ADEM
Alabama Department of Environmental Management
Use Attainability Analysis

Rivers and Streams Monitoring Program
2006 Monitoring Summary
™
Poor

Muddy Fork of Big Nance Creek at Lawrence County Road 234 (34.5223/-87.3535)

BACKGROUND

The Muddy Fork from Big Nance Creek to Crow Branch is classified for *Agriculture and Industry (A&I)* uses. As mandated, the ADEM conducted a Use Attainability Analysis (UAA) study to determine if the reach could reasonably be expected to attain water quality criteria consistent with Alabama's *Fish & Wildlife (F&W)* water use classification which achieves the Clean Water Act interim "fishable/swimmable" goal.

As part of this effort, habitat and macroinvertebrate assessments were conducted on the Muddy Fork of Big Nance Creek at MFBN-3 on June 8, 2006.

Figure 1. Muddy Fork of Big Nance Creek at MFBN-3, April 13, 2006.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. The Muddy Fork of Big Nance Creek (Fig. 1) is located in the Eastern Highland Rim ecoregion. Landuse within the watershed was primarily pasture with some forested areas. As of September 18, 2009, the Department has issued eight NPDES permits in this watershed.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. When compared to other reference reaches in the Eastern Highland Rim ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Muddy Fork of Big Nance Creek at MFBN-3 is a shallow, medium-gradient stream reach with bedrock, boulder and gravel substrates. Overall habitat quality was categorized as *good.* However, riparian buffer zone conditions were rated as poor.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi^2)		34
Ecoregion[a]		71g
% Landuse		
Open water		<1
Wetland	Woody	6
Forest	Deciduous	12
	Evergreen	4
	Mixed	2
Shrub/scrub		8
Grassland/herbaceous		1
Pasture/hay		52
Cultivated crops		4
Development	Open space	6
	Low intensity	3
	Moderate intensity	1
	High intensity	<1
Barren		<1
Population/km^{2} [b]		49
# NPDES Permits[c]	**TOTAL**	8
401 Water Quality Certification		1
Construction Stormwater		6
Municipal Individual		1

a. Eastern Highland Rim
b. 2000 US Census
c. #NPDES permits downloaded from ADEM's NPDES Management System database, 18 Sep 2009

Table 2. Physical characteristics of Muddy Fork of Big Nance Creek at MFBN-3, June 8, 2006.

Physical characteristics		
Width (ft)		35
Canopy cover		Open
Depth (ft)	Riffle	0.3
	Run	1.5
	Pool	2.5
% of Reach	Riffle	5.0
	Run	70
	Pool	25
% Substrate	Bedrock	20
	Boulder	25
	Cobble	5
	Gravel	30
	Sand	5
	Silt	10
	Clay	2
	Organic Matter	3

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 characterized by pollution-tolerant taxa groups, indicating *poor* community condition (Table 4).

Table 3. Results of habitat assessment conducted June 8, 2006.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	72	Optimal (> 70)
Sediment deposition	78	Optimal (> 70)
Sinuosity	80	Sub-optimal (65-84)
Bank and vegetative stability	63	Sub-optimal (60-74)
Riparian buffer	48	Poor (<50)
Habitat assessment score	159	
% Maximum score	**66**	**Sub-optimal (59-70)**

Table 4. Results of macroinvertebrate assessment (June 8, 2006).

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	6	100	Excellent (>83)
Taxonomic composition measures			
% Non-insect taxa	18	28	Poor (24.7-49.4)
% Non-insect organisms	14	63	Fair (62.8-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	5	18	Very Poor (<20.2)
WMB-I Assessment Score	**---**	**38**	**Poor (24-48)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples are collected monthly and semi-monthly (metals), during March through October to help identify any stressors to the biological communities. In-situ measurements indicated pH values above the 8.5 standard unit criterion for Fish & Wildlife (F&W) during five of 12 sampling events. Dissolved oxygen concentrations ranged from 6.5-14.1 mg/L. Stream flow was visible but not measureable in August. Stream flows were not taken during three sampling events in September. Median total dissolved solids, specific conductance, hardness, CBOD-5, chlorides, nutrients (total Kjeldahl nitrogen, dissolved reactive phosphorus) and metals (total aluminum; dissolved cadmium) concentrations were elevated based on the 90th percentile of reference reaches in ecoregion 71.

