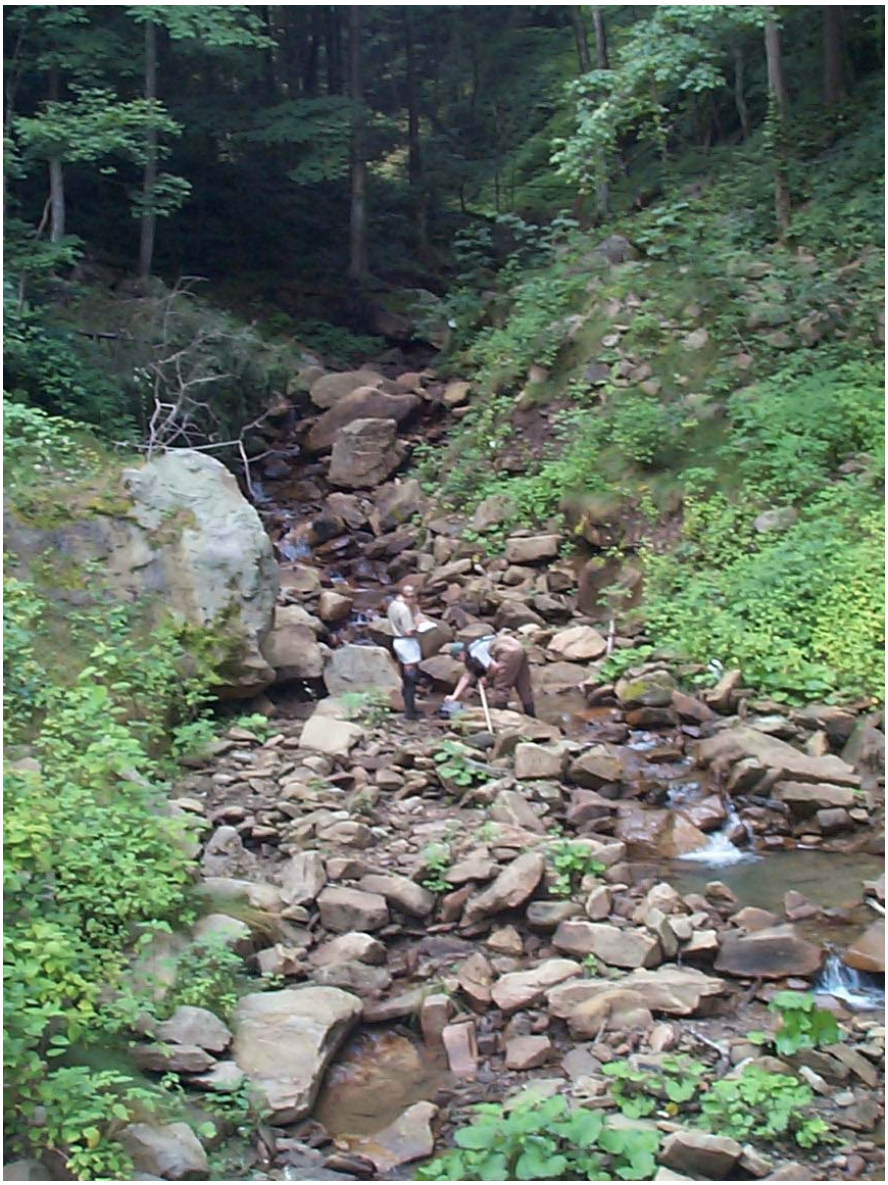
# Water Quality Monitoring Program 2004- 2006
# New River Gorge National River
# Bluestone National Scenic River
# Gauley River National Recreation Area



Jesse M. Purvis
Lisa Wilson
July 2007

New River Gorge National River was established by Public Law (PL) 95- 625 on November 10, 1978. The park was created to conserve and interpret outstanding natural values and objects, and to preserve an important segment of the New River as a free- flowing stream for the benefit and enjoyment of present and future generations.

Gauley River National Recreation Area was established on October 26, 1988 by PL 100- 534. The park was created to protect and preserve scenic, recreational, geological, and fish and wildlife resources of the Gauley River and its tributary, the Meadow River.

The legislation that established Gauley River National Recreation Area also made boundary adjustments to New River Gorge National River, and amended the Wild and Scenic Rivers Act (16 USC 1274(a)), to designate Bluestone National Scenic River. This designation was made to protect and enhance the natural, scenic, cultural and recreational values of a free- flowing segment of the Bluestone River for the benefit and enjoyment of present and future generations.

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# New River Gorge National River
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United States Department of the Interior
National Park Service
Glen Jean, West Virginia

July 2007

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## EXECUTIVE SUMMARY

This report presents the results of baseline water quality monitoring in New River Gorge National River, Bluestone National Scenic River, and Gauley River National Recreation Area between 2004 and 2006. This report culminates a concerted effort to bring our reporting of this monitoring up- to- date. Future reports will be prepared annually.

These three river parks located in southern West Virginia contain some of the most popular and demanding whitewater recreation in the eastern United States, support the most significant and highest quality warm water fishery in West Virginia, and offer outstanding opportunities for solitude. Together, these three parks represent some of the most significant water resources in the National Park System.

Appalachia has a long history of impoverishment. Today this is reflected in infrastructure that is often less than adequate. Sewage treatment is absent or woefully inadequate in many areas, including the vicinity of the three parks.

The National Park Service uses this water quality monitoring data to inform regulators and decision makers of the extent of sewage- related water quality problems surrounding the three parks. We believe this effort has led to a better informed public, and the commitment of effort and funding that are working towards improving local sanitary water quality.

For more information about the water quality monitoring program, please contact the authors at 304- 465- 0508.

## ACKNOWLEDGEMENTS

The following people and organizations provided assistance or access during the monitoring effort: United States Army Corps of Engineers (Bluestone and Summersville Dams); United States Geological Survey (West Virginia Water Science Center); West Virginia Division of Natural Resources (Bluestone and Pipestem State Parks); West Virginia Department of Environmental Protection Inspectors John Fredericks, Ron Garrett, Susan Kershner, Nick Lewis, and Larry Robertson; the Mount Hope Waste Water Treatment Plant; the Oak Hill Sewage Treatment Plant, the Fayetteville Sewage Treatment Plant, the Arbuckle Public Service District, the White Oak Public Service District; ACE Adventure Center, CSX Corporation, the Nuttall Estate, and Dennis Richmond.

Completing this report benefited from many specialists, interns, and volunteers at New River Gorge National River. Andy Steel produced the maps. Field and laboratory assistance was provided by Kathy Oney, Karen Vandersall, Sammy Pugh, Clif Bobinski, Lori Hindson, Mary Taylor, Cynthia Bollinger and Aleah Denny.

Additional thanks are extended to staff from other Divisions at New River Gorge National River and other individuals whom we may have neglected to mention.

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# INTRODUCTION

## WATER QUALITY MONITORING PROGRAM

The history of water quality monitoring by the National Park Service (NPS) in New River Gorge National River (NRGNR), Bluestone National Scenic River (BNSR), and Gauley River National Recreation Area (GRNRA) is summarized in a previous report (Wilson and Purvis 2003). Monitoring in NRGNR began in 1980, while monitoring of BNSR and GRNRA began in 1991. Monitoring focuses on fecal coliform bacteria, an indicator of sewage pollution.

Fecal coliform bacteria live in the lower gut of warm- blooded animals and are excreted with the feces. Fecal coliforms are not necessarily pathogenic (disease-causing). However, other microorganisms that are pathogenic also live in the lower gut and are also excreted with the feces. Fecal coliforms are relatively easy to detect, and thus serve as an indicator of potential pathogenic conditions related to sewage pollution. Fecal coliforms are the basis for the West Virginia standard for primary contact recreational waters. This standard is that fecal coliforms not exceed 200 per 100 milliliters (200 FC/100ml) of water (West Virginia Water Resources Board 1998). This standard is based on the geometric mean (a kind of average) of at least five samples a month. Alternately, waters should not exceed 400 FC/100ml in more than 10% of samples taken in a month.

Several reports summarize earlier water quality monitoring efforts (West Virginia Department of Natural Resources 1988, 1989; Wood 1990a, b, c; Schmidt and Hebner 1991; Hebner 1991a, b; Sullivan 1993a, b, c; Gibson 1993; Purvis and Wilson 1999; Wilson and Purvis 2000, 2003, Wilson *et al*. 2006).

## THE 2004- 2006 EFFORT

This report presents baseline water quality monitoring data collected by NPS at the three parks between 2004 and 2006. Baseline monitoring is designed to produce a long- term estimate of average conditions. Samples were collected at 39 sites (29 associated with NRGNR, and five each associated with GRNRA and BNSR). Samples were analyzed for fecal coliforms, temperature, pH, turbidity, conductivity, and dissolved oxygen. The results focus on fecal coliform bacteria, and their relationship with factors (turbidity, stream flow, recent precipitation, land use, and sewage treatment patterns) shown to be related to changes in fecal coliform density. Most samples were analyzed by NPS staff at the NPS Water Quality Laboratory at park headquarters. Some samples were analyzed by one or more of the local commercial testing laboratories.

## METHODS

The study area is described in previous reports (e.g. Wilson *et al*. 2006). All three parks are in the Kanawha- New River watershed (Fig. 1). The New River begins in the North Carolina Blue Ridge Mountains and flows generally north for 250 miles through Virginia and West Virginia. Bluestone River and Greenbrier River, the two major tributaries to the New River, both enter within a few miles of each other near Hinton, West Virginia. The New River joins the Gauley River at Gauley Bridge, West Virginia to form the Kanawha River. The Kanawha River flows northwest to the Ohio River at Point Pleasant, West Virginia.

Bluestone National Scenic River (Fig. 2) includes 10.5 miles of the lower Bluestone River. Previous monitoring showed the lower Bluestone River to be generally satisfactory for water contact recreation. Domestic, municipal, agricultural, mining and industrial pollution is contributed from developed areas in the upper watershed, above the Scenic River boundary.

New River Gorge National River includes 53 miles of the lower New River. New River water quality is generally satisfactory for water contact recreation. Some tributaries are impaired by raw or inadequately treated domestic sewage. Many of the impaired tributaries enter the New River near popular recreational access sites. Pollution contributed by tributaries may impact the New River for some distance downstream.

Gauley River National Recreation Area (Fig. 4) contains 25 miles of the Gauley River and the lower 5.5 miles of the Meadow River. Gauley and Meadow Rivers water quality is generally satisfactory for water contact recreation. Inadequate disposal of human and/or animal waste was identified as a major problem in the watershed (West Virginia Department of Natural Resources 1984).

