

2007 Monitoring Summary



Fivemile Creek at Seaboard Road in Jefferson County (33.58498/-86.78891)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) monitored Fivemile Creek at FMCJ-2 and several other upstream locations for possible impacts from added discharges from Sloss Industries and ABC Polymer Industries. Results from monthly water sampling events may be used in determining Total Maximum Daily Loads (TMDL) needs and priorities. Macroinvertebrate and habitat assessments were also conducted to evaluate any impairment to the aquatic communities.



Figure 1. Five Mile Creek at FMCJ-2.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Fivemile Creek at FMCJ-2 is a *Fish and Wildlife (F&W)* stream located in the city of Birmingham, below the Boyle's railroad yard within the Shale Hills ecoregion. Based on the 2000 National Land Cover Dataset, landuse within the watershed is primarily development (68%) (Table 1). As of February 23, 2011, 113 permitted discharges have been issued 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. Fivemile Creek at FMCJ-2 is a high-gradient stream with a bedrock substrate (Figure 1). Overall habitat quality was categorized as *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. 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 *poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Black Warrior River	
Drainage Area (mi ²)	29	
Ecoregion ^a	68f	
% Landuse		
Open water		1
Wetland	Woody	<1
Forest	Deciduous	17
	Evergreen	5
	Mixed	3
Shrub/scrub		1
Grassland/herbaceous		1
Pasture/hay		1
Cultivated crops		<1
Development	Open space	36
	Low intensity	23
	Moderate intensity	6
	High intensity	3
Barren		2
Population/km ^{2b}		751
# NPDES Permits ^c	TOTAL	113
	401 Water Quality Certification	2
	Construction Stormwater	19
	Mining	2
	Industrial General	23
	Industrial Individual	4
	Municipal Individual	7

a. Shale Hills

b. 2000 US Census

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

Table 2. Physical characteristics of Fivemile Creek at FMCJ-2, May 29, 2007.

Physical Characteristics		
Width (ft)	40	
Canopy cover	50/50	
Depth (ft)	Riffle	0.8
	Run	1
	Pool	1.5
% of Reach	Riffle	30
	Run	65
	Pool	5
% Substrate	Bedrock	60
	Boulder	20
	Cobble	10
	Gravel	5
	Sand	1
	Silt	2
	Organic Matter	2

Table 3. Results of the habitat assessment conducted on Fivemile Creek at FMCI-2, May 29, 2007

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	78	Optimal (> 70)
Sediment Deposition	78	Optimal (> 70)
Sinuosity	90	Optimal (> 84)
Bank and Vegetative Stability	73	Sub-optimal (60-74)
Riparian Buffer	64	Marginal (50-69)
Habitat Assessment Score	180	
% Maximum score	75	Optimal (> 70)

Table 4. Results of the macroinvertebrate bioassessment conducted in Fivemile Creek at FMCI-2, May 29, 2007.

Macroinvertebrate Assessment Results		
	Results Scores (0-100)	Rating
Taxa richness measures		
# Ephemeroptera (mayfly) genera	4 33	Poor (23-46)
# Plecoptera (stonefly) genera	0 0	Very Poor (<16)
# Trichoptera (caddisfly) genera	5 42	Poor (22-44)
Taxonomic composition measures		
% Non-insect taxa	17 32	Poor (24.7-49.4)
% Non-insect organisms	13 67	Fair (62.8-93.9)
% Plecoptera	0 0	Very Poor (<6.56)
Tolerance measures		
Beck's community tolerance index	8 29	Poor (20.2-40.9)
WMB-I Assessment Score	--- 29	Poor (24-48)

WATER CHEMISTRY

Results of water chemistry analyses 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), March through October of 2007 to help identify any stressors to the biological communities. In addition, an intensive fecal coliform survey was conducted in July and August. In situ parameters were measured during each of the 10 site visits. Temperature exceeded maximum *F&W* criterion during one sampling event in August. Thallium concentrations exceeded the human health criterion during March. Dissolved arsenic concentrations exceeded the human health criterion during eight sampling events. Median concentrations of total dissolved solids, specific conductance, hardness, alkalinity, and nutrients (ammonia nitrogen, nitrate+nitrite-nitrogen, total kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus, total phosphorus, and chlorides) were above concentrations expected in this ecoregion, based on 90th percentile of data from least impaired reference reaches in ecoregion 68f.

SUMMARY

As part of the assessment process, ADEM will review the monitoring information presented in this report, along with other available data to assess water quality of Fivemile Creek .

