Alabama Department of Environmental Management

§303(d)/TMDL Monitoring Site

Rivers and Streams Monitoring Program

2012 Monitoring Summary

Cottonwood Creek at Hale County Road 12 (32.50946/-87.64409)

BACKGROUND

Cottonwood Creek from Big Prairie Creek to its source (11.4 miles) is on Alabama's Clean Water Act (CWA) 2006 §303(d) list of impaired waters for not meeting its *Fish & Wildlife (F&W)* water use classification. It is listed for siltation (habitat alteration), organic enrichment, and nutrients from municipal use and pasture grazing.

The Alabama Department of Environmental Management (ADEM) selected the Cottonwood Creek watershed for biological and water quality monitoring as part of the Assessment of the Black Warrior and Cahaba (BWC) River basins. 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 BWC River basin.

Figure 1. Cottonwood Creek at COTH-57C, June 5, 2012.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Cottonwood Creek at COTH-57C is a *Fish & Wildlife (F&W)* stream located within the Blackland Prairie (65a) ecoregion. According to the 2006 National Land Cover Dataset, landuse within the watershed is primarily pasture/hay. Population density is low. As of September 1, 2012, one NPDES outfall is located 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. Cottonwood Creek at COTH-57C is a small, mostly-shaded stream reach characterized by sand and gravel substrates (Figure 1). Overall habitat quality was rated as *marginal* for supporting macroinvertebrate communities due to limited sinuosity and very little riparian buffer.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Black Warrior River
Drainage Area (mi^2)		42
Ecoregion[a]		65a
% Landuse		
Open water		6
Wetland	Woody	7
	Emergent herbaceous	1
Forest	Deciduous	6
	Evergreen	4
	Mixed	3
Shrub/scrub		5
Grassland/herbaceous		1
Pasture/hay		57
Cultivated crops		4
Development	Open space	6
	Low intensity	2
	Moderate intensity	<1
	High intensity	<1
Population/km^2[b]		19
# NPDES Permits[c]	**TOTAL**	1
Industrial General		1

a.Blackland Prairie

b.2000 US Census

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

Table 2. Summary of physical characteristics of Cottonwood Creek at COTH-57C, April 24, 2012.

Physical Characteristics		
Width (ft)		25
Canopy cover		Mostly shaded
Depth (ft)		
	Run	1.5
	Pool	4
% of Reach		
	Run	50
	Pool	50
% Substrate		
	Sand	50
	Gravel	26
	Hardpan clay	10
	Silt	5
	Cobble	3
	Boulder	2
	CPOM	2
	Woody debris	2

Table 3. Results of a habitat assessment conducted in Cottonwood Creek at COTH-57C, April 24, 2012.

Habitat Assessment	% Maximum Score	Rating
Instream habitat quality	53	Marginal (40-52)
Sediment deposition	49	Marginal (40-52)
Sinuosity	28	Poor <45
Bank and vegetative stability	46	Marginal (35-59)
Riparian buffer	46	Poor <50
Habitat assessment score	106	
% Maximum score	**48**	**Marginal (40-52)**

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 each individual metric. Metric results indicated the macroinvertebrate community to be in *very poor* condition, dominated by three nutrient tolerant taxa (Table 4).

Table 4. Results of the macroinvertebrate bioassessment conducted in Cottonwood Creek at COTH-57C, April 24, 2012.

Macroinvertebrate Assessment	Results
Taxa richness measures	
# EPT genera	1
Taxonomic composition measures	
% Non-insect taxa	14
% Plecoptera	0
% Dominant taxa	55
Functional composition measures	
% Predators	4.5
Tolerance measures	
Beck's community tolerance index	3
% Nutrient tolerant organisms	82
WMB-I Assessment Score	**13**
WMB-I Assessment Rating	**Very Poor**

WATER CHEMISTRY

Water chemistry results are summarized in Table 5. In situ measurements and water samples were collected monthly and semi-monthly (metals) during April through November of 2012 to help identify any stressors to the biological communities. Cottonwood Creek at COTH-57C did not meet the dissolved oxygen criterion applicable to its *Fish and Wildlife* use classification during six of seven sampling events. It also exceeded Human Health criterion for total dissolved arsenic in three out of three sampling events. However, the ADEM criterion for arsenic is expressed as dissolved trivalent arsenic (arsenite – As III). Studies are being conducted to provide a better understanding of the prevalence and areal distribution of dissolved trivalent arsenic to total arsenic in Alabama. Upon conclusion of the studies, Arsenic will be reassessed for arsenic violations.

Median specific conductance and hardness were higher than the median concentration of all verified ecoregional reference data collected in ecoregion 65a. Total dissolved solids, alkalinity, nutrients and dissolved metal concentrations were higher than 90% of all verified ecoregional reference reach data collected in the same ecoregion.