### SAMPLING REGIME

Of the five BNSR sites, three were on the Bluestone River and two were on tributaries. Of the 29 NRGNR sites, 8 were on the New River, 19 were on tributaries, and two were at springs (not all NRGNR sites shown in Fig. 3 were monitored in 2004- 2006). Of the five GRNRA sites, three were on Gauley River and two were on tributaries. Sampling usually occurred between April and October.

Samples for bacteria and turbidity analyses were collected and analyzed according to standard methods (e.g. Brodner *et al*. 1978, American Public Health Association 1992). Details on these routines are described in an earlier report (Wilson *et al*. 2006).


Figure 1. Kanawha - New River watershed, showing the locations of BNSRstone National Scenic River, New River Gorge National River, and Gauley River National Recreation Area.

**Figure 2. Bluestone National Scenic River Water Quality Sample Sites**

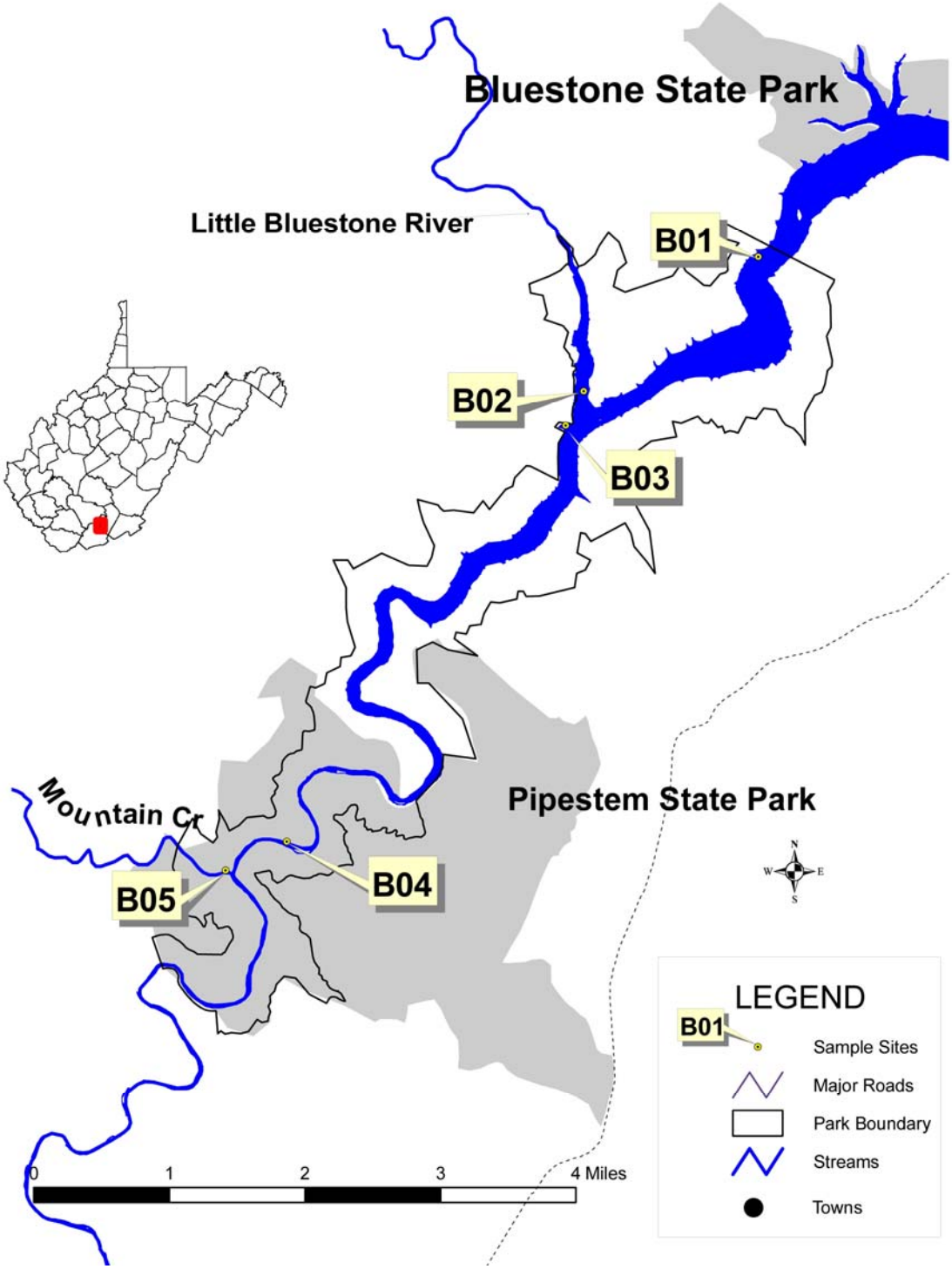


**Figure 3. New River Gorge National River Water Quality Sample Sites**

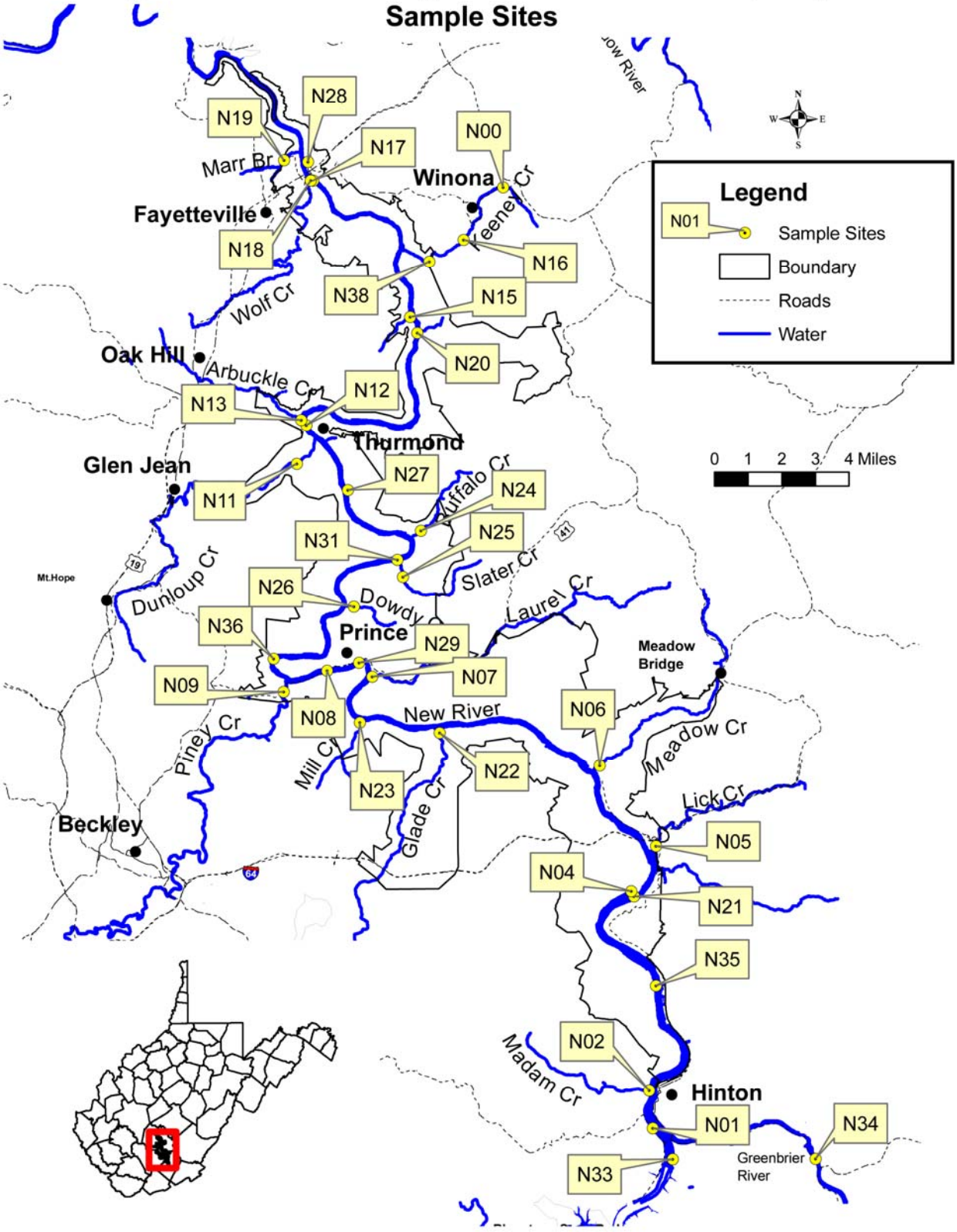
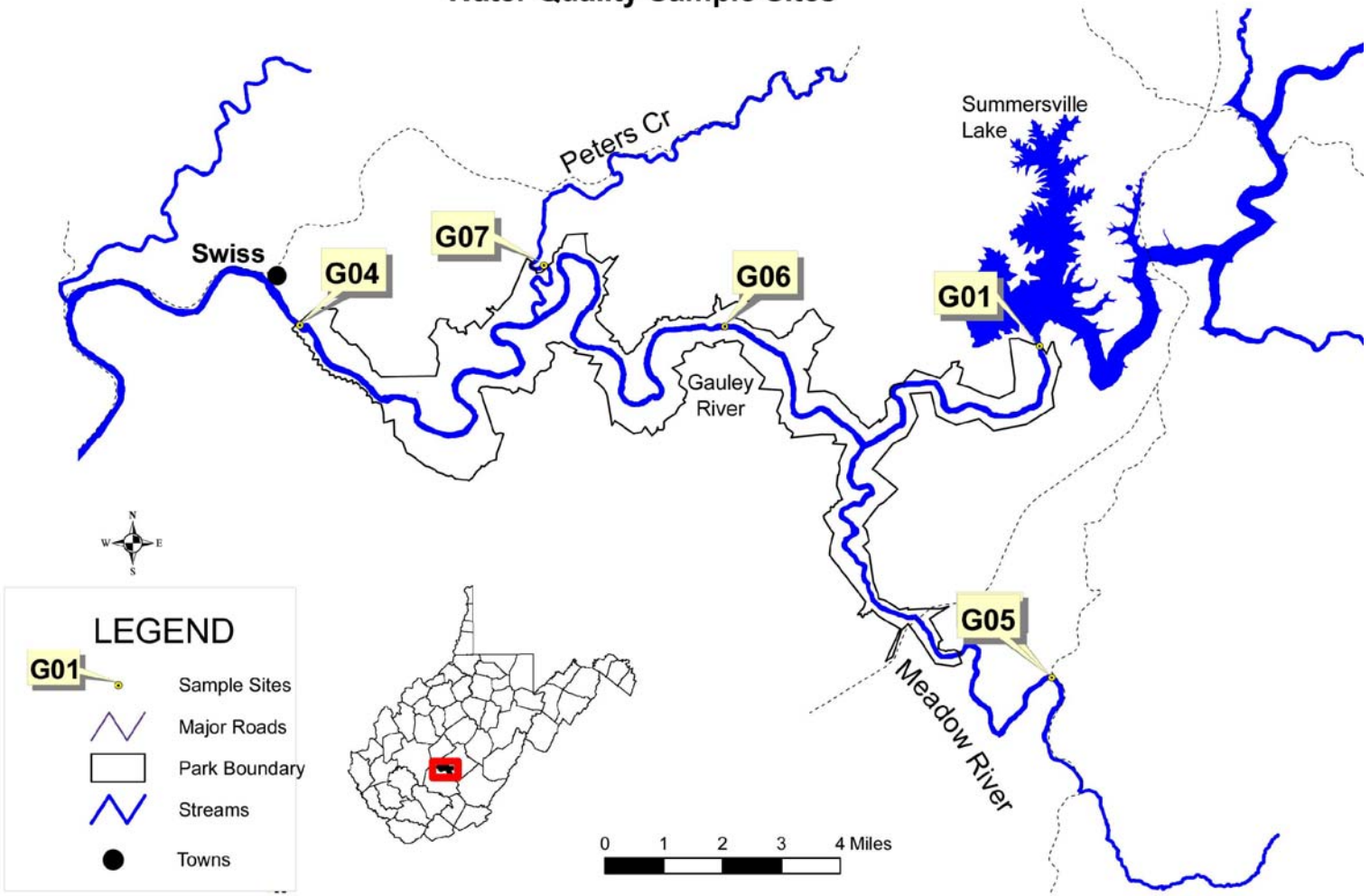


