

2009 Monitoring Summary



Bengis Creek in Jackson County at Old Carmel Road Bridge (34.87230/-85.82110)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Bengis Creek watershed for biological and water quality monitoring as part of the 2009 Tennessee (TN) Basin. The objectives of the project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Tennessee basin.



Figure 1. Bengis Creek at BENJ-3, June 10, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Bengis Creek is a small *Fish & Wildlife (F&W)* stream located southwest of the city of Bridgeport in the Sequatchie Valley ecoregion (68b). Based on the National Land Cover Dataset, landuse within the watershed is predominantly deciduous forest with some pastures. Population is low with little development in the area. As of February 23, 2011, ADEM's NPDES Management System database shows a total of four permitted discharges within the 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. Bengis Creek at BENJ-3 is a low-gradient, glide-pool stream with substrate composed primarily of sand, silt, and clay (Figure 1). Overall habitat quality and availability was rated as *marginal* for supporting diverse aquatic macroinvertebrate communities.

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 overall WMB-I scored BENJ-3 with a *fair* community condition (Table 4).

Table 1. Summary of watershed characteristics.

| Watershed Characteristics | | Tennessee River |
|---------------------------------------|-------------------------|-----------------|
| Basin | | Tennessee River |
| Drainage Area (mi²) | | 13 |
| Ecoregion^a | | 68b |
| % Landuse | | |
| Open water | | <1 |
| Wetland | Woody | 1 |
| Forest | Deciduous | 52 |
| | Evergreen | 1 |
| | Mixed | 5 |
| Shrub/scrub | | 4 |
| Grassland/herbaceous | | 2 |
| Pasture/hay | | 21 |
| Cultivated crops | | 8 |
| Development | Open space | 3 |
| | Low intensity | 2 |
| | Moderate intensity | 1 |
| | High intensity | <1 |
| Barren | | <1 |
| Population/km^{2b} | | 7 |
| # NPDES Permits^c | TO-TAL | 4 |
| | Construction Stormwater | 4 |

a. Sequatchie Valley

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011

Table 2. Physical characteristics of Bengis Creek at BENJ-3, June 10, 2009.

| Physical Characteristics | | |
|--------------------------|----------------|---------------|
| Width (ft) | | 14 |
| Canopy Cover | | Mostly Shaded |
| Depth (ft) | | |
| | Run | 3.5 |
| | Pool | 4.0 |
| % of Reach | | |
| | Run | 90 |
| | Pool | 10 |
| % Substrate | | |
| | Clay | 20 |
| | Mud/Muck | 2 |
| | Gravel | 3 |
| | Sand | 47 |
| | Silt | 20 |
| | Organic Matter | 11 |

Table 3. Results of the habitat assessment conducted on Bengis Creek at BENJ-3, June 10, 2009.

| Habitat Assessment | %Maximum Score | Rating |
|---------------------------------|----------------|-------------------------|
| Instream Habitat Quality | 45 | Marginal (41-58) |
| Sediment Deposition | 49 | Marginal (41-58) |
| Sinuosity | 23 | Poor <45 |
| Bank and Vegetative Stability | 39 | Marginal (35-59) |
| Riparian Buffer | 51 | Marginal (50-69) |
| Habitat Assessment Score | 101 | |
| % Maximum Score | 46 | Marginal (41-58) |

Table 4. Results of the macroinvertebrate bioassessment conducted in Bengis Creek at BENJ-3, June 10, 2009.

| Macroinvertebrate Assessment | | | |
|--|---------------|-----------|---------------------|
| | Result Scores | | Rating |
| Taxa richness measures | | | |
| # EPT genera | 14 | 56 | Fair (38-56) |
| Taxonomic composition | | | |
| % Non-insect taxa | 17 | 39 | Poor (30.9-61.8) |
| % Plecoptera | 0 | 0 | Very Poor |
| % Dominant taxa | 16 | 86 | Excellent (>85.2) |
| Functional composition measures | | | |
| % Predators | 5 | 16 | Poor (15.1-30.1) |
| Tolerance measures | | | |
| Beck's community tolerance | 5 | 23 | Fair (21.3-31.8) |
| % Nutrient tolerant organisms | 35 | 59 | Fair (50.9-76.2) |
| WMB-I Assessment Score | - | 40 | Fair (38-56) |

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, atrazine, and semi-volatile organics) during March through October of 2009 to help identify any stressors to the biological communities.

Organics were collected at BENJ-3 on Mar. 18th and Jul. 17th, but all parameters were below detection limits. On Sept. 23rd, turbidity was > 50 NTU above background levels; the flow measured 17.3 cfs during this sampling event. Dissolved oxygen exceeded the criteria for its use classification on Aug. 19th; stream flow during this sampling event was 0.4 cfs. The median values for total dissolved solids, alkalinity, nitrate+nitrite nitrogen, and dissolved reactive phosphorus were higher than expected for the Southwestern Appalachians ecoregion (68). Median specific conductance and hardness values were higher than background levels for ecoregion 68. Lead exceeded *F&W* criteria on one of four occasions. All nutrient (with the exception of nitrate+nitrite nitrogen and dissolved reactive phosphorus) and mercury samples were excluded from analysis because they did not meet ADEM's laboratory QC requirements.

SUMMARY

Bioassessment results indicated the macroinvertebrate community to be in *fair* condition. However, concentrations of lead were elevated as compared to data from ADEM's least-impaired reference reaches in ecoregion 68. Monitoring should continue to ensure that water quality and biological conditions remain stable.