Results of the habitat assessment indicated the habitat of Fivemile Creek at FMCI-2 to be in *optimal* condition. However, results of the bioassessment indicated the macroinvertebrate community to be in *poor* condition. Intensive water quality sampling suggest that nutrient enrichment, total dissolved solids, conductance, hardness, alkalinity and dissolved arsenic concentrations may be causes of the deterioration of the biological communities. Additionally, the large amount of development (68%) and permitted discharges (113) within this watershed suggest urban/industrial influences as potential sources of these stressors.

Table 5. Summary of water quality data collected March-October 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)	17	16.6	30.5 ^C	25.0 ^M	25.0	4.1	1
Turbidity (NTU)	17	3.1	15.6	5.5	7.3	3.8	
Total Dissolved Solids (mg/L)	8	263.0	492.0	369.5 ^M	385.8	82.8	
Total Suspended Solids (mg/L)	8	2.0	17.0	6.0	7.5	5.4	
Specific Conductance (µmhos)	17	469.1	858.0	629.0 ^G	638.2	108.0	
Hardness (mg/L)	8	176.0	244.0	212.5 ^G	212.8	27.4	
Alkalinity (mg/L)	8	146.0	183.1	166.5 ^M	164.8	13.0	
Stream Flow (cfs)	17	6.1	19.7	12.8	12.3	4.5	
Chemical							
Dissolved Oxygen (mg/L)	17	6.3	12.0	8.1	8.2	1.3	
pH (su)	17	7.8	8.2	7.9	8.0	0.1	
Ammonia Nitrogen (mg/L)	8	0.127	1.397	0.455 ^M	0.558	0.431	
Nitrate+Nitrite Nitrogen (mg/L)	8	0.943	2.330	1.685 ^M	1.666	0.375	
^J Total Kjeldahl Nitrogen (mg/L)	8	0.519	2.950	0.740 ^M	1.144	0.820	
^J Total Nitrogen (mg/L)	8	1.674	4.660	2.674 ^M	2.810	0.902	
Dissolved Reactive Phosphorus (mg/L)	8	0.004	0.182	0.026 ^M	0.054	0.062	
^J Total Phosphorus (mg/L)	8	< 0.008	0.257	0.054 ^M	0.092	0.090	
CBOD-5 (mg/L)	8	< 0.3	1.8	0.5	0.8	0.6	
Chlorides (mg/L)	8	12.5	56.7	35.0 ^M	34.4	16.6	
Atrazine (µg/L)	3	< 0.05	0.09	0.06	0.06	0.03	
Total Metals							
Aluminum (mg/L)	8	0.071	0.866	0.196	0.319	0.291	
Iron (mg/L)	8	< 0.050	0.273	0.154	0.156	0.083	
Manganese (mg/L)	8	< 0.037	0.061	0.040	0.041	0.013	
Dissolved Metals							
Aluminum (mg/L)	8	< 0.050	0.863	0.040	0.273	0.347	
Antimony (µg/L)	8	< 10.0	< 10.0	5.0	5.0	0.0	
Arsenic (µg/L)	8	0.8	3.0 ^H	2.2	2.1	0.7	8
Cadmium (mg/L)	8	< 0.002	< 0.015	0.004	0.004	0.004	
Chromium (mg/L)	8	< 0.002	< 0.050	0.013	0.013	0.013	
Copper (mg/L)	8	< 0.007	< 0.050	0.017	0.016	0.010	
Iron (mg/L)	8	< 0.007	< 0.050	0.025	0.024	0.008	
Lead (µg/L)	8	< 0.5	< 2.0	0.2	0.4	0.4	
Manganese (mg/L)	8	< 0.020	0.034	0.010	0.018	0.011	
Mercury (µg/L)	8	< 0.005	< 0.005	0.005	0.005	0.000	
Nickel (mg/L)	8	< 0.002	< 0.050	0.013	0.013	0.013	
Selenium (µg/L)	8	1.0	4.0	2.2	2.3	1.1	
Silver (mg/L)	8	< 0.005	< 0.050	0.002	0.011	0.012	
Thallium (µg/L)	8	< 0.7	1.1 ^H	0.4	0.5	0.3	1
Zinc (mg/L)	8	< 0.017	< 0.050	0.017	0.017	0.009	
Biological							
^J Fecal Coliform (col/100 mL)	16	13	580	49	91	143	

C=*F&W* Criterion violated; E=# of samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion [68f]; H=*F&W* human health criterion exceeded; J=estimate; N=# samples; M=Value >90% of all verified ecoregional reference reach data collected in the ecoregion.

FOR MORE INFORMATION, CONTACT:

Preston Roberts ADEM Aquatic Assessment Unit
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2703 sproberts@adem.state.al.us