**Figure 4. Gauley River National Recreation Area**
**Water Quality Sample Sites**



# RESULTS

This section is organized in a downstream direction. Information on Bluestone National Scenic River is presented first, followed by New River Gorge National River and Gauley River National Recreation Area. Results are also presented in downstream direction within each park, except that mainstem information is presented first, followed by information from the tributary streams.

One page is provided for the results from each sampling site. At the top of the page is the site name, followed by a unique site number. These are the same numbers used in Figures 2- 4. Underneath the names is a color- coded box containing a quick summary noting the frequency that the site exceeded 200 fecal coliforms per 100 milliliters of water (the West Virginia fecal coliform standard for contact recreation), both in the period covered by this report, and since monitoring began at the site.

These sites do not exceed the West Virginia standard more than 10% of the time, either historically or in 2004-2006.

These sites exceed the West Virginia standard more than 10% of the time but no more than 25% of the time, either historically or in 2004-2006.

These sites exceed the West Virginia standard more than 25% of the time, either historically or in 2004-2006.

These sites were recently added to the monitoring program, so reliable estimates of their water quality are not yet available.

Following the boxes is a brief description of the sample location, and its relation to other sampling locations and U. S. Geological Survey (USGS) stream gages. These gages include (with their full title and USGS number):

- Pipestem (Bluestone River near Pipestem; 03179000),
- Greenbrier (Greenbrier River at Hilldale; 0318400),
- Hinton (New River at Hinton; 03184500),
- Thurmond (New River at Thurmond; 03185400),
- Summersville Dam (Gauley River below Summersville Dam; 03189600),
- Belva (Gauley River above Belva; 03192000), and
- Meadow River (Meadow River near Mount Lookout; 03190400).

Stream gage data is published annually by the USGS. Reports that cover 2004 (Ward *et al*. 2005) and 2005 (Ward and Crosby 2006) are available. Information for 2006 can be accessed on- line at http://web10capp.er.usgs.gov/adr06_lookup/search.jsp.

A short paragraph describes the range and average values noted during 2004- 2006 for fecal coliform bacteria. Three averages – the (arithmetic) mean, the geometric mean and the median – are used to describe the data. The (arithmetic) mean is the average with which most readers will be familiar. It is calculated by adding the values for all the samples and dividing by the number of samples. The geometric mean is often used in cases where one or a few samples have a much greater value than most of the other samples. Such extreme values often occur in fecal coliform data, so the geometric mean is used in the appropriate West Virginia standard to determine whether or not a site is in compliance with water quality regulations. Geometric means are calculated by taking the logarithm of each value, adding these logarithms, dividing the total by the number of samples, and then taking the anti- logarithm of this result. The median of a set of samples is the value with an equal number of values greater than it and less than it. The median may be a more useful average when the sample size is small and the sampled population is not normally distributed (*i.e.* does not produce the traditional bell- shaped curve). The different averages can give quite different results. For example, if five samples produced values of 10, 12, 18, 20, and 540, then the mean would be 120, the median 18, and the geometric mean 29.7. For some sample sets, the averages can be very close. For example, if the sample set is 10, 12, 14, 18 and 20, then the mean would be 14.8, the median 14, and the geometric mean 14.3.

A bar graph shows fecal coliform bacteria densities for each sample. Blue bars indicate samples with bacteria density less than 200 FC/100ml, yellow bars indicate samples with bacteria density between 200 and 400 FC/100ml, and red bars indicate samples with bacteria density greater than 400 FC/100ml. Fecal coliform bacteria densities are presented with the bars for samples that exceeded 200 FC/100ml. Note that many graphs have a logarithmic axis for FC/100ml because of the range of values encountered.

When deciding whether a site with more than one sample on a given date exceeded the contact recreation standard on that date, the arithmetic mean is used.

## BLUESTONE NATIONAL SCENIC RIVER

### BLUESTONE RIVER MAINSTEM

### Bluestone River below Mountain Creek, site B04

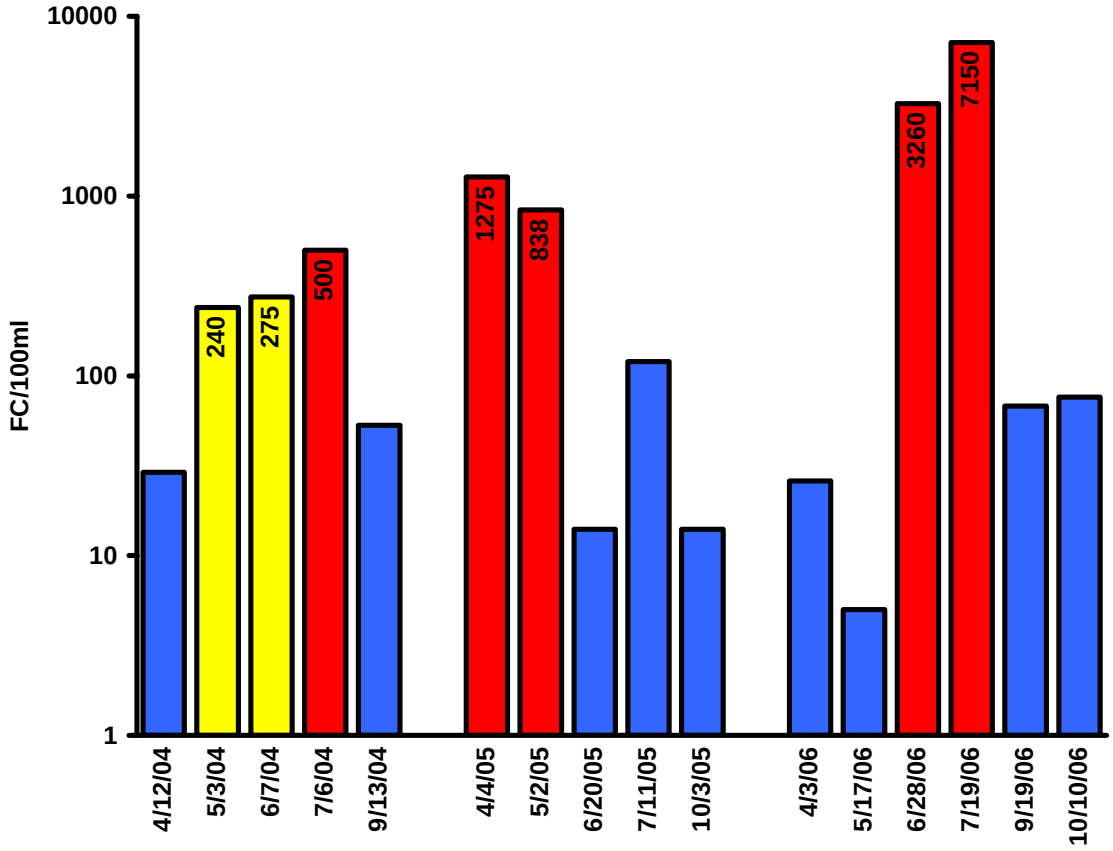
Seven of the 16 (44%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml, and five of the 16 (31%) samples exceeded 400 FC/100ml (Fig. 5).

Since 1991, 17 of 96 (18%) samples exceeded 200 FC/100 ml.

The sampling site is on river left, upstream of Mountain Creek Lodge at Pipestem State Park. The site is about one- half mile upstream of the Pipestem gage. Mountain Creek (0.7 miles) and an intermittent stream (0.4 miles) enter the Bluestone River upstream from the site. Typical visitors include employees of Pipestem State Park, lodge guests, hikers, picnickers and anglers.

Between 2004 and 2006 fecal coliform bacteria density ranged from 5 to 7150 FC/100ml (mean 871, geometric mean 139, median 98).

