ADEM
Alabama Department of Environmental Management
Use Support Assessment

Rivers and Streams Monitoring Program

2013 Monitoring Summary

Very Poor ™

Crow Branch upstream of Moulton WWTP outfall (Lawrence County)(34.48810 /-87.29840)

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) is to 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. Crow Branch at MFBN-5 , April 30, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Crow Branch at MFBN-5 is an *Agriculture and Industry Water Supply (A/I)* stream located in the Eastern Highland Rim ecoregion within Lawrence County. According to the 2006 National Land Cover Dataset, land use within the watershed consists of pasture with some forest and limited development. As of May 13, 2013, ADEM has issued one NPDES permit 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. Crow Branch at MFBN-5 is a high-gradient stream with a substrate consisting primarily of bedrock (Figure 1). Overall habitat quality was rated as *suboptimal* for supporting macroinvertebrate communities due to poor riparian buffer and weak bank and vegetative stability.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi^2)		10
Ecoregion[a]		71g
% Landuse		
Open water		<1
Wetland	Woody	5
Forest	Deciduous	16
	Evergreen	4
	Mixed	4
Shrub/scrub		7
Grassland/herbaceous		2
Pasture/hay		48
Cultivated crops		4
Development	Open space	6
	Low intensity	2
	Moderate intensity	1
	High intensity	<1
Population/km^2[b]		63
# NPDES Permits[c]	**TOTAL**	1
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 Crow Branch at MFBN-5 on June 12, 2013.

Physical Characteristics		
Width (ft)		35
Canopy cover		Mostly shaded
Depth (ft)	Riffle	0.5
	Run	1.5
% of Reach	Riffle	20
	Run	80
% Substrate	Bedrock	75
	Boulder	5
	Cobble	5
	Gravel	5
	Sand	5
	Silt	2
	Organic Matter	3

Table 3. Results of the habitat assessment conducted in Crow Branch at MFBN-5, June 12, 2013.

Habitat Assessment	% Max Score	Rating
Instream habitat quality	72	Optimal (>70)
Sediment deposition	68	Sub-optimal (59-70)
Sinuosity	83	Sub-optimal (65-84)
Bank and vegetative stability	55	Marginal (35-59)
Riparian buffer	28	Poor (<50)
Habitat assessment score	**149**	
% Maximum score	**62**	**Sub-optimal (59-70)**

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 each metric score. Metric results indicated that the macroinvertebrate community to be in *very poor* condition (Table 4).

Table 4. Results of the macroinvertebrate bioassessment conducted in Crow Branch at MFBN-5 June 12, 2013.

Macroinvertebrate Assessment	Results	Scores (0-100)
Taxa richness and diversity measures		
# EPT taxa	10	26
Shannon Diversity	3.51	38
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	2	3
% Non-insect taxa	31	0
Functional feeding group		
% Predator Individuals	5	14
Community tolerance		
% Tolerant taxa	49	0
WMB-I Assessment Score	**---**	**13**
WMB-I Assessment Rating		**Very Poor**

WATER CHEMISTRY

Results of water chemistry analyses are summarized in Table 5. When possible, in situ measurements and water samples were collected monthly and semi-monthly (metals) during March through October to help identify any stressors to the biological communities. Median total dissolved solids, alkalinity, and chlorides were higher than expected when compared to 90% of all verified ecoregional reference data within the same ecoregion. Specific conductance and hardness concentrations were also higher than all other values collected from reference sites located within the 71 ecoregion. It is uncertain if dissolved chromium exceeded criteria applicable to *A/I* use classification. Although samples of dissolved arsenic did exceed human health criteria in Crow Branch, 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 Crow Branch will be reassessed for arsenic violations.

SUMMARY

Bioassessment results indicate the macroinvertebrate community to be in *very poor* condition despite the habitat assessment score of *optimal* for supporting biological communities. Water chemistry results indicated potential impairments from dissolved arsenic and chromium with several other parameters' median values higher than expected. It is uncertain if Crow Branch is meeting it's *A/I* use class designation. As a result, additional monitoring is needed to determine if Crow Branch's 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	E
Physical										
Temperature (°C)	9		13.1		26.7	21.2	20.2	4.8		
Turbidity (NTU)	9		1.3		10.9	4.3	5.8	3.5		
Total Dissolved Solids (mg/L)	8		166.0		238.0	207.5^M	198.9	26.9		
Total Suspended Solids (mg/L)	8	<	1.0		10.0	1.0	3.2	3.8		
Specific Conductance (µmhos)	9		238.8		393.1	327.2^G	330.4	50.4		
Hardness (mg/L)	4		108.0		196.0	152.0^G	152.0	36.2		
Alkalinity (mg/L)	8		111.0		190.0	163.5^M	160.2	29.4		
Stream Flow (cfs)	9		0.3		25.7	9.7	10.7	8.5		
Chemical										
Dissolved Oxygen (mg/L)	9		5.8		12.6	7.8	8.7	2.2		
pH (su)	9		7.0		7.7	7.5	7.4	0.3		
^{J} Ammonia Nitrogen (mg/L)	8	<	0.004	<	0.018	0.009	0.008	0.004		
Nitrate+Nitrite Nitrogen (mg/L)	8		0.040		0.876	0.250	0.288	0.257		
^{J} Total Kjeldahl Nitrogen (mg/L)	8		0.144		1.650	0.320	0.482	0.496		
^{J} Total Nitrogen (mg/L)	8		0.232		1.924	0.548	0.771	0.571		
^{J} Dissolved Reactive Phosphorus (mg/L)	8	<	0.004		0.106	0.012	0.034	0.038		
Total Phosphorus (mg/L)	8		0.011		0.133	0.026	0.054	0.050		
CBOD-5 (mg/L)	8	<	2.0	<	2.0	1.0	1.0	0.0		
Chlorides (mg/L)	8		3.1		6.4	3.5^M	4.4	1.5		
Total Metals										
^{J} Aluminum (mg/L)	4		0.092		0.579	0.346^M	0.341	0.209		
^{J} Iron (mg/L)	4		0.086		0.529	0.366	0.337	0.185		
^{J} Manganese (mg/L)	4		0.021		0.034	0.028^M	0.028	0.007		
Dissolved Metals										
^{J} Aluminum (mg/L)	4	<	0.076		0.129	0.038^M	0.061	0.046		
Antimony (µg/L)	4	<	0.1	<	2.6	0.7	0.7	0.7		
^{J} Arsenic (µg/L)	4	<	0.8		4.4^A	1.2	1.8	1.8	2	1
^{J} Cadmium (µg/L)	4	<	0.046	<	0.170	0.074	0.064	0.029		
^{J} Chromium (µg/L)	4		1.320		<32.000^S	8.700	8.680	8.452	2	
^{J} Copper (mg/L)	4	<	0.0003	<	0.031	0.008	0.008	0.008		
^{J} Iron (mg/L)	4	<	0.018		0.203	0.056	0.081	0.087		
^{J} Lead (µg/L)	4	<	0.1	<	1.1	0.4	0.3	0.2		
^{J} Manganese (mg/L)	4		0.015		0.024	0.022	0.020	0.004		
Mercury (µg/L)	2	<	0.057	<	0.057	0.028	0.028	0.000		
^{J} Nickel (mg/L)	4		0.0002	<	0.016	0.004	0.004	0.004		
^{J} 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		
^{J} Zinc (mg/L)	4	<	0.002	<	0.017	0.006	0.005	0.004		
Biological										
Chlorophyll a (ug/L)	8		0.53		1.34	0.80	0.80	0.29		

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