SUMMARY

Cottonwood Creek at COTH-57C did not meet the F&W use classification criterion for dissolved oxygen. Median nutrient, hardness, total dissolved solids, alkalinity, and specific conductance were also higher than expected, based on comparison with reference reaches in the same ecoregion. Flow was also affected by large woody debris for most of the sampling season.

Table 5. Summary of water quality data collected April-November, 2012. 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)	7	13.1	26.6	22.9	21.2	5.0	
Turbidity (NTU)	8	4.5	166.0[T]	12.2	35.3	55.0	
Total Dissolved Solids (mg/L)	7	214.0	470.0	348.0[M]	337.4	90.7	
Total Suspended Solids (mg/L)	7	7.0	134.0	21.0	35.3	44.2	
Specific Conductance (µmhos)	7	305.6	726.6	524.8[G]	520.2	158.5	
Hardness (mg/L)	3	122.0	270.0	186.0[G]	192.7	74.2	
Alkalinity (mg/L)	7	115.0	331.0	232.0[M]	225.4	80.8	
Stream Flow (cfs)	6	0.4	5.1	1.0	1.6	1.8	
Chemical							
Dissolved Oxygen (mg/L)	7	0.0[C]	6.2	2.8	3.0	2.2	6
pH (su)	7	7.1	7.9	7.5	7.5	0.3	
Ammonia Nitrogen (mg/L)	7	< 0.008	0.852	0.077[M]	0.265	0.341	
[J] Nitrate+Nitrite Nitrogen (mg/L)	7	< 0.005	0.500	0.147	0.177	0.198	
Total Kjeldahl Nitrogen (mg/L)	7	0.803	7.740	1.200[M]	2.095	2.497	
[J] Total Nitrogen (mg/L)	7	< 0.984	7.755	1.537[M]	2.272	2.428	
Dissolved Reactive Phosphorus (mg/L)	7	0.133	0.695	0.207[M]	0.274	0.201	
Total Phosphorus (mg/L)	7	0.219	1.915	0.393[M]	0.585	0.598	
[J] CBOD-5 (mg/L)	7	< 2.0	8.1	1.0	2.4	2.7	
Chlorides (mg/L)	7	15.0	44.3	18.7[M]	26.6	12.2	
Total Metals							
[J] Aluminum (mg/L)	3	0.092	7.440	0.169	2.567	4.220	
Iron (mg/L)	3	0.413	6.580	0.967	2.653	3.412	
Manganese (mg/L)	3	0.126	0.747	0.206	0.360	0.338	
Dissolved Metals							
Aluminum (mg/L)	3	< 0.043	< 0.043	0.022	0.022	0.000	
Antimony (µg/L)	3	< 3.6	< 3.6	1.8[M]	1.8	0.0	
[J] Arsenic (µg/L)	3	4.3	6.7[H]	6.3	5.8	1.3	3
Cadmium (mg/L)	3	< 0.000	< 0.000	0.000	0.000	0.000	
Chromium (mg/L)	3	< 0.009	< 0.009	0.004	0.004	0.000	
Copper (mg/L)	3	< 0.020	< 0.020	0.010	0.010	0.000	
[J] Iron (mg/L)	3	< 0.019	0.075	0.055	0.046	0.034	
[J] Lead (µg/L)	3	< 0.9	1.0	0.4	0.6	0.3	
Manganese (mg/L)	3	< 0.007	0.703	0.180[M]	0.296	0.364	
Mercury (µg/L)	3	< 0.035	< 0.035	0.018	0.018	0.000	
Nickel (mg/L)	3	< 0.042	< 0.042	0.021	0.021	0.000	
Selenium (µg/L)	3	< 2.5	< 2.5	1.2	1.2	0.0	
Silver (µg/L)	3	< 0.015	0.215	0.108	0.074	0.058	
Thallium (µg/L)	3	< 1.4	< 1.4	0.7[M]	0.7	0.0	
Zinc (mg/L)	3	< 0.012	< 0.012	0.006	0.006	0.000	
Biological							
Chlorophyll a (µg/L)	7	5.34	24.03	10.68[M]	12.34	7.02	
[J] E. coli (col/100mL)	3	68	2420	249	912	1309	

C=*F&W* use classification criteria violated; G=value higher than median concentration of all verified ecoregional reference reach data collected in ecoregion 65a; M=value >90% of all verified ecoregional reference reach data collected in the 65a ecoregion; N=# samples; J=estimate; T=value exceeds 50 NTU above the 90th percentile of all verified ecoregional reference reach data collected in ecoregion 65a.

FOR MORE INFORMATION, CONTACT:
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