**Figure 5. Bluestone River below Mountain Creek**



## Bluestone River above Little Bluestone River, site B03

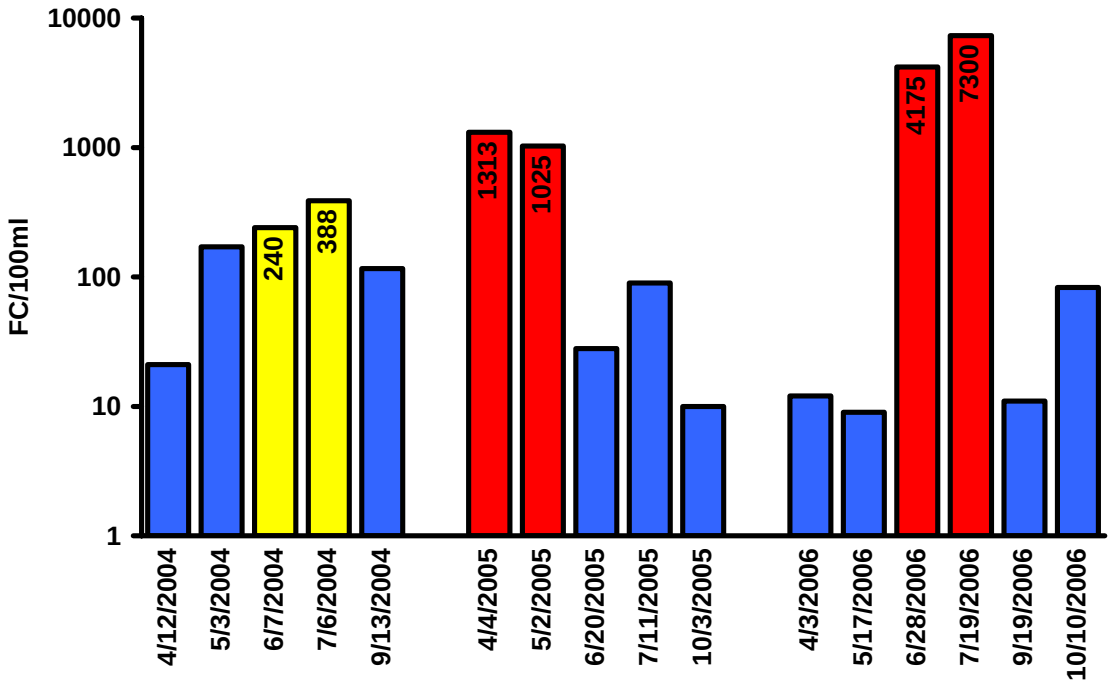
Six of the 16 (38%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml, and four of the 16 (25%) samples (25%) exceeded 400 FC/100ml (Fig. 6).

Since 1991, 9 of 85 (15%) samples exceeded 200 FC/100 ml.

This site is on river left upstream of the confluence of the Bluestone and Little Bluestone Rivers. The site is about 5.4 miles downstream of the Pipestem gage. Twelve tributaries (2 perennial and 10 intermittent) enter the Bluestone River between the Pipestem gage and this site. Typical visitors include hikers, cyclists, anglers and picnickers.

Between 2004 and 2006 fecal coliform bacteria density ranged from 9 to 7300 FC/100 ml (mean 937, geometric mean 126, median 103).

**Figure 6. Bluestone River above Little Bluestone River**



**Bluestone River above Mouth, site B01**

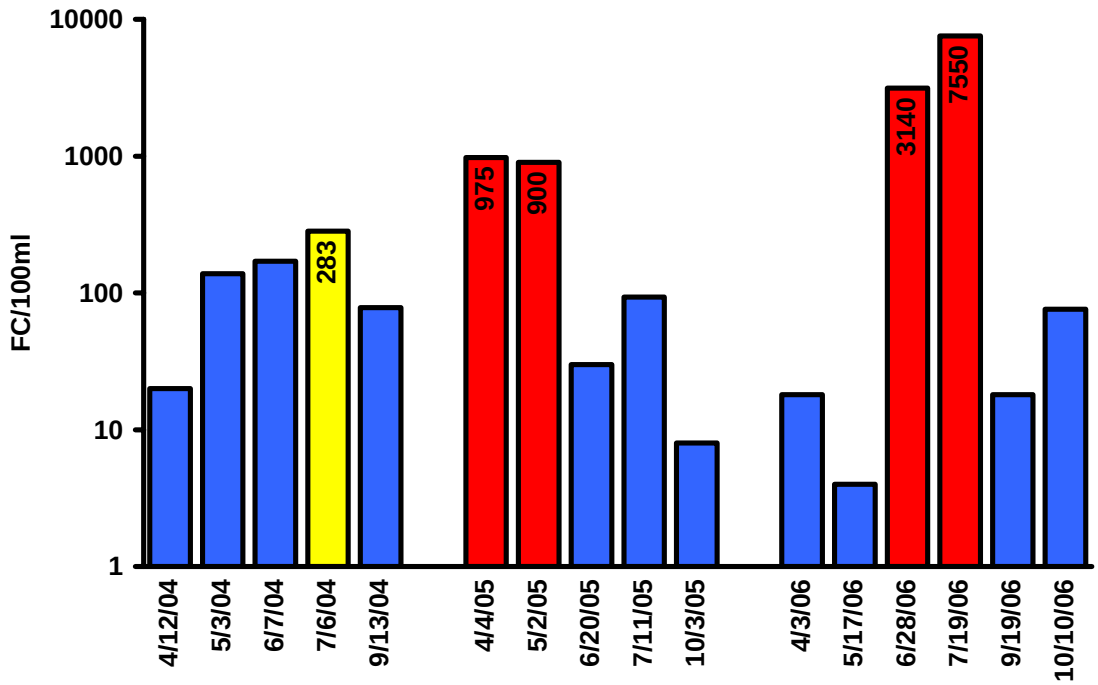
Five of the 16 (31%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml, and four of the 16 (24%) samples exceeded 400 FC/100ml (Fig. 7).

Since 1991, 17 of 101 (17%) samples exceeded 200 FC/100 ml.

This site is upstream of Bluestone State Park on river left off the Bluestone Turnpike Trail. The site is about 7.5 miles downstream of the Pipestem gage. Twenty tributaries (3 perennial and 17 intermittent) enter the Bluestone River between the Pipestem gage and this site. The largest of these tributaries is the Little Bluestone River. Visitors are attracted to this area due to the close proximity of Bluestone State Park, Bluestone Lake and Bluestone Wildlife Management Area. Typical visitors include hikers, cyclists, anglers, and those on horseback.

Between 2004 and 2006 fecal coliform bacteria density ranged from 4 to 7550 FC/100 ml (mean 844, geometric mean 110, median 86).

**Figure 7. Bluestone River above mouth**



## BLUESTONE RIVER TRIBUTARIES

### Mountain Creek, site B05

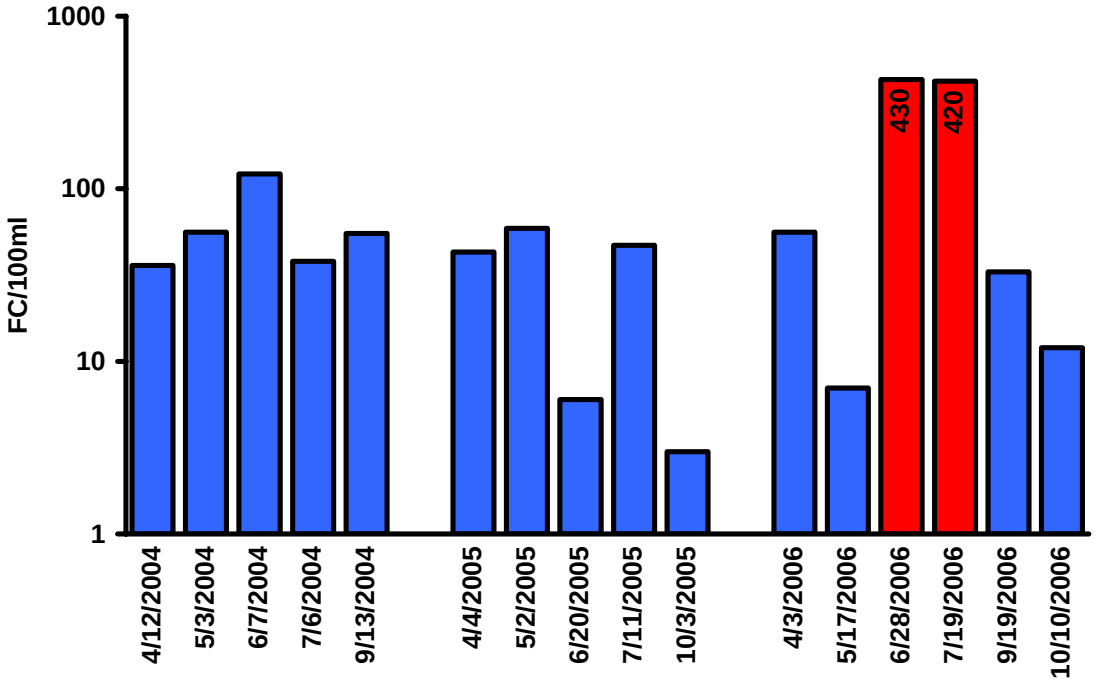
Two of the 16 (12.5%) samples collected between 2004 and 2006 exceeded both 200 FC/100 ml and 400 FC/100ml (Fig. 8).

Since 1991, 12 of 89 (13.5%) samples exceeded 200 FC/100 ml.

The site is on stream left, near the mouth of the creek in Pipestem State Park. The site is about 0.7 miles upstream of site B04, Bluestone River below Mountain Creek. Mountain Creek enters the Bluestone River 1.2 miles upstream of the Pipestem gage. Typical visitors include hikers, cyclists, picnickers and anglers.

Between 2004 and 2006 fecal coliform bacteria density ranged from 3 to 430 FC/100 ml (mean 89, geometric mean 39, median 45).

**Figure 8. Mountain Creek**



## Little Bluestone River, site B02

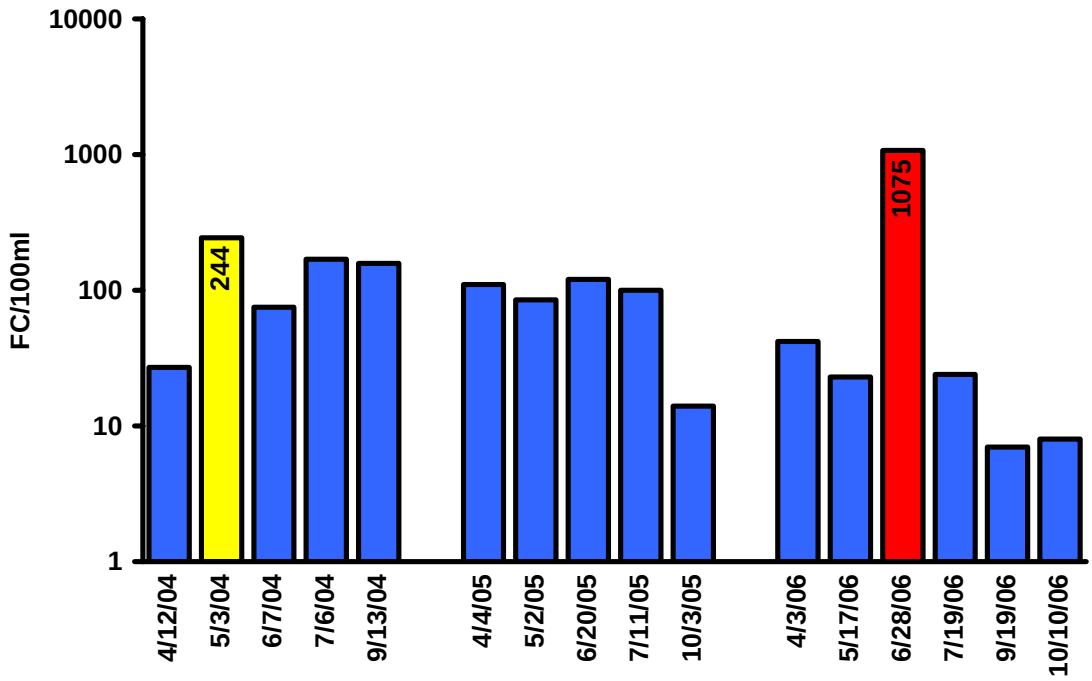
Two of the 16 (12.5%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and one of the 16 (6%) samples exceeded 400 FC/100ml (Fig. 9).

