Alabama Department of Environmental Management

Ecological Reference Reach Site

Rivers and Streams Monitoring Program

# 2011 Monitoring Summary

Good

## Vaughn Creek at AL Hwy 10 in Choctaw County (32.11227/-88.13110)

### BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Vaughn Creek watershed 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.

Vaughn Creek at VANC-1 is among the least-disturbed watersheds in the Alabama, Coosa, Tallapoosa (ACT) basin group based on landuse, road density, and population density and is an ecoreference candidate station. The 2011 data will be used to evaluate Vaughn Creek as a best attainable condition reference watershed for comparison with other stations in the same ecoregion.

**Figure 1**. Vaughn Creek at VANC-1, May18, 2011.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Vaughn Creek is a small *Fish & Wildlife (F&W)* stream that drains through Little Walker town, located in the Southern Hilly Gulf Coastal Plain ecoregion (65d). Based on the 2006 National Land Cover Dataset, landuse within the watershed is mainly forest (75%), followed by shrub/scrub. This watershed has a low population density. As of September 4, 2012, three NPDES permits have been issued 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, this information can give an indication of physical condition and the availability and quality of habitat. Vaughn Creek at VANC-1 (Figure 1) is a low-gradient stream with sand, gravel, and clay substrates. The stream is characterized by poor sinuosity, a narrow riparian zone and unstable banks made overall habitat quality as *marginal*.

**Table 1**. Summary of watershed characteristics.

| Watershed Characteristics | | |
|---|---|---|
| **Basin** | | Lower Tombigbee River |
| **Drainage Area (mi$^2$)** | | 6 |
| **Ecoregion**[a] | | 65d |
| **% Landuse** | | |
| Open water | | <1 |
| Wetland | Woody | 2 |
| | Emergent herbaceous | <1 |
| Forest | Deciduous | 26 |
| | Evergreen | 33 |
| | Mixed | 16 |
| Shrub/scrub | | 16 |
| Grassland/herbaceous | | 3 |
| Pasture/hay | | 1 |
| Cultivated crops | | 1 |
| Development | Open space | 2 |
| **Population/km$^2$** [b] | | 6 |
| **# NPDES Permits**[c] | **TOTAL** | 3 |
| Municipal Individual | | 3 |

a.Southern Hilly Gulf Coastal Plain
b.2000 US Census
c.#NPDES permits downloaded from ADEM's NPDES Management System database, September 4, 2012.

**Table 2.** Physical characteristics of Vaughn Creek at VANC-1, May 18, 2011.

| Physical Characteristics | | |
|---|---|---|
| **Canopy Cover** | | Shaded |
| **Width (ft)** | | 12 |
| **Depth (ft)** | | |
| | Run | 1.0 |
| | Pool | 3.0 |
| **% of Reach** | | |
| | Run | 30 |
| | Pool | 70 |
| **% Substrate** | | |
| | Clay | 5 |
| | Gravel | 10 |
| | Hard Pan Clay | 2 |
| | Sand | 70 |
| | Silt | 3 |
| | Organic Matter | 10 |

### 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. The final score indicated the biological community to be in *good* condition (Table 4).

**Table 3.** Results of the habitat assessment conducted on Vaughn Creek at VANC-1, May 18, 2011.

| Habitat Assessment | %Maximum Score | Rating |
|---|---|---|
| Instream Habitat Quality | 43 | Marginal (40-52) |
| Sediment Deposition | 71 | Optimal >65 |
| Sinuosity | 40 | Poor <45 |
| Bank and Vegetative Stability | 31 | Poor <35 |
| Riparian Buffer | 69 | Marginal (50-69) |
| **Habitat Assessment Score** | **116** | |
| **% Maximum Score** | **53** | **Marginal (40-52)** |

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Vaughn Creek at VANC-1, May 18, 2011.

| Macroinvertebrate Assessment | | |
|---|---|---|
| | **Results** | **Scores** |
| **Taxa richness and diversity measures** | | **(0-100)** |
| % EPC taxa | 29 | 48 |
| % Dominant Taxon | 24 | 65 |
| **Taxonomic composition measures** | | |
| % EPT minus Baetidae and Hydropsychidae | 0 | 0 |
| **Functional feeding group** | | |
| # Collector Taxa | 23 | 80 |
| **Community tolerance** | | |
| % Nutrient Tolerant individuals | 10 | 96 |
| **WMB-I Assessment Score** | **---** | **58** |
| **WMB-I Assessment Rating** | | **Good (48-74)** |

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. *In situ* measurements and water samples were collected in March, May, July and September, 2011 to help identify any stressors to the biological communities. *In situ* parameters were also collected during the bioassessment. *In situ* measurements show Vaughn Creek at VANC-1 to be meeting water quality criteria for its *F&W* use classification. Most of the collected metals were below the detection limits. However, arsenic exceeded the human health criteria for water and fish consumption in July, but stream flow was minimal. Samples were collected for the analyses of pesticides, semi-volatile organics and atrazine in May and September and were below detection limits.

## SUMMARY

As part of assessment process, ADEM will review the monitoring information presented in this report along with all other available data. These data will also be used to evaluate Vaughn Creek as a least-impaired reference reach for Southern Hilly Gulf Coastal Plain (65d) subecoregion.

Vaughn Creek at VANC-1 was typical of other streams in the Southern Hilly Gulf Coastal Plains, which are generally low-gradient streams with sand substrates (Griffith et al. 2001). Bioassessment results showed the macroinvertebrate community to be in *good* condition. However, overall habitat condition was rated as *marginal*, with a narrow riparian zone. Monitoring should be continued to evaluate the stressors to the biological communities.

