Alabama Department of Environmental Management

Ambient Monitoring Site

Rivers and Streams Monitoring Program

2007 Monitoring Summary

Very Poor™

Cahaba River at St. Clair County Road 10 (Roper Rd) at Whites Chapel (33.60503/-86.54924)

BACKGROUND

The Cahaba River is one of a network of 94 ambient sites monitored annually by the Alabama Department of Environmental Management (ADEM) to identify long-term trends in water quality and to provide data for the development of Total Maximum Daily Loads (TMDL) and water quality criteria.

The Cahaba River was also selected for biological and water quality monitoring as part of the 2007 Assessment of the Black Warrior and Cahaba (BWC) River Basins. The objectives of the BWC Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the BWC basin group.

Since 2004, the Cahaba River from Grants Mill Road to U.S. Highway 11 has been on Alabama's Clean Water Act (CWA) §303 (d) list of impaired waters for not meeting its *Fish and Wildlife* (*F&W*) water use classification. It was listed for siltation and other habitat alterations. Sources of these impairments are urban runoff/ storm sewers. The TMDLs for total phosphorous were finalized in 2006.

Figure 1. Cahaba River at C-1, June 16, 2010.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Based on the 2000 National Land Cover Dataset, landuse within the watershed is primarily forest (63%). Development accounts for approximately 16% of watershed. As of February 23, 2011, ADEM's NPDES Management database showed a total of 267 NPDES permitted discharges 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. The Cahaba River at C-1 is a high gradient, riffle-run stream characterized by a mixture of bottom substrates (Figure 1). Overall habitat quality was categorized as *optimal* for supporting macroinvertebrate communities.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Cahaba River
Drainage Area (mi^2)		51
Ecoregion[a]		67h
% Landuse		
Open water		<1
Wetland	Woody	1
Forest	Deciduous	52
	Evergreen	6
	Mixed	5
Shrub/scrub		2
Grassland/herbaceous		4
Pasture/hay		10
Cultivated crops		2
Development	Open space	9
	Low intensity	6
	Moderate intensity	1
	High intensity	<1
Barren		1
Population/km^2[b]		651
# NPDES Permits[c]	**TOTAL**	267
401 Water Quality Certification		2
Construction Stormwater		252
Industrial General		8
Municipal Individual		4
Underground Injection Control		1

a. Southern Sandstone Ridges

b. 2000 US Census

c. #**NPDES permits** downloaded from ADEM's NPDES Management System database, February 23, 2011

Table 2. Physical characteristics of the Cahaba River at C-1, May 29, 2007.

Physical Characteristics		
Width (ft)		35
Canopy cover		Mostly Shaded
Depth (ft)		
	Riffle	0.4
	Run	1.5
	Pool	2
% of Reach		
	Riffle	10
	Run	80
	Pool	10
% Substrate		
	Bedrock	35
	Boulder	10
	Cobble	10
	Gravel	15
	Sand	16
	Silt	10
	Organic Matter	3

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Table 3. Results of the habitat assessment conducted on the Cahaba River at C-1, May 29, 2007.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	71	Optimal (> 70)
Sediment Deposition	65	Sub-optimal (59-70)
Sinuosity	65	Sub-optimal (65-84)
Bank and Vegetative Stability	73	Sub-optimal (60-74)
Riparian Buffer	85	Sub-optimal (70-89)
Habitat Assessment Score	**172**	
% Maximum score	**71**	**Optimal (> 70)**

Table 4. Results of the macroinvertebrate bioassessment conducted in the Cahaba River at C-1, May 29, 2007.

Macroinvertebrate Assessment Results			
	Results	**Scores (0-100)**	**Rating**
Taxa richness measures			
# Ephemeroptera (mayfly) genera	6	50	Fair (47-70)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly) genera	4	33	Poor (22-44)
Taxonomic composition measures			
% Non-insect taxa	19	23	Very Poor (<24.7)
% Non-insect organisms	31	18	Very Poor (<31.3)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	7	25	Poor (20.2-40.9)
WMB-I Assessment Score	**---**	**21**	**Very Poor (<24)**

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 the score for each metric. The relatively low taxa richness of pollution-intolerant groups and high percent dominance of pollution-tolerant groups indicated the macroinvertebrate community in the Cahaba River at C-1 to be in *very poor* condition (Table 4).

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides (atrazine), and semi-volatile organics) during January through December of 2007 to help identify any stressors to the biological communities. Median concentrations of total dissolved solids, specific conductance, hardness, alkalinity, nutrients (nitrate+nitrite nitrogen, total nitrogen, dissolved reactive phosphorous), and antimony were higher than expected for the ecoregion 67h, based on the 90th percentile of samples collected at least-impaired reference reaches. Dissolved arsenic concentrations exceeded standard human health criteria in all four sampling events. Mercury concentrations exceeded chronic aquatic life use and human health criteria in June. Copper concentrations exceeded hardness-adjusted aquatic life use criteria in August.