CONCLUSIONS

As part of the assessment process, ADEM will review the monitoring information presented in this report, along with all other available data, to determine if the Muddy Fork of Big Nance Creek should be reclassified as a *F&W* stream.

Bioassessment results indicated the macroinvertebrate community in Muddy Fork of Big Nance Creek at MFBN-3 to be in *poor* condition. Results of other data collected during 2006 suggest nutrient enrichment and elevated metals to be potential causes of the deteriorated biological conditions.

Table 5. Summary of water quality data collected March-October, 2006. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). 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 (^{o}C)	12	13.2	29.7	23.5	23.3	4.2
Turbidity (NTU)	12	2.6	6.9	3.6	3.9	1.1
Total Dissolved Solids (mg/L)	10	120.0	327.0	200.0[M]	209.0	52.7
Total Suspended Solids (mg/L)	10	<1.0	11.0	4.0	4.8	3.4
Specific Conductance (µmhos)	12	253.0	386.0	337.0[M]	336.5	36.2
Hardness (mg/L)	3	154.0	209.0	173.0[M]	178.7	27.9
Alkalinity (mg/L)	10	90.5	168.1	110.4	121.2	29.1
Stream Flow (cfs)	7	0.3	47.9	6.4	12.6	16.9
Chemical						
Dissolved Oxygen (mg/L)	12	6.5	14.1	10.7	10.5	2.8
pH (su)	12	7.7	8.9[C]	8.3	8.3	0.4
Ammonia Nitrogen (mg/L)	10	<0.015	0.071	0.008	0.026	0.029
Nitrate+Nitrite Nitrogen (mg/L)	10	<0.003	6.010	1.457	2.432	2.258
Total Kjeldahl Nitrogen (mg/L)	10	0.288	1.210	0.898[M]	0.790	0.316
Total Nitrogen (mg/L)	10	0.910	7.110	1.689	2.956	2.502
Dissolved Reactive Phosphorus (mg/L)	10	0.061	0.872	0.293[M]	0.389	0.334
Total Phosphorus (mg/L)	10	<0.100	0.853	0.323	0.400	0.339
CBOD-5 (mg/L)	10	0.3	1.5	1.2[M]	1.1	0.3
Chlorides (mg/L)	10	6.5	34.0	15.5[M]	17.9	11.4
Atrazine (µg/L)	1	0.30	0.30	0.30	0.30	---
Total Metals						
Aluminum (mg/L)	3	0.106	0.116	0.111[M]	0.111	0.005
Iron (mg/L)	3	0.095	0.175	0.113	0.128	0.042
Manganese (mg/L)	3	<0.05	<0.05	0.025	0.025	0.000
Dissolved Metals						
Aluminum (mg/L)	3	<0.05	<0.05	0.025	0.025	0.000
Antimony (µg/L)	3	<10	<10	5	5	0
Arsenic (µg/L)	3	<10	16	5	9	6
Cadmium (mg/L)	3	<0.015	<0.015	0.008[M]	0.008	0.000
Chromium (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Copper (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Iron (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Lead (µg/L)	3	<10	<10	5	5	0
Manganese (mg/L)	3	<0.02	<0.02	0.010	0.010	0.000
[J] Mercury (µg/L)	3	<0.3	0.4	0.2	0.2	0.1
Nickel (mg/L)	3	<0.05	<0.05	0.025	0.025	0.000
Selenium (µg/L)	3	<50	<50	25	25	0
Silver (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Thallium (µg/L)	3	<10	<10	5	5	0
Zinc (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Biological						
Chlorophyll a (µg/L)	9	<1.00	12.80	2.67	4.77	4.17
[J] Fecal Coliform (col/100 mL)	8	2	280	14	46	95

J=estimate; N=# samples; M=value > 90th percentile of all verified ecoregional reference reach data collected within eco-region 71; C= value exceeds established criteria for *A&I* water use classification.