



Water Quality Monitoring, Fiscal Year 2023

Overview

The Cumberland Piedmont Network Inventory and Monitoring Program began long-term water quality monitoring at Stones River National Battlefield in fiscal year 2003. Water quality is measured every month for two years, followed by a five-year hiatus (concordant with the U. S. Geological Survey's national long-term water quality program). Water quality is measured at four sites: West Fork Stones River at Redoubt Brannan (RBWF) and McFadden Ford (MFWF), and King's Pond Spring (KSKP) which flows to the fourth site, Battlefield Spring (BSBS) near the river (see map on page 2). Based upon program requirements and findings of the water quality inventory, a set of parameters was chosen for long-term monitoring. These parameters include field measures of water temperature, specific conductance (SpC), pH, and dissolved oxygen (DO). Samples were also collected for laboratory analysis of *Escherichia coli* (*E. coli*) and nitrate.

This brief summarizes data collected from October 19, 2022 through September 20, 2023 (FY23). Water quality data are available upon request to the Cumberland Piedmont Network.



West Fork Stones River at Redoubt Brannan on September 20, 2023. Photo by Brenda Wells.

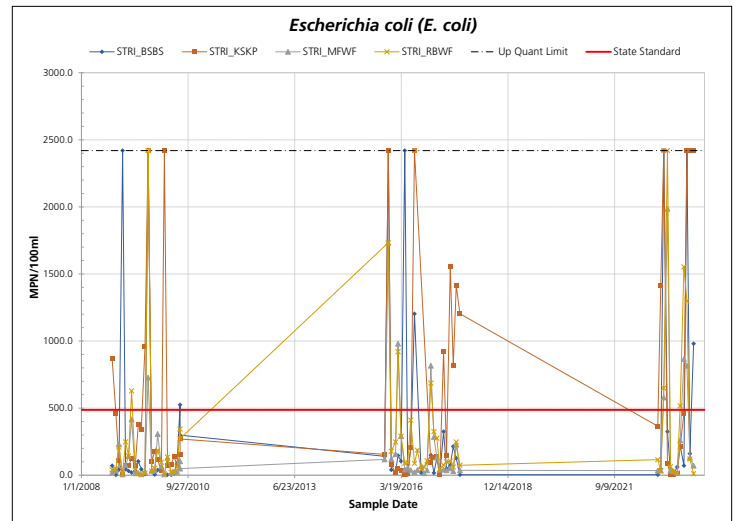


Figure 1. *E. coli* at Stones River National Battlefield FY09–FY23. The solid red line indicates the *E. coli* state standard and the dashed black line indicates the upper quantification limit for the testing method. Data points at this line were greater than or equal to 2419.6 MPN/100mL. BSBS—Battlefield Spring, KSKP—King's Pond, MFVF—West Fork Stones River at McFadden's Ford, and RBWF—West Fork Stones River at Redoubt Brannon.

Significant Findings

There were 20 violations of state water quality standards in fiscal year 2023. Dissolved oxygen dropped below the state standard of 5.0 mg/L three times at Battlefield Spring. These low readings are likely the result of natural hydrological conditions—the springs are fed mostly through the epikarst, the upper few meters of soil-covered limestone where there is no natural aeration of water.

There were 17 violations of the state *E. coli* standard of 487 MPN/100 mL (Figure 1): five times each at West Fork Stones River at Redoubt Brannon and King's Pond Spring, four times at McFadden Ford, and three times at Battlefield Spring. Most Probable Number (MPN) is a statistical method of estimating bacteria colony density.

All measurements of water temperature and pH met Tennessee state standards.

