

2012 Monitoring Summary



Valley Creek upstream of 18th Avenue Bridge in Jefferson County (33.41958/-86.96520)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected Valley Creek watershed for biological and water quality monitoring as part of the 2012 Assessment of the Black Warrior and Cahaba (BWC) River Basins. The objectives of the project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.



Figure 1. Valley Creek at VC-5, July 19, 2012.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Valley Creek is a *Limited Warm Water Fishery* (LWF) from Blue Creek to its source and as a Fish & Wildlife (*F&W*) stream from Blue Creek downstream to the Warrior River. It is located in the Southern Limestone/Dolomite Valleys and Low Rolling Hills ecoregion (67f) near the town of Bessemer. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily development (90%). As of September 1, 2012, ADEM's NPDES Management System database shows a total of 205 permitted discharges 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. Valley Creek at VC-5 is a high-gradient stream with substrate composed primarily of bedrock, cobble, gravel, and sand (Figure 1). Overall habitat quality and availability was rated as *optimal* for supporting diverse aquatic 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. Metric results indicated the macroinvertebrate community to be in *very poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics			
Basin	Black Warrior River		
Drainage Area (mi²)	35		
Ecoregion^a	67f		
% Landuse			
Open water		<1	
Wetland	Woody	<1	
Forest	Deciduous	7	
	Evergreen	1	
	Mixed	1	
Shrub/scrub		1	
Grassland/herbaceous		<1	
Pasture/hay		1	
Cultivated crops		<1	
	Development	Open space	22
		Low intensity	44
		Moderate intensity	15
		High intensity	9
Population/km^{2b}	1260		
# NPDES Permits^c	TOTAL	205	
	Construction Stormwater	125	
	Mining	1	
	Industrial General	51	
	Industrial Individual	8	
	Municipal Individual	15	
	Underground Injection Control	5	

a.Southern Limestone/Dolomite Valleys and Low Rolling Hills

b.2000 US Census

c.#NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Valley Creek at VC-5, April 26, 2012.

Physical Characteristics		
Width (ft)	55	
Canopy Cover	Mostly Open	
Depth (ft)		
	Riffle	1.0
	Run	1.5
	Pool	2.5
% of Reach		
	Riffle	20
	Run	40
	Pool	40
% Substrate		
	Bedrock	15
	Boulder	5
	Cobble	25
	Gravel	25
	Sand	25
	Organic Matter	5

Table 3. Results of the habitat assessment conducted on Valley Creek at VC-5, April 26, 2012.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	83	Optimal >70
Sediment Deposition	72	Optimal >70
Sinuosity	70	Sub-optimal (65-84)
Bank and Vegetative Stability	80	Optimal >74
Riparian Buffer	66	Marginal (50-69)
Habitat Assessment Score	180	
% Maximum Score	75	Optimal >70

Table 4. Results of the macroinvertebrate bioassessment conducted in Valley Creek at VC-5, April 26, 2012.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	11	30
Shannon Diversity	3.46	35
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	0	0
% Non-insect taxa	26	0
Tolerance measures		
% Tolerant taxa	39	29
WMB-I Assessment Score	---	19
WMB-I Assessment Rating		Very Poor (0-22)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected April through November of 2012 to help identify any stressors to the biological communities. Organics were not collected at Valley Creek. Median values for several physical parameters and nutrients were also higher than background levels for ecoregion 67f. On May 24th, July 19th, and September 25th, arsenic exceeded the *LWF* human health criterion; however, results were normal for ecoregion 67f. Although samples of total dissolved arsenic did exceed human health criteria at Valley 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, Valley Creek will be reassessed for arsenic violations.

SUMMARY

Although overall habitat quality was categorized as *optimal*, bioassessment results indicated the macroinvertebrate community to be in *very poor* condition. Intensive water chemistry results indicated higher than expected nitrogen, total dissolved solids, specific conductance, hardness and alkalinity concentrations, as compared to data from least-impaired reference reaches in the same ecoregion. Monitoring should be continued to identify the causes and sources of the degraded biological conditions.

