



# Mammoth Cave Park Water Quality Summary Fiscal Year 2012

## Water quality at Mammoth Cave National Park Park is fair.



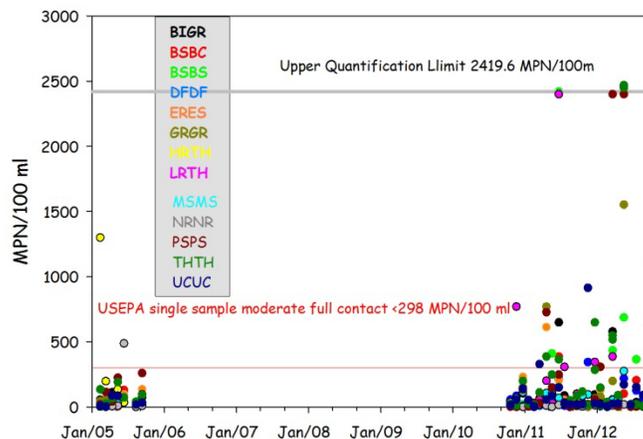
Natural Resource Specialist Brice Leech conducts water quality monitoring at high-flow Echo River Spring, Mammoth Cave National Park, November 16, 2011. Image by Joe Meiman.

The Cumberland Piedmont Network Inventory and Monitoring Program began long-term water quality monitoring at Mammoth Cave National Park in fiscal year 2002. Water quality is measured monthly for two years at 13 sites, ranging from small near-pristine springs, large cave streams to the Green River. Two years of monthly sampling is followed by five years of inactivity, a schedule based on the United States Geologic Survey national water quality program. Based upon program requirements and findings of the water quality inventory and prior monitoring, a set of parameters was chosen for the long-term program; including the field measures of water temperature, specific conductance (SpC), pH, flow, and dissolved oxygen (DO). Samples were also collected for analysis for *Escherichia coli* (*E. coli*), turbidity and nitrate.

### Highlights of Fiscal Year 2012 Monitoring

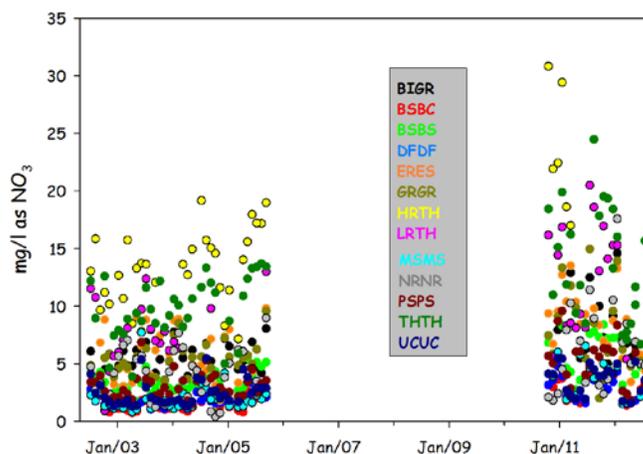
The hydrology of the park is dominated by karst groundwater, either flowing in cave streams or springs recharging the master stream, the Green River. The karst aquifer is extremely quick to respond to rainfall events and the runoff they produce, both in terms of water quantity and quality. Non-point source contaminants such as soil particles or bacteria from animal waste lie in a state of virtual storage on the surface until they are washed into sinkholes and sinking streams, through cave streams and out springs into the river in a matter of hours. With respect to non-point source contaminants; when flow is high, water quality is poor. Conversely, when flow is low, water quality is good.

During fiscal years 2011 and 2012 there were 37 exceedences of the state recreational contact limit for *E. coli* out of 288 individual samples (13% of the samples, see figure). High bacteria values were found at every site except the Nolin River and all were associated with high flow events following runoff-producing rainfall.



*E. coli* of Mammoth Cave National Park waters, 2005-2012. *E. coli* were not collected prior to 2005.

