

2009 Monitoring Summary



Cedar Creek at Lauderdale County Road 105 (34.96790/-88.15081)

BACKGROUND

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



Figure 1. Cedar Creek at CDRL-1, April 14, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Cedar Creek at CDRL-1 is a shallow, high-gradient *Fish & Wildlife (F&W)* stream in Lauderdale County. Based on the 2006 National Land Cover Dataset, land use within the watershed is primarily forest (63%) with shrub. As of May 13, 2013, there are five NPDES permitted outfalls active 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. Cedar Creek at CDRL-1 is a riffle-run gravel and cobble substrate stream, typical of the *Transition Hills* sub-ecoregion (Figure 1). Overall habitat quality was rated as *optimal* for supporting macroinvertebrate communities.

BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). Measures of taxonomic richness, community composition, and community tolerance are used to assess the overall health of the macroinvertebrate community in comparison to conditions expected in north Alabama's streams and rivers. Each site is placed in one of six levels, ranging from 1, or *natural* to 6, or *highly altered*. The macroinvertebrate survey conducted in Cedar Creek at CDRL-1 rated the site as *good-excellent* (Table 4).

Table 1. Summary of watershed characteristics.

| Watershed Characteristics | | |
|---------------------------------------|-------------------------|-----------------|
| Basin | | Tennessee River |
| Drainage Area (mi²) | | 3 |
| Ecoregion^a | | 65j |
| % Landuse | | |
| Open water | | <1 |
| Wetland | Woody | <1 |
| Forest | Deciduous | 47 |
| | Evergreen | 7 |
| | Mixed | 9 |
| Shrub/scrub | | 31 |
| Cultivated crops | | 4 |
| Development | Open space | 3 |
| | Low intensity | <1 |
| Population/km^{2b} | | 2 |
| # NPDES Permits^c | TOTAL | 5 |
| | Construction Stormwater | 2 |
| | Industrial General | 1 |
| | Industrial Individual | 2 |

a. Transition Hills

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, May 13, 2013.

Table 2. Physical characteristics of Cedar Creek at CDRL-1, June 24, 2009.

| Physical Characteristics | | |
|--------------------------|----------------|---------------|
| Width (ft) | | 10 |
| Canopy Cover | | Mostly Shaded |
| Depth (ft) | Riffle | 0.4 |
| | Run | 1.0 |
| | Pool | 1.5 |
| % of Reach | | |
| | Riffle | 50 |
| | Run | 30 |
| | Pool | 20 |
| % Substrate | | |
| | Cobble | 30 |
| | Gravel | 50 |
| | Sand | 7 |
| | Silt | 3 |
| | Organic Matter | 10 |

Table 3. Results of the habitat assessment conducted on Cedar Creek at CDRL-1, June 24, 2009.

| Habitat Assessment | %Maximum Score | Rating |
|---------------------------------|----------------|-----------------------|
| Instream Habitat Quality | 78 | Optimal >65 |
| Sediment Deposition | 80 | Optimal >65 |
| Sinuosity | 93 | Optimal >84 |
| Bank and Vegetative Stability | 83 | Optimal >74 |
| Riparian Buffer | 73 | Sub-optimal (70-89) |
| Habitat Assessment Score | 186 | |
| % Maximum Score | 77 | Optimal >65 |

Table 4. Results of the macroinvertebrate bioassessment conducted in Cedar Creek at CDRL-1 on June 24, 2009

| Macroinvertebrate Assessment | | Results |
|---|-------------|------------------|
| Taxa richness and diversity measures | | |
| Total # Taxa | | 79 |
| # EPT taxa | | 27 |
| Shannon Diversity | | 4.93 |
| # Highly-sensitive and Specialized Taxa | | 10 |
| Taxonomic composition measures | | |
| % EPT minus Baetidae and Hydropsychidae | | 17 |
| % Non-insect taxa | | 10 |
| % Individuals in Dominant 5 Taxa | | 40 |
| Functional feeding group | | |
| % Predator Individuals | | 11 |
| Community tolerance | | |
| # Sensitive EPT | | 17 |
| % Sensitive taxa | | 35 |
| % Tolerant taxa | | 23 |
| WMB-I Assessment Score | | 3.2 |
| WMB-I Assessment Rating | Good | Excellent |

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, 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. Stream pH exceeded criteria applicable to Cedar Creek's *F&W* use classification during one sampling event. All other physical and chemical parameters were within expected ranges for this ecoregion.

SUMMARY

The habitat at Cedar Creek at CDRL-1 was assessed and found to be *optimal* in its ability to support healthy and diverse aquatic macroinvertebrate communities. The overall macroinvertebrate community condition was rated as *good-excellent*.

Water chemistry results indicated one instance of pH exceeding *F&W* criteria. All other physical and chemical parameters were within expected ranges for the *Transition Hills* (65j) sub-ecoregion.