Water Quality Standards

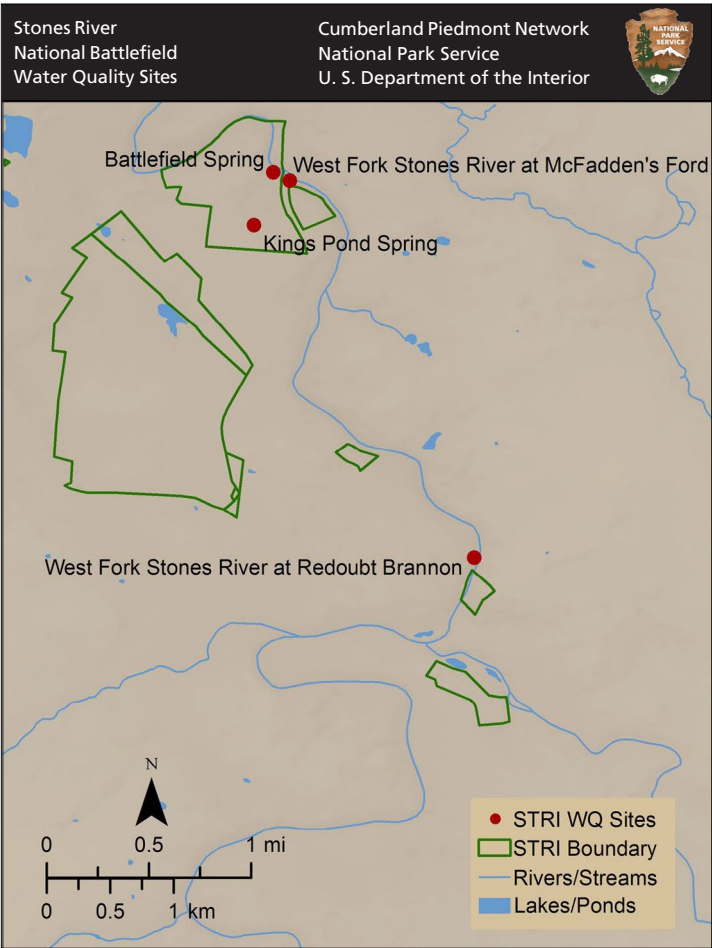
All park waters are considered “Exceptional Tennessee Waters.” This designation prohibits discharge and other pollution sources. Criteria are defined as Tennessee’s “Fish and Aquatic Life and Recreational” standards, a combination of the highest standards under the Clean Water Act as promulgated by the state. The two river sites are considered to support recreational use. There is no state or federal numeric criteria for specific conductance. These parameters are useful in interpreting water quality. We also use the EPA freshwater aquatic life recommended concentration limit for nitrate of 90 mg/L.

Table 1. Parameters and Standards.

Parameter	Standard
Water temperature	Less than 30.5° C
Dissolved oxygen	Greater than 5.0 mg/L
pH	Between 6.0 and 9.0 SU (standard units)
<i>Escherichia coli</i>	Less than 487 MPN/100 mL
Specific conductance	No standard
Nitrate	Less than 90 mg/L

Future Monitoring

Water quality sampling will continue in FY2024.



Water-quality monitoring sites at Stones River National Battlefield in FY2023.

About the Cumberland Piedmont Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as “Vital Signs Monitoring,” to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystem,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and Congressional mandates, and
- Provide a means of measuring progress towards performance goals.

Effective long-term management and stewardship of natural resources in the Cumberland Piedmont Network begins with baseline knowledge of these resources. To acquire this knowledge, an inventory program was established by the National Park Service with the goals of acquiring baseline information for a variety of resources, from bibliographic information to species occurrence and distribution.

For More Information

CUPN Home Page:

<https://www.nps.gov/im/cupn/index.htm>

CUPN Reports & Publications:

<https://www.nps.gov/im/cupn/reports-publications.htm>

About the NPS Inventory & Monitoring Program:

<https://www.nps.gov/im/index.htm>

Data Downloads via the Natural Resource Information Portal:

<https://irma.nps.gov/Portal/>

Contact

Emma Brinley Buckley, CUPN Hydrologist

emma_brinleybuckley@nps.gov

Brenda Wells, CUPN Biologist

brenda_wells@nps.gov