Since 1991, 14 of 100 (14%) samples exceeded 200 FC/100 ml.

The site is on river right near the mouth of the stream. The Little Bluestone River enters the Bluestone River about 5.4 miles downstream of the Pipestem gage and 2.1 miles upstream of the Bluestone River above Mouth site (B01). Typical visitors include hikers, cyclists, anglers and those on horseback.

Between 2004 and 2006 fecal coliform bacteria density ranged from 7 to 1075 FC/100 ml (mean 143, geometric mean 60, median 80).

**Figure 9. Little Bluestone River**



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## NEW RIVER GORGE NATIONAL RIVER

### NEW RIVER MAINSTEM

### New River below Bluestone Dam, site N33

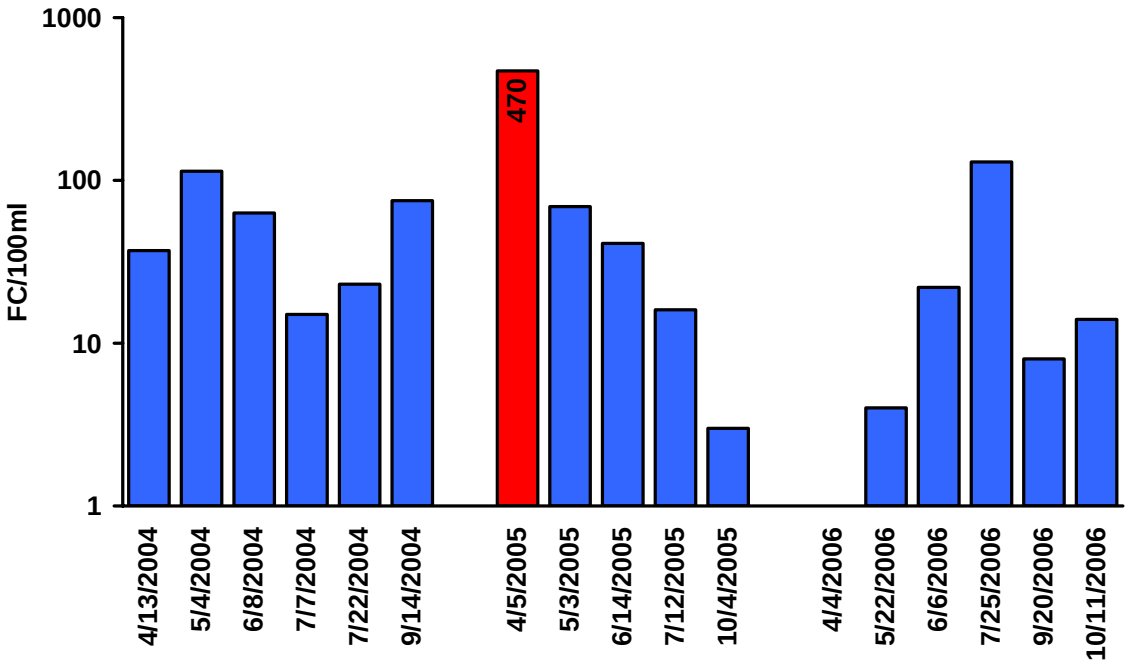
One of the 17 (6%) samples collected in 2004-2006 exceeded both 200 FC/100ml and 400 FC/100ml (Fig. 10).

Since monitoring of this site began in 2003 only one of 23 (4%) samples exceeded 200 FC/100ml.

This site is on river right below the Bluestone Dam tailwaters. It is 1.9 miles upstream of the Hinton gage and 38.3 miles upstream of the Thurmond gage. One intermittent tributary enters the New River just above the sampling site. The Greenbrier River enters the New River 0.6 mile downstream of this site. This site is also 1.1 miles upstream of the New River at Hinton Visitor Center site (N01, see below). Anglers, picnickers and sightseers are typical visitors at this site.

During 2004- 2006 fecal coliform bacteria density ranged from 1 to 470 FC/100 ml (mean 65, geometric mean 25, median 23). Note that the value for 4/4/2006 in Figure 10 is 1.

**Figure 10. New River below Bluestone Dam**



## New River at Brooks Falls, site N35

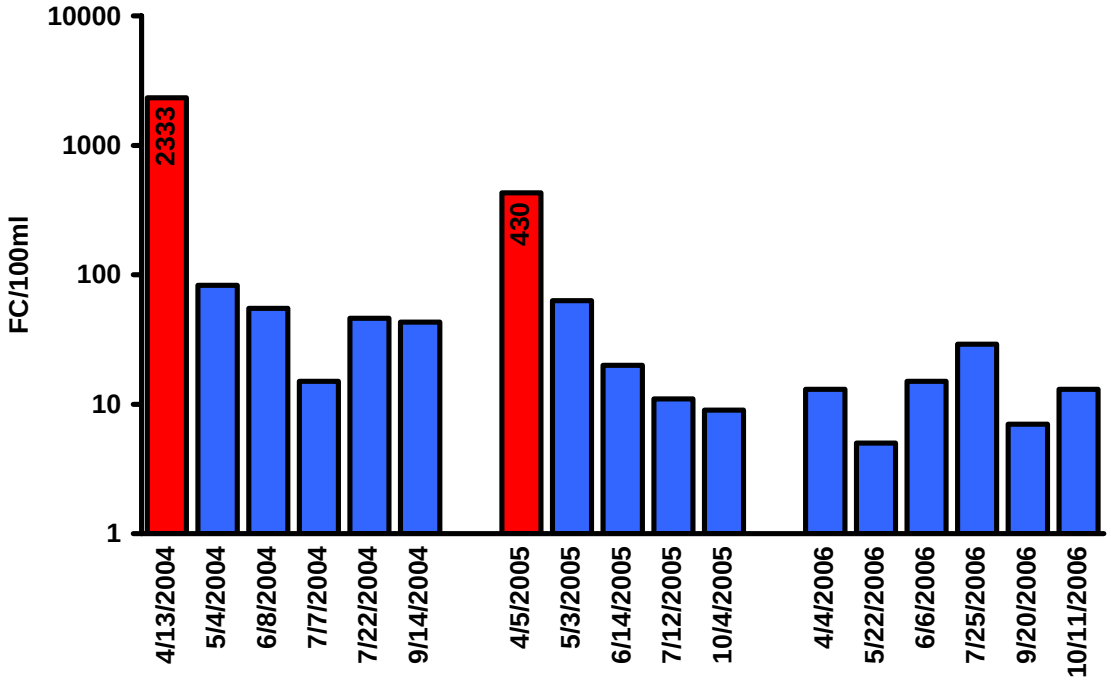
Two of the 17 (12%) samples collected in 2004-2006 exceeded both 200 FC/100ml and 400 FC/100ml (Fig. 11).

Regular monitoring of this site began in 2003. Including one sample taken in 2001, two of the 24 (8%) samples taken at this site exceeded 200 FC/100ml.

This site is on river left adjacent to the parking lot at the National Park Service Brooks Falls Day Use Area next to State Route 26 (River Road). This site is 4.0 miles downstream of the Hinton gage and 32.4 miles upstream of the Thurmond gage. There are 14 tributaries (6 perennial and 8 intermittent) between the Hinton gage and this site. This site is about 10.5 miles downstream from Greenbrier River at Willowwood (N34), 5.9 miles downstream from New River below Bluestone Dam (N33) and 3.9 miles downstream from Madam Creek (N02). Picnickers and sightseers are typical visitors to the site.

During 2004- 2006 fecal coliform bacteria density ranged from 5 to 2333 FC/100 ml (mean 188, geometric mean 32, median 20).

**Figure 11. New River at Brooks Falls**



## New River below Sandstone Falls, site N21

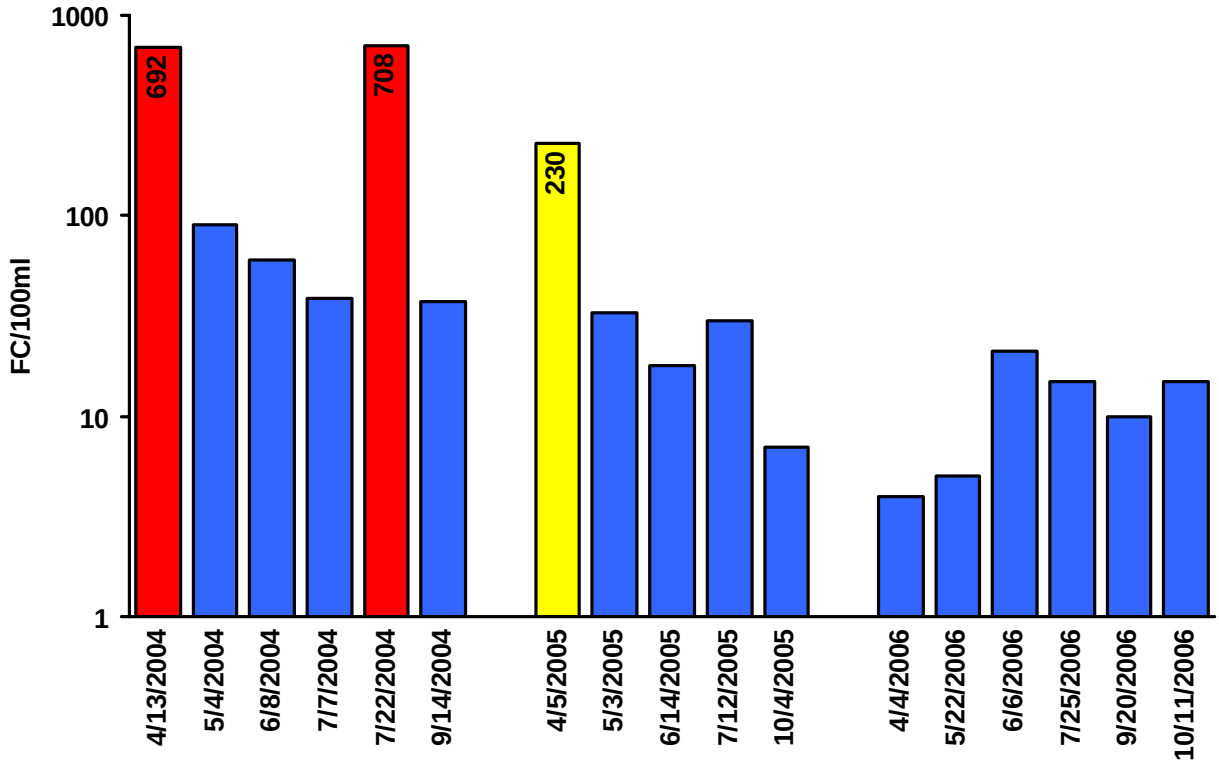
Three of the seventeen samples (18%) collected between 2004 and 2006 exceeded 200 FC/100 ml, and two of these samples exceeded 400 FC/100ml (Fig. 12).