SUMMARY

Bioassessment results indicated the macroinvertebrate community to be in *very poor* condition. Results of intensive water quality data suggests elevated dissolved metals (copper, mercury, and arsenic) and nutrients to be potential causes lower concentrations of macroinvertebrates. Conductivity, total dissolved solids, hardness, and alkalinity were also elevated.

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Table 5. Summary of water quality data collected January-December, 2007. 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)	12	8.5	26.9	13.9	17.1	6.7	
Turbidity (NTU)	12	3.0	39.5	3.9	8.4	10.3	
Total Dissolved Solids (mg/L)	12	98.0	266.0	176.0 M	183.3	63.3	
Total Suspended Solids (mg/L)	12	1.0	9.0	4.5	4.5	2.4	
Specific Conductance (µmhos)	12	153.0	420.0	314.0 G	302.6	98.8	
Hardness (mg/L)	12	69.2	154.0	112.0 G	113.6	29.8	
Alkalinity (mg/L)	12	65.5	155.1	119.2 M	112.8	28.3	
Stream Flow (cfs)	12	2.9	51.0	6.1	12.5	14.6	
Chemical							
Dissolved Oxygen (mg/L)	12	6.1	12.7	9.6	9.6	2.2	
pH (su)	12	7.7	8.4	7.9	7.9	0.2	
Ammonia Nitrogen (mg/L)	12	< 0.015	0.310	0.015	0.043	0.084	
Nitrate+Nitrite Nitrogen (mg/L)	12	0.479	6.930	2.180 M	2.486	2.013	
J Total Kjeldahl Nitrogen (mg/L)	12	< 0.150	1.770	0.436	0.567	0.481	
J Total Nitrogen (mg/L)	12	< 0.583	7.505	2.479 M	3.047	2.352	
Dissolved Reactive Phosphorus (mg/L)	12	< 0.004	1.150	0.268 M	0.367	0.371	
J Total Phosphorus (mg/L)	12	< 0.040	0.874	0.269	0.385	0.317	
CBOD-5 (mg/L)	12	< 0.4	1.8	1.0	1.2	0.385	
J Chlorides (mg/L)	12	2.7	25.0	11.6 M	13.0	8.4	
Atrazine (µg/L)	1	<		<	0.05		
Total Metals							
Aluminum (mg/L)	4	< 0.060	0.250	0.090	0.115	0.095	
Iron (mg/L)	4	< 0.050	0.137	0.094	0.087	0.048	
Manganese (mg/L)	4	< 0.002	0.050	0.021	0.022	0.018	
Dissolved Metals							
Aluminum (mg/L)	4	< 0.050	0.436	0.025	0.128	0.206	
Antimony (µg/L)	4	< 10.0	10.0	5.0 M	5.0	0.0	
Arsenic (µg/L)	4	0.5	2.2 H	1.9	1.6	0.8	4
Cadmium (mg/L)	4	< 0.002	0.015	0.004	0.004	0.004	
Chromium (mg/L)	4	< 0.002	0.050	0.013	0.013	0.014	
Copper (mg/L)	4	< 0.007	0.050 S	0.020	0.017	0.010	1
Iron (mg/L)	4	< 0.008	0.050	0.018	0.017	0.009	
Lead (µg/L)	4	< 0.5	2.0	0.4	0.5	0.4	
Manganese (mg/L)	4	< 0.020	0.029	0.010	0.015	0.010	
Mercury (µg/L)	4	< 0.010	0.079 AH	0.01	0.01	0.01	1
Nickel (mg/L)	4	< 0.002	0.050	0.014	0.014	0.013	
Selenium (µg/L)	4	< 0.3	0.5	0.2	0.2	0.2	
Silver (mg/L)	4	< 0.005	0.050	0.002	0.008	0.011	
Thallium (µg/L)	4	< 0.7	1.0	0.4	0.4	0.1	
Zinc (mg/L)	4	< 0.017	0.050	0.017	0.017	0.010	
Biological							
Chlorophyll a (ug/L)	12	< 1.00	6.94	0.50	1.19	1.89	
J Fecal Coliform (col/100 mL)	12	1	204	44	63	57	

A=[use class] aquatic life use criterion exceeded; C=[use class] criterion violated; E= # samples that exceeded criteria; H=[use class] human health criterion exceeded; M=value>90% of all verified ecoregional reference reach data collected in the sub-ecoregion 67h; N= # samples; S=[use class] hardness-adjusted aquatic life use criteria exceeded.