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**Table 5.** Summary of water quality data collected March-September, 2011. 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) | 5 | 12.7 | 24.8 | 19.8 | 18.7 | 5.4 | | |
| Turbidity (NTU) | 5 | 5.3 | 23.2 | 8.8 | 10.9 | 7.0 | | |
| Total Dissolved Solids (mg/L) | 4 | 90.0 | 106.0 | 94.0 | 96.0 | 7.7 | J | |
| Total Suspended Solids (mg/L) | 4 | < 1.0 | 4.0 | 0.8 | 1.5 | 1.7 | J | |
| Specific Conductance (µmhos) | 5 | 0.0 | 110.7 | 85.8 | 74.2 | 45.1 | | |
| Hardness (mg/L) | 4 | 18.7 | 34.6 | 30.4 | 28.5 | 7.0 | | |
| Alkalinity (mg/L) | 4 | 5.7 | 37.9 | 21.1 | 21.4 | 13.7 | | |
| Stream Flow (cfs) | 4 | 0.4 | 1.4 | 0.8 | 0.8 | 0.4 | | |
| **Chemical** | | | | | | | | |
| Dissolved Oxygen (mg/L) | 5 | 6.1 | 9.8 | 7.0 | 7.5 | 1.5 | | |
| pH (su) | 5 | 6.4 | 6.8 | 6.6 | 6.6 | 0.2 | | |
| Ammonia Nitrogen (mg/L) | 4 | < 0.005 | < 0.005 | 0.002 | 0.002 | 0.000 | | |
| Nitrate+Nitrite Nitrogen (mg/L) | 4 | 0.010 | 0.217 | 0.026 | 0.070 | 0.099 | J | |
| Total Kjeldahl Nitrogen (mg/L) | 4 | < 0.107 | 0.407 | 0.228 | 0.229 | 0.150 | | |
| Total Nitrogen (mg/L) | 4 | < 0.064 | 0.624 | 0.254 | 0.299 | 0.237 | J | |
| Dissolved Reactive Phosphorus (mg/L) | 4 | 0.006 | 0.011 | 0.009 | 0.009 | 0.002 | J | |
| Total Phosphorus (mg/L) | 4 | 0.020 | 0.023 | 0.020 | 0.021 | 0.001 | | |
| CBOD-5 (mg/L) | 4 | < 2.0 | 2.4 | 1.0 | 1.4 | 0.7 | J | |
| COD (mg/L) | 4 | 10.4 | 22.6 | 14.6 | 15.6 | 5.2 | | |
| TOC (mg/L) | 3 | 3.2 | 4.0 | 3.7 | 3.6 | 0.4 | | |
| Chlorides (mg/L) | 4 | 4.0 | 5.1 | 4.3 | 4.4 | 0.5 | | |
| Atrazine (µg/L) | 2 | < 0.02 | < 0.02 | 0.01 | 0.01 | 0.00 | | |
| **Total Metals** | | | | | | | | |
| Aluminum (mg/L) | 4 | 0.098 | 0.387 | 0.200 | 0.221 | 0.122 | J | |
| Iron (mg/L) | 4 | 0.742 | 1.640 | 1.160 | 1.176 | 0.384 | | |
| Manganese (mg/L) | 4 | 0.046 | 0.131 | 0.076 | 0.082 | 0.038 | J | |
| **Dissolved Metals** | | | | | | | | |
| Aluminum (mg/L) | 4 | < 0.043 | 0.124 | 0.045 | 0.059 | 0.049 | J | |
| Antimony (µg/L) | 4 | < 1.9 | < 1.9 | 0.9 | 0.9 | 0.0 | | |
| Arsenic (µg/L) | 4 | < 1.4 | 1.6 H | 0.7 | 0.9 | 0.5 | J | 1 |
| Cadmium (mg/L) | 4 | < 0.000 | < 0.000 | 0.000 | 0.000 | 0.000 | | |
| Chromium (mg/L) | 4 | < 0.009 | < 0.009 | 0.004 | 0.004 | 0.000 | | |
| Copper (mg/L) | 4 | < 0.020 | < 0.020 | 0.010 | 0.010 | 0.000 | | |
| Iron (mg/L) | 4 | 0.225 | 0.768 | 0.534 | 0.515 | 0.250 | | |
| Lead (µg/L) | 4 | < 0.9 | < 0.9 | 0.5 | 0.5 | 0.0 | | |
| Manganese (mg/L) | 4 | 0.043 | 0.118 | 0.068 | 0.074 | 0.034 | J | |
| Mercury (µg/L) | 4 | < 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Nickel (mg/L) | 4 | < 0.042 | < 0.042 | 0.021 | 0.021 | 0.000 | | |
| Selenium (µg/L) | 4 | < 1.3 | < 1.3 | 0.7 | 0.7 | 0.0 | | |
| Silver (mg/L) | 4 | < 0.000 | < 0.000 | 0.000 | 0.000 | 0.000 | | |
| Thallium (µg/L) | 4 | < 1.1 | < 1.1 | 0.5 | 0.5 | 0.0 | | |
| Zinc (mg/L) | 4 | < 0.012 | < 0.012 | 0.006 | 0.006 | 0.000 | | |
| **Biological** | | | | | | | | |
| Chlorophyll a (ug/L) | 4 | < 0.10 | 0.67 | 0.29 | 0.32 | 0.32 | | |
| E. coli (col/100mL) | 4 | 47 | 326 | 114 | 151 | 130 | J | |

E=# samples that exceeded criteria; H= F&W human health criteria exceeded; J=estimate; N= # samples; Q=qualifier.