Table 5. Summary of water quality data collected March-October, 2009. 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 | E |
|---|---|------------------|-------------------|--------------------|-------|-------|---|
| Physical | | | | | | | |
| Temperature (°C) | 9 | 12.8 | 23.0 | 18.3 | 17.0 | 3.6 | |
| Turbidity (NTU) | 9 | 6.6 | 81.7 ^T | 11.5 | 18.7 | 23.7 | |
| Total Dissolved Solids (mg/L) | 8 | 145.0 | 212.0 | 172.0 ^M | 171.8 | 21.6 | |
| Total Suspended Solids (mg/L) | 8 | 6.0 | 10.0 | 7.5 | 7.6 | 1.4 | |
| Specific Conductance (µmhos) | 9 | 210.0 | 378.0 | 300.2 ^G | 282.4 | 52.2 | |
| Hardness (mg/L) | 4 | 82.0 | 150.0 | 102.0 ^G | 109.0 | 30.3 | |
| Alkalinity (mg/L) | 8 | 104.0 | 196.0 | 147.4 ^M | 146.1 | 37.2 | |
| Stream Flow (cfs) | 9 | 0.4 | 43.8 | 14.1 | 17.0 | 16.3 | |
| Chemical | | | | | | | |
| Dissolved Oxygen (mg/L) | 9 | 4.7 ^C | 10.2 | 8.5 | 7.9 | 1.8 | 1 |
| pH (su) | 9 | 7.3 | 7.8 | 7.6 | 7.6 | 0.2 | |
| ^B Ammonia Nitrogen (mg/L) | 0 | | | | | | |
| ^J Nitrate+Nitrite Nitrogen (mg/L) | 8 | < 0.003 | 5.276 | 3.206 ^M | 3.084 | 1.909 | |
| ^B Total Kjeldahl Nitrogen (mg/L) | 0 | | | | | | |
| ^B Total Nitrogen (mg/L) | 0 | | | | | | |
| ^J Dissolved Reactive Phosphorus (mg/L) | 8 | < 0.008 | 0.093 | 0.052 ^M | 0.052 | 0.043 | |
| ^B Total Phosphorus (mg/L) | 0 | | | | | | |
| CBOD-5 (mg/L) | 8 | < 1.0 | < 1.0 | 0.5 | 0.5 | 0.0 | |
| Chlorides (mg/L) | 8 | 1.4 | 15.1 | 3.9 | 5.2 | 4.7 | |
| Atrazine (µg/L) | 2 | < 0.06 | < 0.06 | 0.03 | 0.03 | 0.00 | |
| Total Metals | | | | | | | |
| ^J Aluminum (mg/L) | 4 | 0.269 | 1.450 | 0.435 ^M | 0.647 | 0.552 | |
| Iron (mg/L) | 4 | 0.340 | 0.891 | 0.446 | 0.531 | 0.246 | |
| ^J Manganese (mg/L) | 4 | 0.035 | 0.067 | 0.048 | 0.049 | 0.015 | |
| Dissolved Metals | | | | | | | |
| ^J Aluminum (mg/L) | 4 | < 0.034 | 0.060 | 0.030 | 0.031 | 0.002 | |
| Antimony (µg/L) | 4 | < 0.5 | < 6.0 | 3.0 | 2.3 | 1.4 | |
| Arsenic (µg/L) | 4 | < 0.4 | < 0.4 | 0.2 | 0.2 | 0.0 | |
| Cadmium (mg/L) | 4 | < 0.000 | < 0.002 | 0.001 | 0.001 | 0.000 | |
| Chromium (mg/L) | 4 | < 0.007 | < 0.007 | 0.004 | 0.004 | 0.000 | |
| Copper (mg/L) | 4 | < 0.200 | < 0.200 | 0.100 ^M | 0.100 | 0.000 | |
| ^J Iron (mg/L) | 4 | < 0.020 | 0.044 | 0.022 | 0.024 | 0.017 | |
| ^J Lead (µg/L) | 4 | < 0.3 | 8.4 ^S | 0.8 | 2.6 | 3.9 | 1 |
| ^J Manganese (mg/L) | 4 | 0.019 | 0.048 | 0.030 | 0.032 | 0.013 | |
| ^B Mercury (µg/L) | 0 | | | | | | |
| Nickel (mg/L) | 4 | < 0.008 | < 0.008 | 0.004 | 0.004 | 0.000 | |
| ^J Selenium (µg/L) | 4 | < 0.4 | 0.5 | 0.2 | 0.3 | 0.1 | |
| Silver (mg/L) | 4 | < 0.001 | < 0.001 | 0.000 | 0.000 | 0.000 | |
| Thallium (µg/L) | 4 | < 0.4 | < 0.4 | 0.2 | 0.2 | 0.0 | |
| Zinc (mg/L) | 4 | < 0.060 | < 0.060 | 0.030 | 0.030 | 0.000 | |
| Biological | | | | | | | |
| Chlorophyll a (ug/L) | 8 | < 1.00 | 4.75 | 0.50 | 1.03 | 1.50 | |
| ^J Fecal Coliform (col/100 mL) | 8 | 52 | 440 | 124 | 170 | 151 | |
| ^J E. coli (col/100mL) | 1 | | | | | 579 | |

B=samples excluded due to laboratory QC concerns; C=value exceeds criteria for *F&W* use classification; E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68; N=# samples; S=*F&W* hardness-adjusted aquatic life use criteria exceeded; T=value exceeds 50 NTU above the 90th percentile of all verified ecoregional reference reach data collected in ecoregion 68.

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