

# 2013 Monitoring Summary



## Muddy Fork of Big Nance Creek at Lawrence County Road 234 (34.52359 /-87.35356 )

### BACKGROUND

Muddy Fork Big Nance Creek is one of only a few streams in Alabama currently designated as an *Agricultural and Industrial Water Supply (A&I)*. The best usage of waters with this use classification are agricultural irrigation, livestock watering, industrial cooling and process water supplies, and any other usage except fishing, bathing, recreational activities, or as a source of water supply for drinking or food-processing purposes. Consistent with the Clean Water Act's (CWA) "fishable/swimmable" goal, one of the goals of the Alabama Department of Environmental Management (ADEM) classify all Alabama waters with a use classification of at least *Fish&Wildlife (F&W)* or higher, where attainable. With its more stringent criteria to provide protection of aquatic life and human health, *F&W* is an improved classification over *A&I* waters. Therefore, ADEM selected the Muddy Fork of Big Nance Creek watershed for biological and water quality monitoring as part of the 2013 Basin Assessment of the Tennessee River Basin. The data collected will be used to determine if an upgrade is justified.



Figure 1. Muddy Fork of Big Nance Creek at MFBN-3 , August 19, 2013.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Muddy Fork Big Nance Creek at MFBN-3 is an *Agriculture and Industry Water Supply (A/I)* stream located in Lawrence County. According to the 2006 National Land Cover Dataset, land use within the watershed is primarily pasture with some forest and limited development. As of May 13, 2013, ADEM 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. 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. Muddy Fork Big Nance Creek at MFBN-3 is a high-gradient stream consisting of various stable substrates (Figure 1). Overall habitat quality was rated as *optimal* for supporting macroinvertebrate communities.

Table 1. Summary of watershed characteristics.

Watershed Characteristics			
<b>Basin</b>	Tennessee River		
<b>Drainage Area (mi<sup>2</sup>)</b>	34		
<b>Ecoregion<sup>a</sup></b>	71g		
<b>% Landuse</b>			
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
<b>Population/km<sup>2b</sup></b>	49		
<b># NPDES Permits<sup>c</sup></b>	<b>TOTAL</b>		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, May 13, 2013.

Table 2. Physical characteristics of Muddy Fork Big Nance Creek at MFBN-3 on June 12, 2013.

Physical Characteristics			
<b>Width (ft)</b>	36		
<b>Canopy cover</b>	50/50		
<b>Depth (ft)</b>	Riffle		0.3
	Run		1.5
	Pool		3.0
<b>% of Reach</b>	Riffle		5
	Run		60
	Pool		35
<b>% Substrate</b>	Bedrock		10
	Boulder		10
	Cobble		20
	Gravel		20
	Sand		30
	Silt		5
	Organic Matter		5

**Table 3.** Results of the habitat assessment conducted on Muddy Fork Big Nance Creek at MFBN-3, June 12, 2013.

Habitat Assessment	% Max Score	Rating
Instream habitat quality	72	Optimal (>70)
Sediment deposition	64	Sub-optimal (59-70)
Sinuosity	78	Sub-optimal (65-84)
Bank and vegetative stability	69	Sub-optimal (60-74)
Riparian buffer	85	Sub-optimal (70-89)
<b>Habitat assessment score</b>	<b>175</b>	
<b>% Maximum score</b>	<b>73</b>	<b>Optimal (&gt;70)</b>

## BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I measures 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 that the macroinvertebrate community to be in *poor* condition (Table 4).

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Muddy Fork Big Nance Creek at MFBN-3 June 12, 2013.

Macroinvertebrate Assessment		
	Results	Scores (0-100)
<b>Taxa richness and diversity measures</b>		
# EPT taxa	8	17
Shannon Diversity	3.50	37
<b>Taxonomic composition measures</b>		
% EPT minus Baetidae and Hydropsychidae	39	85
% Non-insect taxa	22	2
<b>Functional feeding group</b>		
% Predator Individuals	4	11
<b>Community tolerance</b>		
% Tolerant taxa	45	10
<b>WMB-I Assessment Score</b>	---	<b>27</b>
<b>WMB-I Assessment Rating</b>		<b>Poor</b>

## WATER CHEMISTRY

Results of water chemistry analyses are summarized 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. Several median parameters were higher than expected when compared to 90% of all verified ecoregional reference data within the same ecoregion. Specific conductance and hardness concentrations were higher than all other values collected in the 71g subecoregion. It is uncertain if dissolved chromium exceeded criteria applicable to A/T use classification. Although samples of dissolved arsenic did exceed human health criteria in Needham Creek, ADEM criteria for arsenic are expressed as dissolved trivalent arsenic (arsenite – As III). Presently studies are being conducted in order to provide a better understanding of the prevalence and areal distribution of dissolved trivalent arsenic to total arsenic in the State of Alabama. Upon conclusion of the studies Muddy Fork Big Nance Creek will be reassessed for arsenic violations.

