2005 Monitoring Summary

Alabama Department of Environmental Management

Basin Assessment Site

™

Poor

Broken Arrow Creek at St. Clair County Road 144 (33.67620/-86.23844)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Mill Creek watershed for biological and water quality monitoring as part of the 2005 Assessment of the Alabama, Coosa, and Tallapoosa (ACT) River Basins. The objectives of the ACT Basin Assessments were to assess the biological integrity of each monitoring site to estimate overall water quality within the ACT basin group.
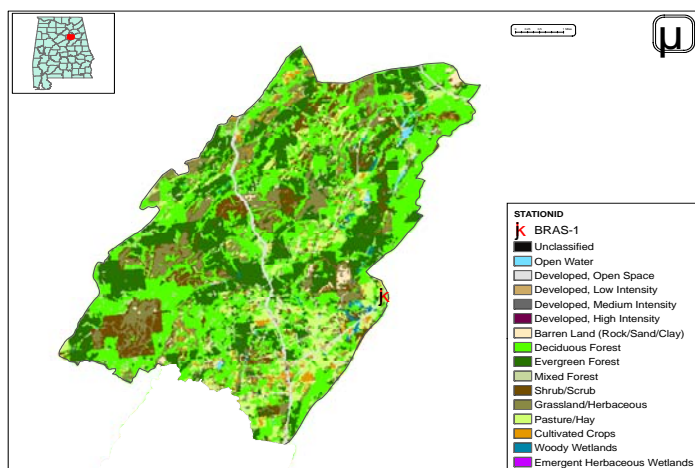

Figure 1. Sampling location and landuse within the Broken Arrow Creek water-

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Broken Arrow Creek is a small *Fish & Wildlife (F&W)* stream located near Pell City (Fig. 1). The watershed is located within the Southern Shale Valleys ecoregion, which is characterized by moderate to low gradient streams with bedrock, cobble, gravel and sand substrates. Landuse within the watershed is primarily forest (63%) with some areas of grassland and pasture/hay. The presence of mixed forests and pasture/hay areas are characteristic of streams in the Southern Shale Valleys ecoregion. There were a total of 12 NPDES permits that were issued within the watershed.

REACH CHARACTERISTICS

General observations (Table 2) and habitat assessments (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. Broken Arrow Creek at BRAS-1 is a low-gradient, sand bottomed stream in the Coosa River basin. Overall habitat quality was categorized as *poor* due to lack of good instream habitat, sediment deposition, sinuosity, and bank and vegetative stability.

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 an average of the score for each metric. Metric results indicated the macroinvertebrate community to be in *poor* community condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Drainage Area (mi^2)		41
Ecoregion[a]		67g
% Landuse		
Open water		<1
Wetland	Woody	1
	Emergent herbaceous	<1
Forest	Deciduous	36
	Evergreen	23
	Mixed	4
Shrub/scrub		9
Grassland/herbaceous		13
Pasture/hay		9
Cultivated crops		2
Development	Open space	3
	Low intensity	<1
	Moderate intensity	<1
Barren		1
Population/km[b]		28
# NPDES Permits[c]	TOTAL	12
401 Water Quality Certification		1
Construction Stormwater		5
Mining		1
Mining General Permit (old)		3
Industrial Gen-		2

a. Southern Shale Valleys
b. 2000 US census data
c. #NPDES permits downloaded from ADEM's NPDES Management System database, 9 Jun 2008

Table 2. Physical characteristics at BRAS-1, June 28, 2005.

Physical Characteristics		
Width (ft)		30
Canopy cover		Shaded
Depth (ft)		
	Run	1.8
	Pool	3.0
% of Reach		
	Run	30
	Pool	70
% Substrate		
	Gravel	7
	Sand	51
	Silt	15
	Clay	15
	Organic Matter	2
	Mud/Muck	10

Table 3. Results of the habitat assessment conducted on BRAS-1, June 28, 2005.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	30	Poor (<41)
Sediment deposition	39	Poor (<41)
Sinuosity	20	Poor (<45)
Bank and vegetative stability	33	Poor (<35)
Riparian buffer	55	Marginal (50-69)
Habitat assessment score	84	
% Maximum score	**38**	**Poor (<41)**

Table 4. Results of the macroinvertebrate bioassessment conducted at BRAS-1, June 28, 2005.

Macroinvertebrate Assessment Results			
	Results	Scores (0-100)	Rating
Taxa richness measures			
# Ephemeroptera (mayfly) genera	7	58	Fair (47-70)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly) genera	9	75	Good (67-83)
Taxonomic composition measures			
% Non-insect taxa	14	43	Poor (24.7-49.4)
% Non-insect organisms	10	73	Fair (62.7-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	3	11	Very Poor (<20.2)
WMB-I Assessment Score	**---**	**37**	**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) during March through October of 2005 to help identify any stressors to the biological communities.

