2013 Monitoring Summary

ADEM — Alabama Department of Environmental Management

Ecological Reference Reach

Fair-Good

Clear Creek at Alabama Highway 65 in Jackson County (34.71935/-86.31083)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Clear Creek watershed for biological and water quality monitoring as part of the 2013 assessment of the Tennessee River Basin. The objectives of these surveys were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Tennessee River Basin. A habitat and a macroinvertebrate assessment were conducted on Clear Creek at CLER-1 on June 26, 2013.

Figure 1. Clear Creek at CLER-1, June 26, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Clear Creek at CLER-1 is a *Fish and Wildlife* (*F&W*) stream located in Jackson County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily forest (87%). As of September 5, 2014, no NPDES permits have been issued in the watershed.

REACH CHARACTRISTICS

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. Clear Creek at CLER-1 is a riffle-run stream located in the Eastern Highland Rim ecoregion (71g) (Figure 1). Benthic substrate in the reach consists primarily of clay and gravel. Overall habitat quality was rated as *sub-optimal* for supporting 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 in comparison to conditions expected in north Alabama streams and rivers. Each score is based on a six-point scale, ranging from 1, or *natural*, to 6, or *highly altered*. The macroinvertebrate survey conducted in Clear Creek at CLER-1 rated the macroinvertebrate community to be in *good –fair* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi^2)		18
Ecoregion[a]		71g
% Landuse		
Wetland	Woody	<1
Forest	Deciduous	85
	Evergreen	1
	Mixed	1
Shrub/scrub		1
Grassland/herbaceous		<1
Pasture/hay		9
Cultivated crops		1
Development	Open space	1
	Low intensity	<1
Population/km^{2b}		3

a. Eastern Highland Rim

b. 2000 US Census

Table 2. Physical characteristics of Clear Creek at CLER-1, June 26, 2013.

Physical Characteristics		
Width (ft)		20
Canopy Cover		Mostly Shaded
Depth (ft)		
	Riffle	0.2
	Run	1.5
	Pool	2.5
% of Reach		
	Riffle	10
	Run	70
	Pool	20
% Substrate		
	Clay	30
	Cobble	15
	Gravel	30
	Sand	5
	Silt	7
	Organic Matter	13

Table 3. Results of the habitat assessment conducted on Clear Creek at CLER-1, June 26, 2013.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	64	Sub-optimal (59-70)
Sediment Deposition	68	Sub-optimal (59-70)
Sinuosity	85	Optimal (>84)
Bank and Vegetative Stability	71	Sub-optimal (60-74)
Riparian Buffer	63	Marginal (50-69)
Habitat Assessment Score	**168**	
% Maximum Score	**66**	Sub-optimal (59-70)

Table 4. Results of the macroinvertebrate bioassessment conducted in Clear Creek at CLER-1, June 26, 2013.

Macroinvertebrate Assessment	
	Results
Taxa richness and diversity measures	
Total # Taxa	78
# EPT taxa	23
# Sensitive EPT	12
Shannon Diversity	3.96
# Highly-sensitive and Specialized Taxa	5
Taxonomic composition measures	
% EPT minus Baetidae and Hydropsychidae	17
% Non-insect taxa	14
Functional feeding group	
% Predator Individuals	6
Community tolerance	
% Sensitive taxa	27
% Tolerant taxa	20
WMB-I Assessment Score	**4+**
WMB-I Assessment Rating	**Fair-Good**

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 communities. Dissolved arsenic concentrations were higher than expected for *F&W* streams in one sample collected on October 16, 2013. Flow conditions were categorized as "visible but not measureable" at the time of sampling. Summer *E. coli* counts exceeded maximum single sample criteria during June and August. Median conductivity and concentrations of total dissolved solids, hardness, alkalinity, total manganese, and dissolved aluminum were higher than expected based on reference reach data for streams located in ecoregion 71.