Since 1993, 12 of 101 samples (12%) have exceeded 200 FC/100 ml.

This site is on river left below the main falls at the end of the boardwalk at the NPS Sandstone Falls day- use area off State Route 26 (River Road). The site is about 8.0 miles downstream from the Hinton gage and 28.4 miles upstream of the Thurmond gage. There area 25 tributaries (11 perennial and 14 intermittent) between the Hinton gage and this site. The site provides a spectacular view of the falls and is frequented by sightseers, anglers and picnickers.

Between 2004 and 2006 fecal coliform bacteria density ranged from 4 to 708 FC/100 ml (mean 118, geometric mean 34, median 30).

**Figure 12. New River below Sandstone Falls**



## New River below Laurel Creek, site N29

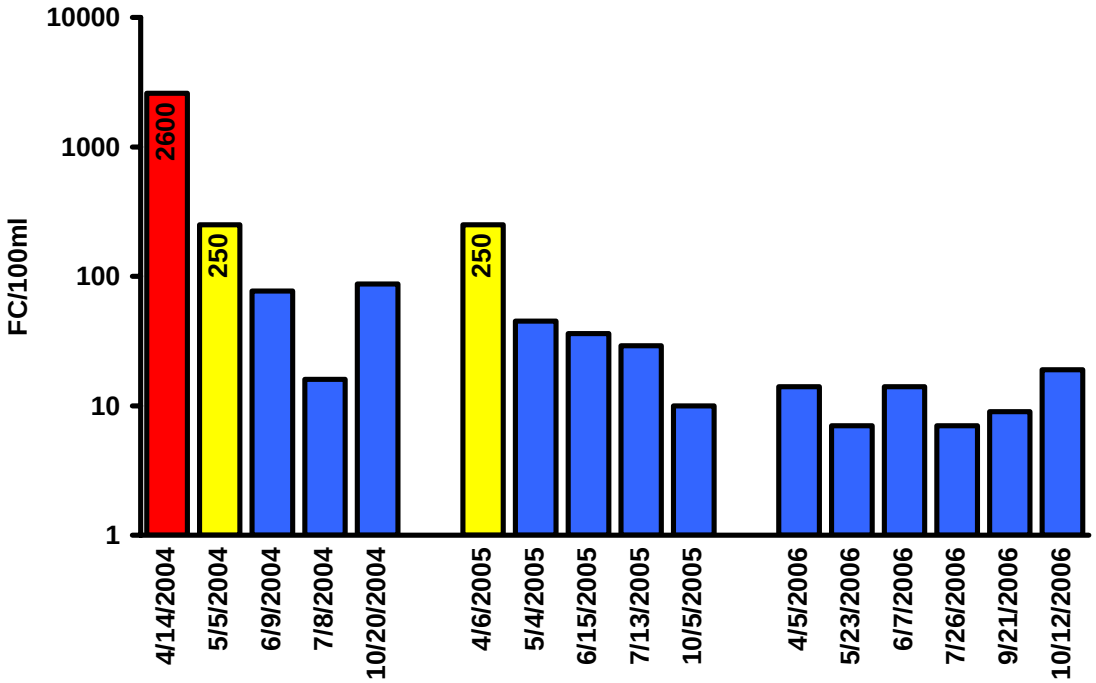
Three of 16 (19%) samples collected between 2004 and 2006 exceeded 200 FC/100ml, and one (6%) of these samples exceeded 400 FC/100ml (Figure 13).

Since monitoring of this site began in 2003, three of the 21 samples (14%) exceeded 200 FC/100ml.

This site is on river left at the National Park Service Grandview Sandbar public access. This site is about 21.9 miles downstream from the Hinton gage and 14.4 miles upstream from the Thurmond gage. Forty- nine tributaries (24 perennial and 25 intermittent) enter the New River between the Hinton gage and this site. Twenty- one tributaries (10 perennial and 11 intermittent) enter the New River between this site and the Thurmond gage. This site is 14.0 miles downstream from New River below Sandstone Falls (N21). Meadow Creek (N06), Glade Creek (N22), Mill Creek (N23) and Laurel Creek (N07) enter the New River between New River below Sandstone Falls and this site. Anglers, boaters and campers are common visitors to this site.

During 2004- 2006 fecal coliform bacteria density ranged from 7 to 2600 FC/100 ml (mean 217, geometric mean 37, median 24).

**Figure 13. New River below Laurel Creek**



## New River below Piney Creek, site N36

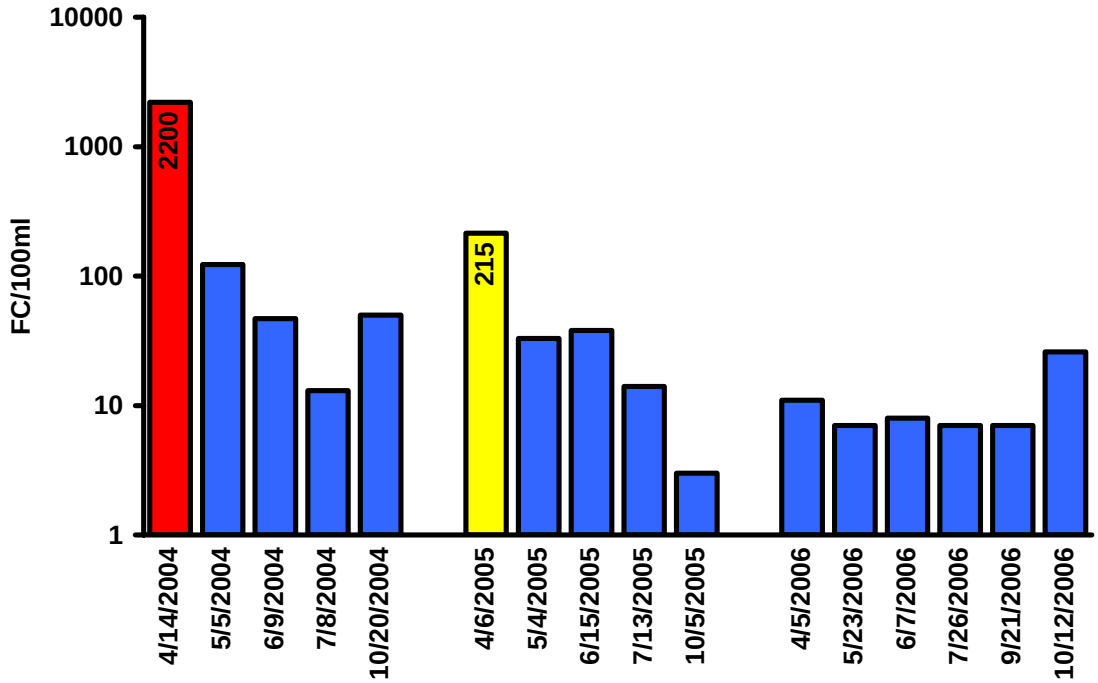
Two of 16 (12.5%) samples collected between 2004 and 2006 exceeded 200 FC/100ml, and one (6%) of these samples exceeded 400 FC/100ml (Figure 14).

Since monitoring of this site began in 2003 two of 21 (10%) samples exceeded 200 FC/100ml.

This site is on river right at the National Park Service Army Camp public access. This site is about 25.2 miles downstream from the Hinton gage and 11.1 miles upstream from the Thurmond gage. There are 53 tributaries (26 perennial and 27 intermittent) between the Hinton gage and this site, and 17 tributaries (8 perennial and 9 intermittent) between this site and the Thurmond gage. This site is 3.3 miles downstream from site New River below Laurel Creek (N29). Piney Creek (N09) enters the New River 1 mile upstream from this site on river left. Anglers, boaters and campers are common visitors to the site.

During 2004- 2006 fecal coliform bacteria density ranged from 3 to 2200 FC/100 ml (mean 175, geometric mean 27, median 20).

**Figure 14. New River below Piney Creek**



## New River at Thurmond, site N12

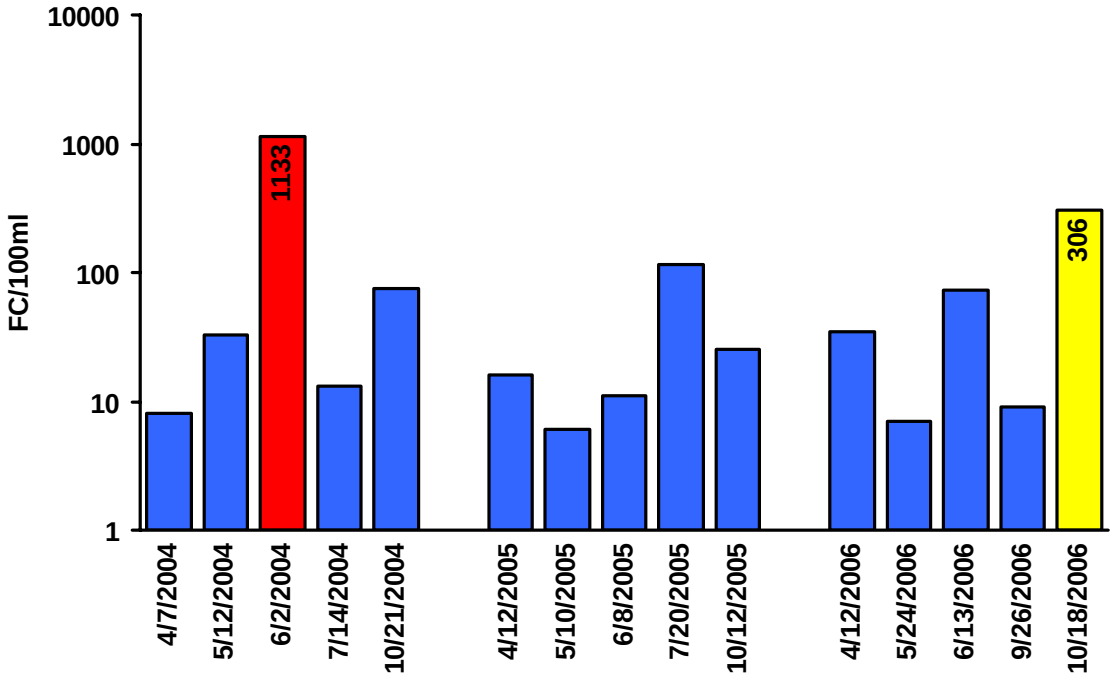
Two of the 15 samples (13%) collected between 2004 and 2006 exceeded 200 FC/100 ml, and one (7%) of these samples exceeded 400 FC/100ml (Fig. 15).

