

# Characterization of Bacteria and Geochemistry of Springs in Nashville, Tennessee

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## Abstract

The objective of the project was to evaluate the water quality of four limestone bedrock springs in an urban environment during a severe drought in the summer of 2007. Three of the springs were discovered on the Tennessee State University (TSU) campus in Nashville, TN in May, 2007. Two are located near a poultry research facility and a third near the TSU athletic center. An additional spring flowing from a cave in the Charlotte Park neighborhood of west Nashville (Carlos Cave) was also included in the study. The two TSU springs behind the poultry barns were sampled approximately every week from June through September, 2007. The cave and TSU athletic center springs were sampled less frequently. Water quality parameters included temperature, specific conductance, and dissolved oxygen, pH, sulfate, nitrogen, *E. coli*, and bacteria Biological Activity Reaction Tests (BART). Continuous water-quality monitoring devices were installed at two of the springs to measure changes associated with different weather patterns. Water temperatures were very stable, ranging from 16°C in June to 19°C in September. Sulfate concentrations were consistently higher in the spring water than the receiving surface waters, suggesting that surface vegetation may have removed the sulfate. Conversely, nitrogen levels were lower in the spring water (< 10 mg/L) than the surface waters, suggesting denitrification by bacteria in the subsurface. Fecal bacteria levels fluctuated randomly with no discernable correlation to weather pattern. BART tests confirmed the presence of denitrifying, iron-reducing, sulfur-reducing, and slime-producing bacteria at each of the springs. Spring discharges decreased at all sites as the drought continued but never decreased below 10 gallons per minute. The data showed that each spring had unique water quality characteristics reflective of the different hydrologic recharge areas that replenish them.