Nitrate levels within developed watersheds of Mammoth Cave are elevated (see figure below). The highest nitrate values are found in the Turnhole Spring watershed; at Turnhole Spring (THTH) and its cave stream tributaries of Logsdon River (LRTH) and Hawkins River (HRTH). Nitrate levels are highest when flow is at the lowest suggesting point sources – further data analysis should provide answers. It also appears that nitrate levels are trending upwards, especially in the Turnhole Spring watershed. Trend analysis and nitrate source determination will be the focus of a study in 2013. There is no state or federal standards for nitrate. For reference consider the USEPA drinking water limit of 45 mg/l as  $\text{NO}_3$  or a screening level used in Texas of 8.8 mg/l. There are no data which may suggest a limit of nitrate for surface or subterranean aquatic fauna in the park.



Nitrate of Mammoth Cave National Park waters, 2002-2012.

## Water Quality Standards

All park waters are considered “Outstanding Resource Waters” by Kentucky. This designation does not set higher water quality standards but does provide a higher level of review for permits that may cause degradation. Cave streams and springs are designated as “Cold Water Aquatic Habitat” (CW) under the Clean Water Act as promulgated by the commonwealth of Kentucky. The Green and Nolin Rivers are considered “Warm Water Aquatic Habitat” (WW). As all park waters are subject to recreational activities we adapted the USEPA recommendations for “Single Sample Moderate Full Contact Recreation” of 298 MPN/100ml. We also use the USEPA freshwater aquatic life recommendation for nitrate of 90 mg/l. There is no state or federal standards for SpC.

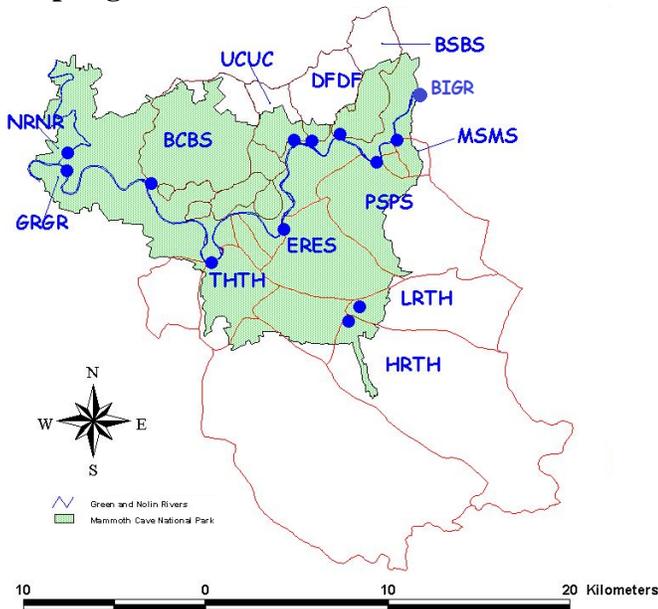
<b>Water Temperature</b>	Not to exceed 31.7°C (WW)
<b>Dissolved Oxygen</b>	Not to exceed 5 mg/l (CW) 4 mg/l (WW)
<b>pH</b>	Between 6.0 and 9.0 SU
<b><i>Escherichia coli</i></b>	Not to exceed 298 MPN/100ml
<b>Nitrate</b>	Not to exceed 90 mg/l
<b>SpC</b>	No state standard
<b>Turbidity</b>	No state standard

## Future Monitoring

Water quality sampling is scheduled resume in fiscal year 2017. Water quality data are available upon request to the Cumberland Piedmont Network or our website:

<http://science.nature.nps.gov/im/units/cupn/reports.cfm>

## Sampling Sites



<b>BIGR</b>	Green River at Bush Island
<b>BSBC</b>	Buffalo Spring
<b>BSBS</b>	Big Spring
<b>DFDF</b>	Doyles Ford Spring
<b>ERES</b>	Echo River Spring
<b>GRGR</b>	Green River upstream from Nolin River
<b>HRTH</b>	Hawkins River (cave stream)
<b>LRTH</b>	Logsdon River (cave stream)
<b>MSMS</b>	Mile 205.7 Spring
<b>NRNR</b>	Nolin River upstream from Green River
<b>PPS</b>	Pike Spring
<b>THTH</b>	Turnhole Spring
<b>UCUC</b>	Ugly Creek Spring