Since 1993, 14 of 128 samples (11%) exceeded 200 FC/100 ml.

This site is on river right downstream from the town of Thurmond. This site is about 0.5 miles downstream of the Thurmond gage and 36.9 miles downstream of the Hinton gage. There are 71 tributaries (35 perennial and 36 intermittent) between the Hinton gage and this site. Only Dunloup Creek enters the New River between the Thurmond gage and this site. This site is 11.7 miles downstream from New River below Piney Creek (N36). Piney Creek (N09) and Dunloup Creek (N11) are major tributaries entering the New River above this site. Boaters and anglers frequent this section of the river.

Between 2004 and 2006 fecal coliform bacteria density ranged from 6 to 1133 FC/100 ml (mean 124, geometric mean 32, median 25).

**Figure 15. New River at Thurmond**



## New River above Coal Run, site N20

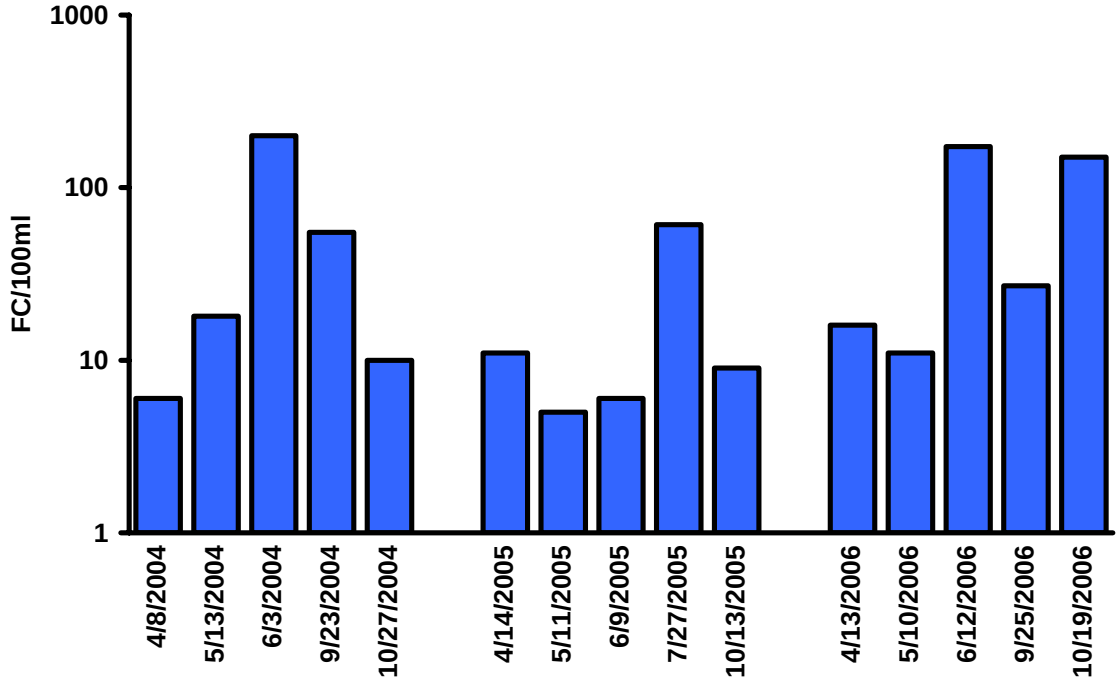
None of the 15 samples (0%) collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 16).

Since 1993, 10 of 111 samples (9%) exceeded 200 FC/100 ml.

This site is on river left downstream of the National Park Service public access at Cunard. This site is about 7.2 miles downstream from the Thurmond gage. There are 9 tributaries (6 perennial and 3 intermittent) between the Thurmond gage and this site. Dunloup Creek (N11) and Arbuckle Creek (N13) are the closest monitored upstream tributaries. This site is 6.6 miles downstream from New River at Thurmond (N12). Whitewater boaters and anglers are typical visitors to this site.

Between 2004 and 2006 fecal coliform bacteria density ranged from 5 to 200 FC/100 ml (mean 51, geometric mean 23, median 16).

**Figure 16. New River above Coal Run**



## New River above Wolf Creek, site N17

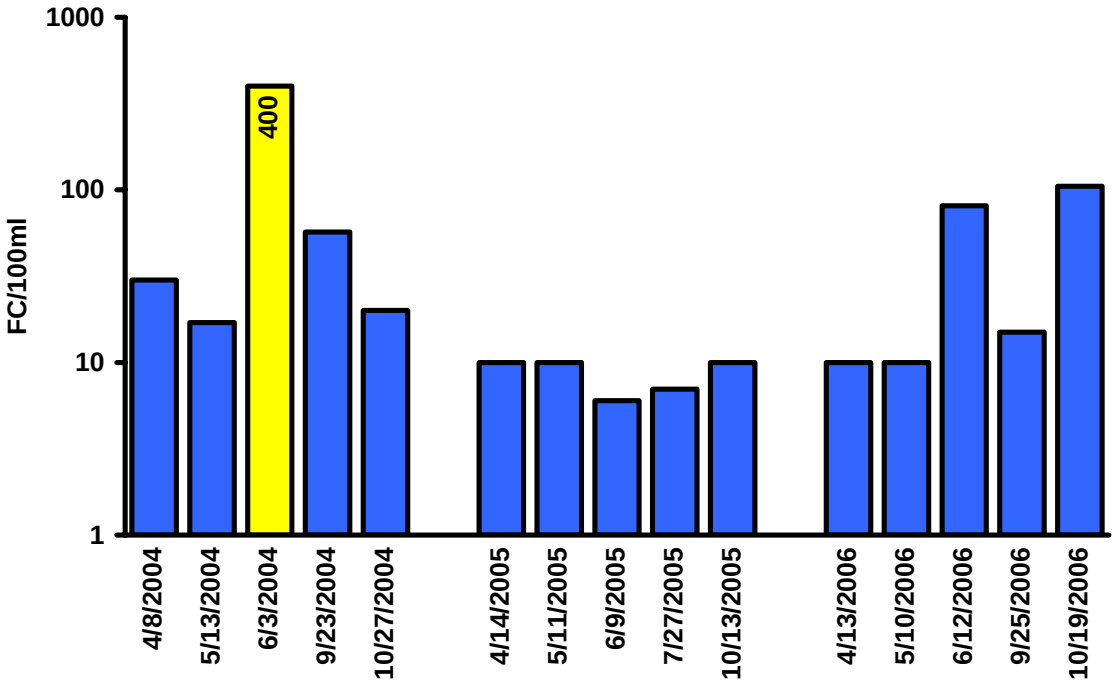
One of the 15 samples (7%) collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 17).

Since 1990, 16 of 130 samples (12%) have exceeded 200 FC/100 ml.

This site is on river left upstream of the mouth of Wolf Creek. It is about 13.6 miles downstream of the Thurmond gage. There are 18 tributaries (13 perennial and 5 intermittent) enter the New River between the Thurmond gage and this site. The site is 6.4 miles downstream of New River above Coal Run (N20). Monitored tributaries Coal Run (N15) and Keeney Creek (monitored at three sites: N00, N16, and N38) enter the New River between N20 and this site. Anglers, whitewater boaters and swimmers are common visitors to this site.

Between 2004 and 2006 fecal coliform bacteria density ranged from 6 to 400 FC/100 ml (mean 53, geometric mean 22, median 15).

**Figure 17. New River above Wolf Creek**



## NEW RIVER TRIBUTARIES

### Greenbrier River at Willowwood, site N34

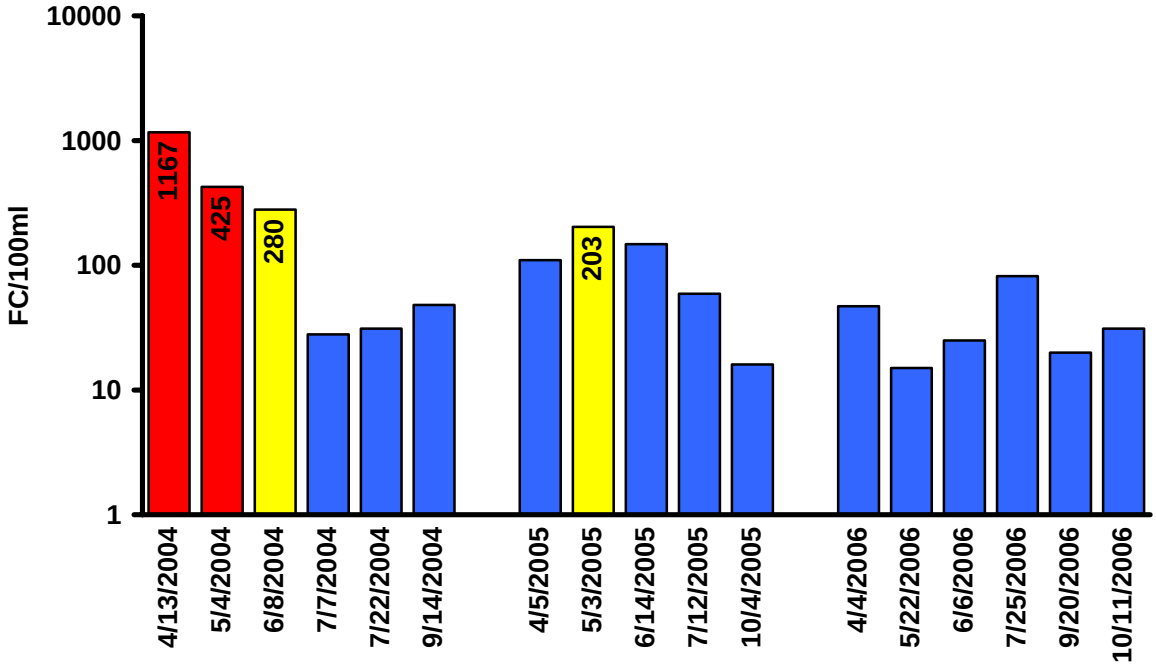
Four of the 18 (22%) samples collected in 2004-2006 exceeded 200 FC/100ml, and two (11%) of these samples exceeded 400 FC/100ml (Fig. 18)

Since monitoring of this site began in 2003 four of the 24 (17%) samples exceeded 200 FC/100ml.

