoring Program. The objectives of the BWC River Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin. Macroinvertebrate and habitat assessments were conducted at the site in 2015, along with the collection of monthly water chemistry samples.



Figure 1. Brushy Creek at BRSW-2, May 14, 2015.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Brushy Creek is a *Fish and Wildlife (F&W)* stream that drains approximately 60 square miles in Winston and Lawrence Counties. Based on the 2011 National Land Cover Dataset, landuse within the watershed is primarily forest (92%). Population density is low, as is the percentage of developed land (<5%). As of April 1, 2016, five NPDES outfalls were active in the watershed (ADEM NPDES Management System).

### REACH CHARACTERISTICS

General observations (Figure 1, Table 2) and habitat assessments (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. Brushy Creek at BRSW-2 is a medium gradient stream characterized predominantly by boulder, cobble, and sand substrates. Overall habitat quality and availability was rated as *sub-optimal* for supporting the macroinvertebrate community.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
<b>Basin</b>	Black Warrior River	
<b>Drainage Area (mi<sup>2</sup>)</b>	60	
<b>Ecoregion<sup>a</sup></b>	68E	
<b>Landuse<sup>b</sup></b>		
	Open water	<1%
	Wetland	Woody <1%
	Forest	Deciduous 33%
		Evergreen 35%
		Mixed 24%
	Shrub/scrub	2%
	Grassland/herbaceous	<1%
	Pasture/hay	2%
	Cultivated crops	<1%
	Development	Open space 2%
		Low intensity <1%
		Moderate intensity <1%
		High intensity <1%
<b>Population/km<sup>2c</sup></b>	2	
<b># NPDES Permits<sup>d</sup></b>	<b>TOTAL</b>	5
	Industrial	5
	General	5

a. Dissected Plateau

b. 2011 National Land Cover Dataset

c. 2010 US Census

d. #NPDES outfalls downloaded from ADEM's NPDES Management System database, April 1, 2016.

Table 2. Physical characteristics of Brushy Creek at BRSW-2, May 11, 2015.

Physical Characteristics		
<b>Width (ft)</b>	45	
<b>Canopy Cover</b>	Mostly Open	
<b>Depth (ft)</b>	Riffle	1.0
	Run	2.0
	Pool	3.5
<b>% of Reach</b>	Riffle	5
	Run	20
	Pool	75
<b>% Substrate</b>	Bedrock	2
	Boulder	25
	Cobble	25
	Gravel	13
	Sand	25
	Silt	6
	Organic Matter	4

**Table 3.** Results of the habitat assessment conducted on Brushy Creek at BRSW-2, May 11, 2015.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	67	Sub-Optimal (55-79)
Sediment Deposition	66	Sub-Optimal (55-79)
Riffle frequency	65	Sub-Optimal (55-79)
Bank Vegetative Stability	71	Sub-Optimal (58-79)
Riparian Buffer	93	Optimal (>84)
<b>Habitat Assessment Score</b>	<b>145</b>	
<b>% of Maximum Score</b>	<b>76</b>	<b>Sub-Optimal (57-80)</b>

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Brushy Creek at BRSW-2, May 11, 2015.

Macroinvertebrate Assessment		Results
<b>Taxa richness measures</b>		
	Total # Taxa	102
	# EPT taxa	32
	# Highly-sensitive and Specialized Taxa	12
<b>Taxonomic composition measures</b>		
	% EPC taxa	39
	% Non-insect taxa	6
	% Dominant taxon	16
	% Individuals in Dominant 5 Taxa	43
<b>Functional feeding group measures</b>		
	% Predators	14
<b>Tolerance measures</b>		
	# Sensitive EPT	22
	% Sensitive Taxa	50
	% Taxa as Tolerant	20
	<b>WMB-I Assessment Score</b>	<b>2-</b>
	<b>WMB-I Assessment Rating</b>	<b>Good-Very Good</b>

## BIOASSESSMENT RESULTS

The benthic macroinvertebrate community was sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). Measures of taxonomic richness, community composition, and community tolerance were used to assess the overall health of the macroinvertebrate community in comparison to conditions expected in north Alabama streams and rivers. Each site is placed in one of six levels, ranging from 1, or *natural*, to 6, or *highly altered*. The macroinvertebrate survey conducted at BRSW-2 rated the site as a 2-, or *Good-Very Good* (Table 4).

## WATER CHEMISTRY

Results of water chemistry analyses are summarized in Table 5. In situ measurements and water samples were collected monthly and semi-monthly (metals), from March through October 2015 to help identify any stressors to the biological community. Hardness and chlorides were higher than expected based on reference reach data for streams in ecoregion 68E. No samples were collected for the analysis of pesticides, semi-volatile organics, or atrazine.

