

# 2011 Monitoring Summary



Special Study Site

## Cowpen Creek at Baldwin County Road 33 Crossing (30.48312/-87.81894)

### BACKGROUND

The Alabama Department of Environmental Management (ADEM) monitored Cowpen Creek as part of a study to determine the sources, fate, transport and effects of nutrients within the Weeks Bay estuary. The principal tributaries to the bay are the Fish River, with a drainage area of approximately 152 square miles, and the Magnolia River, with a drainage area of approximately 40 square miles. Cowpen Creek is a small tributary of Fish River. The final report of Weeks Bay study is available at <http://www.adem.alabama.gov/programs/water/wqsurvey/table/2011/2011WeeksBayReport.pdf>.

Cowpen Creek watershed was also selected for biological and water quality monitoring as part of the 2011 Assessment of the Escatawpa, Mobile, Lower Tombigbee (EMT) River Basins. The objectives of the EMT Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basins.



Figure 1. Cowpen Creek at CWPB-100, May 9, 2011.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Cowpen Creek from Fish River to its source is designated as a *Swimming/Fish & Wildlife (S/F&W)* stream located in the Southern Pines Plains & Hills ecoregion (65f), near Clay City, Alabama. This creek drains eleven square miles in Baldwin County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is composed of development (27%), pasture, wetland and cultivated crops. Population density is relatively high. As of September 1, 2012, ADEM has issued 84 construction 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. Cowpen Creek at CWPB-100 is a low-gradient stream dominated by sand substrate (Figure 1). Overall habitat quality was categorized as *optimal* due to the habitat created by snags, leaf packs and root banks within the reach.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Mobile River
Drainage Area (mi <sup>2</sup> )		11
Ecoregion <sup>a</sup>		65f
% Landuse		
Open water		<1
Wetland	Woody	13
	Emergent herbaceous	1
Forest	Evergreen	9
	Mixed	<1
Shrub/scrub		5
Grassland/herbaceous		10
Pasture/hay		22
Cultivated crops		13
Development	Open space	14
	Low intensity	9
	Moderate intensity	3
	High intensity	1
Barren		1
Population/km <sup>2</sup> <sup>b</sup>		173
# NPDES Permits <sup>c</sup>	TOTAL	84
	Construction Stormwater	64
	Mining	3
	Municipal Individual	17

a.Southern Pine Plains & Hills

b.2000 US Census

c.#NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Cowpen Creek at CWPB-100, May 25, 2011.

Physical Characteristics		
Canopy Cover		Mostly Shaded
Width (ft)		10
Depth (ft)	Run	0.5
	Pool	4.0
% of Reach	Run	50
	Pool	50
% Substrate	Clay	1
	Cobble	1
	Mud/Muck	2
	Gravel	2
	Sand	71
	Silt	5
	Organic Matter	18

## 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 *fair* community condition (Table 4).

**Table 3.** Results of the habitat assessment conducted on Cowpen Creek at CWPB-100, May 25, 2011.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	65	Sub-optimal (53-65)
Sediment Deposition	73	Optimal >65
Sinuosity	45	Marginal (45-64)
Bank and Vegetative Stability	43	Marginal (35-59)
Riparian Buffer	90	Optimal >89
<b>Habitat Assessment Score</b>	<b>145</b>	
<b>% Maximum Score</b>	<b>66</b>	<b>Optimal &gt;65</b>

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Cowpen Creek at CWPB-100, May 25, 2011.

Macroinvertebrate Assessment		
	Results	Scores (0-100)
<b>Taxa richness and diversity measures</b>		
% EPC taxa	30	52
% Trichoptera & Chironomidae Taxa	47	22
<b>Taxonomic composition measures</b>		
% EP Individuals	8	13
<b>Functional feeding group</b>		
% Collector-Filterer Individuals	29	51
<b>Community tolerance</b>		
% Nutrient Tolerant individuals	15	87
<b>WMB-I Assessment Score</b>	---	<b>45</b>
<b>WMB-I Assessment Rating</b>		<b>Fair (31-45)</b>

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. *In situ* measurements and water samples were collected monthly from February through November of 2011 to document nutrient conditions within the watershed. Intensive sampling was also conducted in April, June, July, and September. Low pH is a natural phenomenon in South Alabama streams. Median concentration of specific conductivity was higher than expected, based on the median concentration of all verified reference reach data collected in ecoregion 65f. Median concentration of nitrate+nitrite nitrogen and total nitrogen were also higher than expected.

**Table 5.** Summary of water quality data collected February-November, 2011. 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.

Parameter	N	Min	Max	Med	Avg	SD
<b>Physical</b>						
Temperature (°C)	25	16.6	23.6	21.7	21.0	2.0
Turbidity (NTU)	23	1.0	6.9	2.1	2.5	1.2
Total Dissolved Solids (mg/L)	10	32.0	46.0	39.5	39.0	3.7
Total Suspended Solids (mg/L)	10	< 5.0	6.0	2.5	2.8	1.1
Specific Conductance (µmhos)	25	42.8	46.7	44.0 <sup>G</sup>	44.3	1.1
Alkalinity (mg/L)	10	< 4.0	< 4.0	2.0	2.0	0.0
Stream Flow (cfs)	23	3.4	6.4	4.2	4.5	0.8
<b>Chemical</b>						
Dissolved Oxygen (mg/L)	25	7.2	8.8	7.5	7.6	0.4
pH (su)	25	5.0	6.1	5.6	5.5	0.3
Ammonia Nitrogen (mg/L)	10	< 0.014	0.090	0.007	0.015	0.026
Nitrate+Nitrite Nitrogen (mg/L)	10	1.190	1.360	1.280 <sup>M</sup>	1.277	0.053
Total Kjeldahl Nitrogen (mg/L)	10	< 0.050	0.490	0.075	0.128	0.143
Total Nitrogen (mg/L)	10	< 1.285	1.690	1.368 <sup>M</sup>	1.405	0.120
Dissolved Reactive Phosphorus (mg/L)	10	0.005	0.011	0.007	0.007	0.002
Total Phosphorus (mg/L)	10	< 0.004	0.025	0.009	0.010	0.007
CBOD-5 (mg/L)	10	< 1.0	< 1.0	0.5	0.5	0.0
TOC (mg/L)	10	0.4	2.0	0.7	0.9	0.6
Chlorides (mg/L)	10	< 0.2	6.4	6.2	5.0	2.6
<b>Biological</b>						
Chlorophyll a (ug/L)	10	< 1.00	< 1.00	0.50	0.50	0.00
E. coli (col/100mL)	9	3	150	42	60	58

G=value > median concentration of all verified reference reach data collected in the ecoregion 65f; J=estimate; M=value > 90th percentile of all verified ecoregional reference reach data collected within ecoregions 65f; N=# samples.

## SUMMARY

As part of assessment process, ADEM will review the monitoring information presented in this report along with all other available data.

Bioassessment results indicated the macroinvertebrate community to be in *fair* condition; habitat quality and availability was assessed as *optimal* for supporting macroinvertebrate communities. However, specific conductance, nitrate+nitrite nitrogen, and total nitrogen were higher than expected for this ecoregion. Monitoring should continue to ensure that water quality and biological conditions remain stable and that downstream conditions are protected.

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