## SUMMARY

Bioassessment results indicate the macroinvertebrate community to be in *poor* condition despite the habitat assessment score of *optimal* for biological communities. Several parameters were above expected values when compared to other streams within the same ecoregion. Further monitoring is needed to determine if Muddy Fork Big Nance Creek use classification can be upgraded.

**Table 5.** Summary of water quality data collected March-October, 2013. 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	Q
<b>Physical</b>							
Temperature (°C)	9	12.9	25.9	21.2	20.3	4.4	
Turbidity (NTU)	9	2.3	22.3	5.9	8.3	6.7	
Total Dissolved Solids (mg/L)	8	158.0	224.0	191.0	192.9	26.2	
Total Suspended Solids (mg/L)	8	< 1.0	12.0	3.0	4.9	4.7	
Specific Conductance (µmhos)	9	241.3	404.6	321.8 <sup>G</sup>	313.8	64.4	
Hardness (mg/L)	4	110.0	178.0	115.0 <sup>G</sup>	129.5	32.4	
Alkalinity (mg/L)	8	112.0	183.0	140.0 <sup>M</sup>	142.4	29.4	
Stream Flow (cfs)	9	2.0	91.6	18.6	35.2	32.9	
<b>Chemical</b>							
Dissolved Oxygen (mg/L)	9	7.1	12.3	9.0	9.3	1.8	
pH (su)	9	6.8	8.2	7.6	7.5	0.4	
<sup>J</sup> Ammonia Nitrogen (mg/L)	8	< 0.004	0.196	0.031 <sup>M</sup>	0.054	0.066	
Nitrate+Nitrite Nitrogen (mg/L)	8	0.467	2.160	0.610	0.825	0.563	
Total Kjeldahl Nitrogen (mg/L)	8	0.156	0.926	0.526 <sup>M</sup>	0.547	0.299	
Total Nitrogen (mg/L)	8	0.623	2.955	1.086	1.372	0.730	
Dissolved Reactive Phosphorus (mg/L)	8	0.021	0.470	0.087 <sup>M</sup>	0.145	0.142	
Total Phosphorus (mg/L)	8	0.035	0.503	0.129 <sup>M</sup>	0.178	0.144	
CBOD-5 (mg/L)	8	< 2.0	2.0	1.0	1.0	0.0	
Chlorides (mg/L)	8	3.2	15.6	5.0 <sup>M</sup>	6.5	4.3	
<b>Total Metals</b>							
Aluminum (mg/L)	4	< 0.076	1.090	0.538 <sup>M</sup>	0.551	0.446	
<sup>J</sup> Iron (mg/L)	4	0.052	0.893	0.596 <sup>M</sup>	0.534	0.382	
<sup>J</sup> Manganese (mg/L)	4	0.018	0.045	0.034 <sup>M</sup>	0.033	0.011	
<b>Dissolved Metals</b>							
<sup>J</sup> Aluminum (mg/L)	4	< 0.076	0.389	0.170 <sup>M</sup>	0.192	0.147	
Antimony (µg/L)	4	< 0.1	2.6	0.7	0.7	0.7	
<sup>J</sup> Arsenic (µg/L)	4	< 0.8	2.7 <sup>A</sup>	1.6	1.6	0.9	3
<sup>J</sup> Cadmium (µg/L)	4	< 0.046	0.170	0.084	0.069	0.031	
<sup>J</sup> Chromium (µg/L)	4	< 1.250	32.000 <sup>S</sup>	8.800	8.712	8.416	2
<sup>J</sup> Copper (mg/L)	4	< 0.000	0.031	0.008	0.008	0.008	
<sup>J</sup> Iron (mg/L)	4	0.028	0.443	0.188 <sup>M</sup>	0.212	0.172	
<sup>J</sup> Lead (µg/L)	4	< 0.1	1.1	0.4	0.3	0.2	
<sup>J</sup> Manganese (mg/L)	4	0.015	0.033	0.022	0.023	0.007	
Mercury (µg/L)	2	< 0.057	0.057	0.028	0.028	0.000	
<sup>J</sup> Nickel (mg/L)	4	< 0.000	0.016	0.004	0.004	0.004	
<sup>J</sup> Selenium (µg/L)	4	< 0.2	1.4	0.5	0.5	0.3	
Silver (µg/L)	4	< 0.215	2.120	0.584	0.584	0.550	
Thallium (µg/L)	4	< 0.1	1.1	0.3	0.3	0.3	
<sup>J</sup> Zinc (mg/L)	4	< 0.004	0.017	0.008	0.008	0.003	
<b>Biological</b>							
Chlorophyll a (ug/L)	8	< 0.10	2.14	0.58	0.86	0.89	

A=A/T aquatic life use criterion exceeded; G=value higher than median concentration of all verified ecoregional reference reach data collected in ecoregion 71g; J=estimate; N= # of samples; M=value >90% of collected samples in ecoregion 71g; Q=# of uncertain exceedances; S=A/T hardness-adjusted aquatic life use criterion exceeded;

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