Table 5. Summary of water quality data collected April-November, 2012. 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	E
Physical							
Temperature (°C)	5	12.6	24.7	19.7	19.4	4.5	
Turbidity (NTU)	5	0.9	8.3	2.0	3.1	3.0	
Total Dissolved Solids (mg/L)	4	160.0	306.0	293.5 ^M	263.2	69.1	
Total Suspended Solids (mg/L)	4	< 1.0	4.0	2.0	2.1	1.4	
Specific Conductance (µmhos)	5	239.0	497.2	480.0 ^G	435.8	110.3	
Hardness (mg/L)	4	102.0	248.0	224.5 ^G	199.8	66.8	
^B Alkalinity (mg/L)	3	65.4	161.9	145.0 ^M	124.1	51.5	
Stream Flow (cfs)	5	22.3	34.9	29.8	28.2	5.4	
Chemical							
Dissolved Oxygen (mg/L)	5	7.2	11.3	8.6	9.0	1.6	
pH (su)	5	7.8	8.3	8.1	8.0	0.2	
^J Ammonia Nitrogen (mg/L)	4	< 0.010	< 0.028	0.014	0.012	0.004	
Nitrate+Nitrite Nitrogen (mg/L)	4	0.677	1.200	0.769 ^M	0.854	0.235	
Total Kjeldahl Nitrogen (mg/L)	4	0.181	0.597	0.363	0.376	0.185	
Total Nitrogen (mg/L)	4	1.054	1.381	1.242 ^M	1.230	0.137	
Dissolved Reactive Phosphorus (mg/L)	4	0.013	0.067	0.022 ^M	0.031	0.024	
^J Total Phosphorus (mg/L)	4	0.016	0.079	0.022	0.035	0.030	
CBOD-5 (mg/L)	4	< 2.0	< 2.0	1.0	1.0	0.0	
^J Chlorides (mg/L)	4	4.6	19.6	10.0 ^M	11.0	6.5	
Total Metals							
^J Aluminum (mg/L)	4	< 0.030	0.246	0.032	0.081	0.111	
^J Iron (mg/L)	4	< 0.051	0.217	0.050	0.092	0.083	
^J Manganese (mg/L)	4	0.008	0.028	0.016	0.017	0.009	
Dissolved Metals							
^J Aluminum (mg/L)	4	< 0.030	0.066	0.040	0.040	0.029	
^J Antimony (µg/L)	4	< 0.8	0.8	0.4	0.5	0.2	
^J Arsenic (µg/L)	4	< 1.0	2.0 ^H	1.2	1.2	0.6	3
^J Cadmium (µg/L)	4	< 0.090	< 0.090	0.045	0.045	0.000	
^J Chromium (mg/L)	4	< 0.005	< 0.005	0.002	0.002	0.000	
^J Copper (mg/L)	4	< 0.100	< 0.300	0.100 ^M	0.100	0.058	
Iron (mg/L)	4	< 0.100	< 0.100	0.050	0.050	0.000	
Lead (µg/L)	4	< 1.6	< 1.6	0.8	0.8	0.0	
^J Manganese (mg/L)	4	< 0.002	0.010	0.007	0.006	0.004	
^J Nickel (mg/L)	4	< 0.010	< 0.010	0.005	0.005	0.000	
Selenium (µg/L)	4	< 2.0	< 2.0	1.0	1.0	0.0	
^J Silver (µg/L)	4	< 1.000	< 1.000	0.500	0.500	0.000	
Thallium (µg/L)	4	< 0.4	< 0.4	0.2	0.2	0.0	
^J Zinc (mg/L)	4	< 0.009	< 0.020	0.010	0.009	0.003	
Biological							
^J Chlorophyll a (µg/L)	4	< 1.00	2.14	0.50	0.91	0.82	
<i>E. coli</i> (col/100mL)	4	45	387	198	207	154	

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 67f; H=*LWF* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 67f; N=# samples.

FOR MONITORING INFORMATION, CONTACT:
 Alicia K. Phillips ADEM Environmental Indicators Section
 1350 Coliseum Boulevard Montgomery, AL 36110
 (334) 260-2797 akphillips@adem.state.al.us