## SUMMARY

ADEM monitored Brushy Creek at BRSW-2 in 2015 to evaluate its status as a "best attainable" condition reference watershed. This station was also sampled as part of the 2015 BWC River Basin Assessment. Landuse and population density categorize Brushy Creek among the least-disturbed watersheds in the Black Warrior River basin. Overall habitat quality and availability was rated as *sub-optimal*, and the macroinvertebrate community was found to be in *good-very good* condition. However, hardness and chlorides were elevated as compared to data from ADEM's least-impaired reference reaches in ecoregion 68E. Monitoring should continue to ensure that water quality and biological conditions remain stable.

**Table 5.** Summary of water quality data collected March-October, 2015. 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
<b>Physical</b>							
Temperature (°C)	8	13.0	25.9	19.2	19.7	4.6	
Turbidity (NTU)	9	1.6	10.0	3.4	3.9	2.5	
Total Dissolved Solids (mg/L)	8	18.0	57.0	33.5	34.2	11.0	
Total Suspended Solids (mg/L)	8	< 1.0	9.0	1.0	2.2	3.0	
Specific Conductance (µmhos/cm)	8	24.0	61.0	37.0	37.5	12.7	
Hardness (mg/L)	4	2.5	22.8	16.4 <sup>G</sup>	14.6	8.9	
Alkalinity (mg/L)	8	< 1.0	12.9	6.5	7.5	4.3	
Monthly Stream Flow (cfs)	7	0.1	19.6	13.1	11.3	7.7	
Measured Stream Flow (cfs)	6	1.7	19.6	14.6	13.2	6.4	
<b>Chemical</b>							
Dissolved Oxygen (mg/L)	8	7.1	10.4	9.0	8.8	1.1	
pH (SU)	8	6.8	8.1	7.2	7.3	0.4	
Ammonia Nitrogen (mg/L)	8	< 0.007	0.070	0.004	0.013	0.023	
Nitrate+Nitrite Nitrogen (mg/L)	8	0.034	0.190	0.100	0.108	0.059	
Total Kjeldahl Nitrogen (mg/L)	8	0.075	0.752	0.185	0.268	0.228	
Total Nitrogen (mg/L)	8	0.207	0.786	0.281	0.376	0.198	
Dis Reactive Phosphorus (mg/L)	8	< 0.004	0.007	0.004	0.004	0.000	
Total Phosphorus (mg/L)	8	< 0.007	0.013	0.009	0.009	0.003	
CBOD-5 (mg/L)	8	< 2.0	< 2.0	1.0	1.0	0.0	
COD (mg/L)	8	5.9	15.4	11.4	10.7	3.4	
TOC (mg/L)	8	1.5	3.1	2.1	2.2	0.6	
Chlorides (mg/L)	8	1.0	2.1	1.7 <sup>M</sup>	1.6	0.4	
<b>Total Metals</b>							
Aluminum (mg/L)	4	< 0.014	0.575	0.168	0.230	0.246	
Iron (mg/L)	4	0.335	0.710	0.398	0.460	0.176	
Manganese (mg/L)	4	0.031	0.457	0.036	0.140	0.212	
<b>Dissolved Metals</b>							
Aluminum (mg/L)	4	< 0.014	0.057	0.027	0.030	0.026	
Antimony (µg/L)	4	< 0.233	< 0.233	0.116	0.116	0.000	
Arsenic (µg/L)	4	< 0.146	0.286 <sup>H</sup>	0.269	0.224	0.102	2
Cadmium (µg/L)	4	< 0.118	< 0.118	0.059	0.059	0.000	
Chromium (µg/L)	4	< 0.131	0.454	0.345	0.302	0.169	
Copper (µg/L)	4	< 0.180	2.480 <sup>S</sup>	0.090	0.688	1.195	1
Iron (mg/L)	4	0.096	0.533	0.391	0.353	0.185	
Lead (µg/L)	4	< 0.168	< 0.168	0.084	0.084	0.000	
Manganese (mg/L)	4	0.012	0.067	0.036	0.038	0.024	
Nickel (µg/L)	4	< 0.232	< 0.232	0.116	0.116	0.000	
Selenium (µg/L)	4	< 0.341	< 0.341	0.170	0.170	0.000	
Silver (µg/L)	4	< 0.208	< 0.208	0.104	0.104	0.000	
Thallium (µg/L)	4	< 0.153	< 0.153	0.076	0.076	0.000	
Zinc (µg/L)	4	< 0.857	1.450	0.428	0.684	0.511	
<b>Biological</b>							
Chlorophyll a (mg/m <sup>3</sup> )	8	< 1.00	1.60	0.50	0.74	0.45	
E. coli (MPN/DL)	8	24.6	204.6	52.0	67.6	60.2	

G=value higher than median of all verified ecoregional reference reach data collected in ecoregion 68E; H=F&W human health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in ecoregion 68E; N=# samples; Q=# of uncertain exceedances; S=F&W hardness-adjusted aquatic life use criteria exceeded.

FOR MONITORING INFORMATION, CONTACT:  
 Tim Wynn, ADEM Aquatic Assessment Unit  
 110 Vulcan Road, Birmingham AL 35209  
 (205) 942-6168 timothy.wynn@adem.alabama.gov