SUMMARY

Bioassessment results indicated the macroinvertebrate community in Clear Creek at CLER-1 to be in *fair-good* condition. Overall habitat quality was categorized as *sub-optimal* for supporting biological communities. Median conductivity and concentrations of total dissolved solids, hardness, alkalinity, and some metals were higher than expected for the ecoregion. Monitoring should continue to ensure that water quality and biological conditions meet current standards.

Table 5. Summary of water quality data collected April-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)	5		11.9		23.6	20.1	19.1	4.6	
Turbidity (NTU)	4		2.9		5.3	4.3	4.2	1.1	
Total Dissolved Solids (mg/L)	4		138.0		191.0	164.0 M	164.2	23.1	
Total Suspended Solids (mg/L)	4	<	1.0		14.0	3.0	5.1	6.1	
Specific Conductance (µmhos)	5		215.8		314.8	257.3 G	261.4	35.2	
Hardness (mg/L)	4		113.0		158.0	126.5 G	131.0	20.0	
Alkalinity (mg/L)	4		103.0		158.0	127.0 M	128.8	22.6	
Stream Flow (cfs)	4		2.8		52.2	4.3	15.9	24.2	
Chemical									
Dissolved Oxygen (mg/L)	5		6.0		11.2	8.6	8.5	1.9	
pH (su)	5		7.6		8.1	7.8	7.8	0.2	
Ammonia Nitrogen (mg/L)	4	<	0.004	<	0.018	0.006	0.006	0.004	
Nitrate+Nitrite Nitrogen (mg/L)	4		0.135		0.271	0.200	0.201	0.069	
Total Kjeldahl Nitrogen (mg/L) [J]	4		0.115		0.357	0.195	0.216	0.109	
Total Nitrogen (mg/L) [J]	4		0.250		0.507	0.455	0.417	0.118	
Dissolved Reactive Phosphorus (mg/L) [J]	4	<	0.004		0.008	0.007	0.006	0.003	
Total Phosphorus (mg/L) [J]	4		0.007		0.018	0.014	0.013	0.005	
CBOD-5 (mg/L)	4	<	2.0	<	2.0	1.0	1.0	0.0	
Chlorides (mg/L)	4		1.1		1.8	1.3	1.4	0.3	
Total Metals									
Aluminum (mg/L) [J]	4	<	0.076		0.116	0.104	0.090	0.035	
Iron (mg/L) [J]	4		0.117		0.273	0.143	0.169	0.072	
Manganese (mg/L) [J]	4		0.012		0.038	0.026 M	0.026	0.011	
Dissolved Metals									
Aluminum (mg/L)	4	<	0.076	<	0.076	0.038 M	0.038	0.000	
Antimony (µg/L)	4	<	0.1		2.6	0.0	0.4	0.6	
Arsenic (µg/L) [J]	4	<	0.3	<	1.4 H	0.3	0.4	0.2	1
Cadmium (µg/L)	4	<	0.046	<	0.170	0.085	0.070	0.031	
Chromium (mg/L) [J]	4	<	0.763		32.000 S	0.904	4.642	7.573	
Copper (mg/L) [J]	4	<	0.0003	<	0.031	0.0006	0.004	0.008	
Iron (mg/L) [J]	4	<	0.018		0.081	0.044	0.044	0.030	
Lead (µg/L)	4	<	0.1	<	1.1	0.0	0.2	0.2	
Manganese (mg/L) [J]	4	<	0.009		0.032	0.022	0.020	0.012	
Mercury (µg/L)	1	<				<	0.057		
Nickel (mg/L) [J]	4	<	0.0002		0.016	0.0003	0.004	0.008	
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	0.0	0.2	0.2	
Zinc (mg/L) [J]	4	<	0.002		0.017	0.002	0.004	0.003	
Biological									
Chlorophyll a (ug/L)	4	<	0.10		0.80	0.40	0.41	0.32	
E. coli (col/100mL)	4		59		770 H	574	494	318	2

E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 71; H=*F&W* human health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 71; N=# samples; Q=# of uncertain exceedances; S=*F&W* hardness-adjusted aquatic life use criteria exceeded.