Median concentrations of total iron, total manganese, and dissolved manganese, were above values expected in this eco-region.

CONCLUSIONS

Bioassessment results indicated the macroinvertebrate community to be in *poor* condition. Overall habitat quality was categorized as *poor* due to sedimentation, bank erosion, sinuosity and a lack of stable in-stream habitat. Parameters of concern include total iron, total manganese, and dissolved manganese which were above expected values.

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Table 5. Summary of water quality data collected March-October, 2005. 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. Metals results were compared to ADEM's chronic aquatic life use criteria adjusted for hardness.

Parameter	N	Min	Max	Median	Avg	SD
Physical						
Temperature (°C)	8	13.5	27.0	22.5	20.7	5.1
Turbidity (NTU)	8	6.7	61.9	10.6	18.0	18.5
Total Dissolved Solids (mg/L)	7	31.0	90.0	47.0	53.3	21.0
Total Suspended Solids (mg/L)	7	5.0	53.0	14.0^M	19.1	16.1
Specific Conductance (µmhos)	8	56.1	119.2	77.1	79.5	21.6
Hardness (mg/L)	5	20.5	47.4	28.8	31.8	10.5
Alkalinity (mg/L)	7	11.7	47.3	18.4	24.5	13.8
Stream Flow (cfs)	7	1.2	94.2	35.4	38.2	---
Chemical						
Dissolved Oxygen (mg/L)	8	4.9	10	6.9	7.4	1.8
pH (su)	8	6.7	7.3	7.0	7.0	0.2
Ammonia Nitrogen (mg/L)	7	< 0.015	0.024	0.008	0.010	0.006
Nitrate+Nitrite Nitrogen (mg/L)	7	0.055	0.207	0.122	0.125	0.045
Total Kjeldahl Nitrogen (mg/L)	7	< 0.150	0.311	0.215	0.184	0.106
Total Nitrogen (mg/L)	7	0.197	0.481	0.291	0.341	0.087
Dissolved Reactive Phosphorus (mg/L)	7	0.004	0.016	0.007	0.008	0.004
Total Phosphorus (mg/L)	7	< 0.004	0.084	0.041	0.038	0.026
CBOD-5 (mg/L)	7	< 1.0	4.6	2.2	2.4	1.6
^{J} Chlorides (mg/L)	6	3.7	4.4	3.9	4.0	0.2
Atrazine (µg/L)	1	< 0.05	< 0.05	0.05	0.05	---
Total Metals						
Aluminum (mg/L)	4	0.011	0.267	0.082	0.110	0.125
Iron (mg/L)	4	0.598	1.460	1.220^M	1.125	0.376
Manganese (mg/L)	3	0.128	0.196	0.165^M	0.163	0.034
Dissolved Metals						
Aluminum (mg/L)	4	< 0.015	< 0.015	0.008	0.008	0.000
Antimony (µg/L)	4	< 2	< 2	1	1	0.0
Arsenic (µg/L)	3	< 10	< 10	5	5	0.0
Cadmium (mg/L)	4	< 0.005	< 0.005	0.003	0.003	0.000
Chromium (mg/L)	4	< 0.004	< 0.004	0.002	0.002	0.000
Copper (mg/L)	4	< 0.005	< 0.005	0.003	0.003	0.000
Iron (mg/L)	4	0.129	< 0.589	0.356	0.358	0.205
Lead (µg/L)	3	< 2	< 2	1	1	0.0
Manganese (mg/L)	3	< 0.104	< 0.117	0.106^M	0.109	0.007
Mercury (µg/L)	3	< 0.3	< 0.3	0.15	0.15	0.00
Nickel (mg/L)	3	< 0.006	< 0.006	0.003	0.003	0.000
Selenium (µg/L)	3	< 10	< 10	5	5	0.0
Silver (mg/L)	3	< 0.003	< 0.003	0.002	0.002	0.000
Thallium (µg/L)	3	< 1	< 1	0.5	0.5	0.000
Zinc (mg/L)	3	< 0.006	< 0.006	0.003	0.003	0.000
Biological						
^{J} Chlorophyll a (µg/L)	7	0.53	7.48	2.14	2.70	2.5
^{J} Fecal Coliform (col/100 mL)	7	30	1800	90	390	637

J=estimate; N=# samples; M=value > 90th percentile of all data collected within eco-region 67