Alabama Department of Environmental Management

303(d)/TMDL

Rivers and Streams Monitoring Program

2013 Monitoring Summary

Fair

Sulphur Creek at unnamed Limestone County Road (Easter Ferry Road Bridge) (34.90830/-87.02980)

BACKGROUND

The 8.34 mile segment of Sulphur Creek, from its confluence with the Elk River upstream to its source, has been on Alabama's Clean Water Act (CWA) §303(d) list of impaired waters since 2008. It was listed for nutrients from agricultural and industrial sources. The Alabama Department of Environmental Management (ADEM) monitored Sulphur Creek at SLRL-1 in 2013 to investigate the extent of the impairment. Macroinvertebrate, fish, and habitat assessments were conducted at the site, and monthly water chemistry samples were also collected. These data will be used to develop Total Maximum Daily Loads (TMDLs), which are targeted for completion in 2015.

Figure 1. Sulphur Creek at SLRL-1, April 24, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Sulphur Creek at SLRL-1 is a *Fish & Wildlife* (*F&W*) stream located in Limestone County. Based on the 2006 National Land Cover Dataset, land use within the watershed is predominantly pasture/row crops (45%) and forest (41%) with relatively little development (<7%). Population density is also relatively low in this area. As of May 13, 2013, a total of six NPDES outfalls are active in 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. Sulphur Creek at SLRL-1 is a riffle-run stream located in the Outer Nashville Basin ecoregion (71h) (Figure 1). Benthic substrate consists primarily of bedrock, cobble, and gravel. Overall habitat quality was rated as *optimal* for supporting the macroinvertebrate community.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi²)		17
Ecoregion[a]		71h
% Landuse		
Open water		<1
Wetland	Woody	1
	Emergent herbaceous	<1
Forest	Deciduous	26
	Evergreen	5
	Mixed	10
Shrub/scrub		5
Grassland/herbaceous		2
Pasture/hay		33
Cultivated crops		12
Development	Open space	4
	Low intensity	1
	Moderate intensity	<1
	High intensity	<1
Population/km²[b]		36
# NPDES Permits[c]	**TOTAL**	6
Construction Stormwater		2
Industrial General		2
Industrial Individual		1
Underground Injection Control		1

a. Outer Nashville Basin

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, May 13, 2013.

Table 2. Physical Characteristics of Sulphur Creek at SLRL-1, June 3, 2013.

Physical Characteristics		
Width (ft)		37
Canopy Cover		Estimate 50/50
Depth (ft)		
	Riffle	0.5
	Run	0.7
	Pool	0.5
% of Reach		
	Riffle	35
	Run	40
	Pool	25
% Substrate		
	Bedrock	40
	Boulder	2
	Cobble	24
	Gravel	24
	Sand	5
	Silt	2
	Organic Matter	3

Table 3. Results of the habitat assessment conducted on Sulphur Creek at SLRL-1, June 3, 2013.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	79	Optimal (>70)
Sediment Deposition	80	Optimal (>70)
Sinuosity	88	Optimal (>84)
Bank and Vegetative Stability	84	Optimal (>74)
Riparian Buffer	83	Sub-optimal (70-89)
Habitat Assessment Score	**189**	
% Maximum Score	**79**	**Optimal (>70)**

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 metric results indicated the macroinvertebrate community at SLRL-1 to be in *fair* condition (Table 4).

Table 4. Results of the macroinvertebrate bioassessment conducted in Sulphur Creek at SLRL-1, June 3, 2013.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness and diversity measures		**(0-100)**
# EPT taxa	15	48
Shannon Diversity	3.84	53
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	4	8
% Non-insect taxa	16	35
Functional feeding group		
% Predator Individuals	3	3
Community tolerance		
% Tolerant taxa	26	66
WMB-I Assessment Score	—	35
WMB-I Assessment Rating		Fair (29-43)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, *in situ* measurements and water samples were collected monthly from March-October of 2013 to help identify any stressors to the biological community. On one sampling occasion, pH exceeded the criterion applicable to Sulphur Creek's *F&W* use classification. This sample also coincided with the lowest recorded stream flow of the year. Median conductivity was higher than the median of all reference reach data for the Interior Plateau ecoregion (71). Also, median concentrations of total nitrogen, dissolved reactive phosphorus, and chlorides were higher than expected based on the 90th percentile of reference reaches within this ecoregion.

Table 5. Summary of water quality data collected March-October 2013. 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	E
Physical							
Temperature (°C)	9	10.5	27.5	21.1	20.6	5.3	
Turbidity (NTU)	13	2.3	22.2	4.4	6.7	6.0	
J Total Dissolved Solids (mg/L)	8	99.0	251.0	131.0	140.6	49.8	
Total Suspended Solids (mg/L)	8	< 1.0	9.0	4.5	4.6	3.0	
Specific Conductance (µmhoe)	9	155.0	235.0	197.0 G	195.9	24.0	
J Alkalinity (mg/L)	8	42.0	83.0	67.8	65.8	14.3	
Stream Flow (cfs)	13	2.8	63.4	13.3	18.1	16.4	
Chemical							
Dissolved Oxygen (mg/L)	9	8.3	12.0	9.4	9.5	1.1	
pH (su)	9	7.7	8.8 C	8.1	8.1	0.4	1
J Ammonia Nitrogen (mg/L)	8	< 0.015	0.080	0.010	0.022	0.023	
Nitrate+Nitrite Nitrogen (mg/L)	8	1.050	1.620	1.305	1.298	0.183	
Total Kjeldahl Nitrogen (mg/L)	8	< 0.071	0.483	0.288	0.282	0.130	
Total Nitrogen (mg/L)	8	< 1.323	1.825	1.588 M	1.580	0.166	
Dissolved Reactive Phosphorus (mg/L)	8	0.021	0.061	0.036 M	0.042	0.019	
J Total Phosphorus (mg/L)	8	0.033	0.088	0.045	0.053	0.021	
J CBOD-5 (mg/L)	7	< 2.0	< 2.0	1.0	1.0	0.0	
J Chlorides (mg/L)	8	2.1	5.6	3.7 M	3.7	1.2	
Biological							
Chlorophyll a (ug/L)	8	1.07	2.67	1.20	1.54	0.71	

C= *F&W* criterion violated; E= # of samples that exceeded criteria; G= value > median of all ecoregional reference reach data collected in ecoregion 71; J=estimate; M=value >90% of collected samples in ecoregion 71; N= # samples.

SUMMARY

Bioassesment results indicated the macroinvertebrate community in Sulphur Creek at SLRL-1 to be in *fair* condition. Habitat assessment results were scored as *optimal*. Water chemistry analyses showed elevated pH, specific conductance, total nitrogen, and dissolved reactive phosphorus to be potential causes of stress to the biological community in the Sulphur Creek watershed.

FOR MORE INFORMATION, CONTACT:
Tim Wynn, ADEM Aquatic Assessment Unit
110 Vulcan Road, Birmingham AL 35209
(205) 917-2497 timothy.wynn@adem.state.al.us