Table 5. Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value for non-metals parameters. 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 | 12.4 | 21.4 | 18.1 | 17.5 | 2.9 | | |
| Turbidity (NTU) | 9 | 1.4 | 3.4 | 2.0 | 2.1 | 0.6 | | |
| Total Dissolved Solids (mg/L) | 8 | 12.0 | 52.0 | 27.0 | 26.8 | 12.6 | J | |
| Total Suspended Solids (mg/L) | 8 | < 0.3 | 5.0 | 0.8 | 1.3 | 1.6 | | |
| Specific Conductance (µmhos) | 9 | 28.4 | 32.7 | 31.6 | 31.3 | 1.6 | | |
| Hardness (mg/L) | 4 | 6.7 | 11.6 | 9.8 | 9.5 | 2.5 | | |
| Alkalinity (mg/L) | 8 | 1.3 | 11.9 | 10.4 | 9.2 | 3.5 | | |
| Stream Flow (cfs) | 9 | 0.2 | 6.9 | 1.2 | 2.3 | 2.2 | | |
| Chemical | | | | | | | | |
| Dissolved Oxygen (mg/L) | 9 | 8.0 | 10.3 | 8.3 | 8.7 | 0.9 | | |
| pH (su) | 9 | 5.8 ^C | 7.0 | 6.4 | 6.4 | 0.4 | 1 | |
| Ammonia Nitrogen (mg/L) | 4 | < 0.006 | < 0.014 | 0.003 | 0.004 | 0.002 | JB | |
| Nitrate+Nitrite Nitrogen (mg/L) | 4 | < 0.045 | 0.475 | 0.058 | 0.159 | 0.211 | JB | |
| Total Kjeldahl Nitrogen (mg/L) | 4 | < 0.089 | 0.320 | 0.146 | 0.164 | 0.141 | JB | |
| Total Nitrogen (mg/L) | 4 | < 0.114 | 0.520 | 0.330 | 0.323 | 0.168 | JB | |
| Dissolved Reactive Phosphorus (mg/L) | 3 | 0.008 | 0.010 | 0.009 | 0.009 | 0.001 | JB | |
| Total Phosphorus (mg/L) | 4 | < 0.005 | 0.009 | 0.006 | 0.006 | 0.003 | JB | |
| CBOD-5 (mg/L) | 8 | < 1.0 | < 2.0 | 0.5 | 0.7 | 0.3 | | |
| Chlorides (mg/L) | 8 | 0.6 | 8.6 | 1.1 | 2.3 | 2.8 | J | |
| Atrazine (µg/L) | 1 | < | | < | 0.06 | | | |
| Total Metals | | | | | | | | |
| Aluminum (mg/L) | 4 | < 0.048 | < 0.060 | 0.039 | 0.039 | 0.010 | J | |
| Iron (mg/L) | 4 | < 0.014 | 0.029 | 0.012 | 0.015 | 0.010 | J | |
| Manganese (mg/L) | 4 | < 0.001 | < 0.009 | 0.003 | 0.003 | 0.002 | J | |
| Dissolved Metals | | | | | | | | |
| Aluminum (mg/L) | 4 | < 0.033 | 0.069 | 0.032 | 0.037 | 0.022 | J | |
| Antimony (µg/L) | 4 | < 0.7 | < 6.0 | 2.0 | 1.8 | 1.4 | | |
| Arsenic (µg/L) | 4 | < 0.4 | < 1.6 | 0.2 | 0.4 | 0.3 | | |
| Cadmium (mg/L) | 4 | < 0.002 | < 0.003 | 0.001 | 0.001 | 0.000 | | |
| Chromium (mg/L) | 4 | < 0.007 | < 0.013 | 0.005 | 0.005 | 0.002 | | |
| Copper (mg/L) | 4 | < 0.013 | < 0.200 | 0.053 | 0.053 | 0.054 | | |
| Iron (mg/L) | 4 | < 0.014 | < 0.026 | 0.010 | 0.010 | 0.002 | | |
| Lead (µg/L) | 4 | < 0.6 | < 1.5 | 0.6 | 0.6 | 0.2 | | |
| Manganese (mg/L) | 4 | < 0.001 | < 0.009 | 0.003 | 0.003 | 0.002 | J | |
| Mercury (µg/L) | 2 | < 0.1 | < 0.1 | 0.0 | 0.0 | 0.0 | JB | |
| Nickel (mg/L) | 4 | < 0.004 | < 0.019 | 0.004 | 0.005 | 0.003 | | |
| Selenium (µg/L) | 4 | < 0.4 | < 1.5 | 0.2 | 0.3 | 0.3 | | |
| Silver (mg/L) | 4 | < 0.001 | < 0.002 | 0.001 | 0.001 | 0.000 | | |
| Thallium (µg/L) | 4 | < 0.4 | < 0.5 | 0.2 | 0.2 | 0.0 | | |
| Zinc (mg/L) | 4 | < 0.003 | < 0.060 | 0.016 | 0.016 | 0.016 | | |
| Biological | | | | | | | | |
| Chlorophyll a (ug/L) | 8 | < 0.10 | 2.40 | 0.50 | 0.72 | 0.71 | | |
| Fecal Coliform (col/100 mL) | 8 | 5 | 220 | 27 | 49 | 71 | J | |

B=data was not included because of data quality concerns; C= *F&W* criterion exceeded; E=# samples that exceeded criteria; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 65j; N=# samples; Q= qualifier codes

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