This site is on river left at the West Virginia Division of Natural Resources (WVDNR) Willowwood Public Fishing Access Area boat launch. This site is about 0.2 mile downstream from the Greenbrier River at Hilldale gage and 6.5 miles upstream of the Hinton gage. No tributaries enter the Greenbrier River between the Hilldale gage and this site. This site is 5.2 miles upstream of the confluence of the Greenbrier and New Rivers. Boaters and anglers are typical visitors to this site.

During 2004 – 2006 fecal coliform bacteria density ranged from 15 to 1167 FC/100 ml (mean 161, geometric mean 69, median 48).

**Figure 18. Greenbrier River at Willowwood**



## Madam Creek, site N02

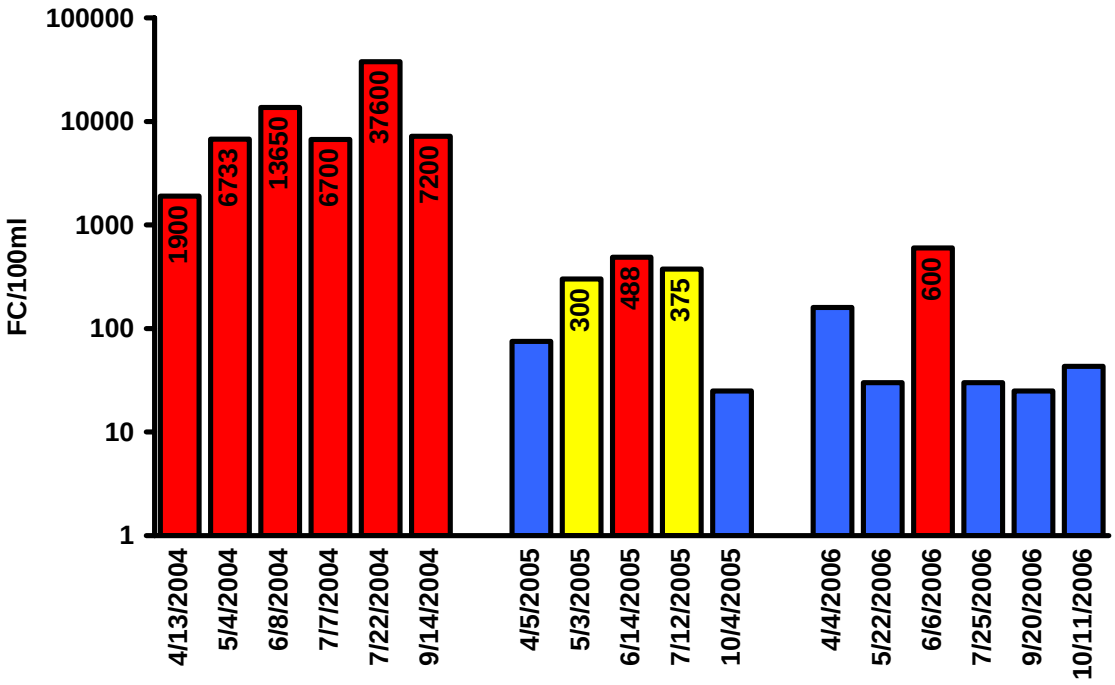
Ten of the 17 (59%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and eight (47%) of these samples exceeded 400 FC/100ml (Fig. 19).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 118 of 132 samples (89%) exceeded 200 FC/100 ml.

This site is on stream left near the mouth of the creek, just downstream of the State Route 26 bridge across the creek. Madam Creek enters the New River about 0.2 miles downstream of the Hinton gage and 36.2 miles upstream of the Thurmond gage. Some anglers occasionally fish in the New River near the mouth of Madam Creek.

Between 2004 and 2006 fecal coliform bacteria density ranged from 25 to 37600 FC/100 ml (mean 4467, geometric mean 474, median 375).

**Figure 19. Madam Creek**



## Lick Creek, site N05

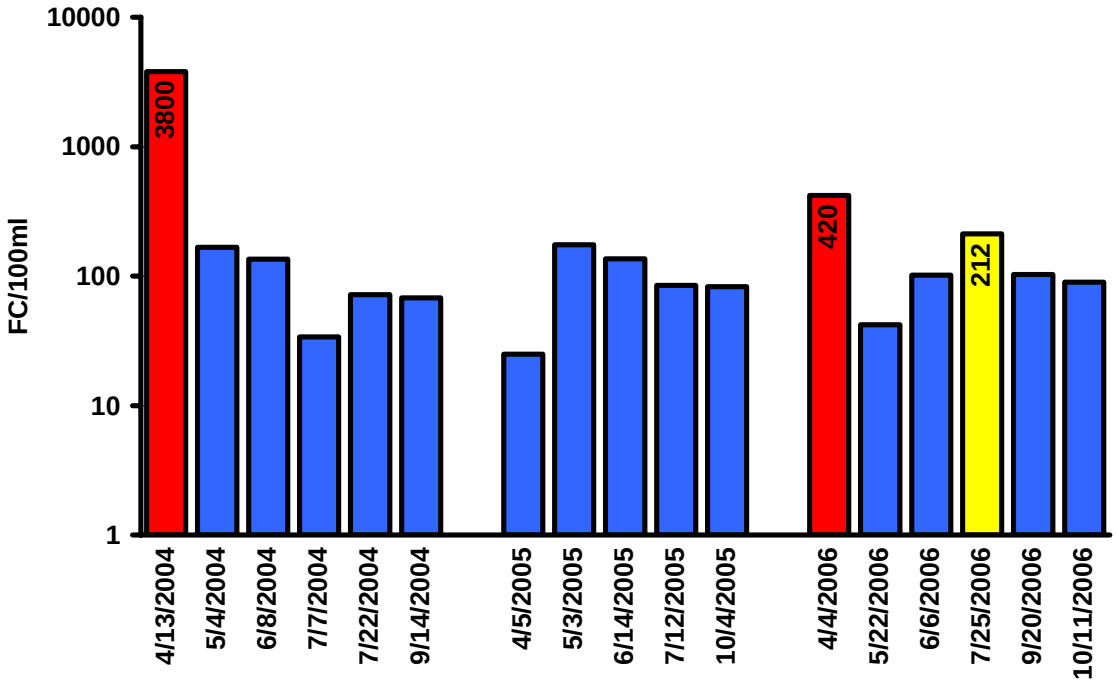
Three of the 17 (18%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and two of these (12%) exceeded 400 FC/100ml (Fig. 20).

Since 1990, 23 of 132 samples (17%) exceeded 200 FC/100 ml.

This site is on stream right near the mouth of the stream, just downstream of a CSX railroad bridge. Lick Creek enters the New River about 9.4 miles downstream of the Hinton gage and 27.0 miles upstream of the Thurmond gage. Anglers and campers are commonly seen in this area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 25 to 3800 FC/100 ml (mean 338, geometric mean 120, median 102).

**Figure 20. Lick Creek**



## Meadow Creek, site N06

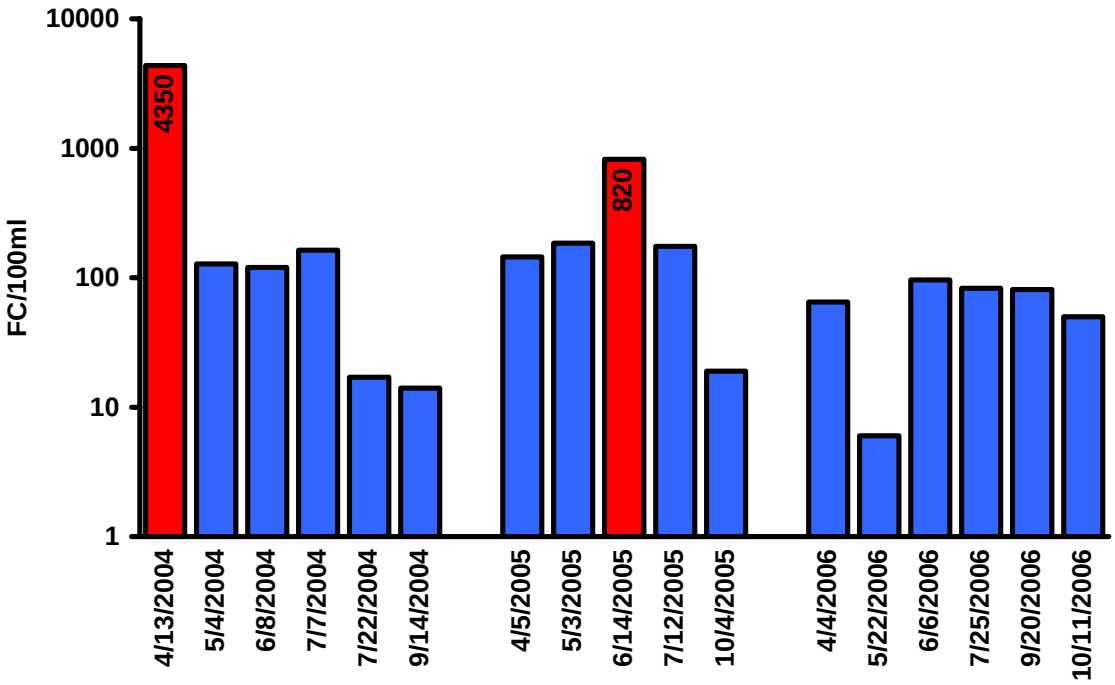
Two of the 17 (12%) samples collected between 2004 and 2006 exceeded both 200 FC/100 ml and 400 FC/100ml (Fig. 21).

Since 1990, 27 of 132 (20%) samples exceeded 200 FC/100 ml.

This site is on stream left, near the mouth, and beneath the County Road 7 bridge just north of the community of Meadow Creek. Meadow Creek enters the New River about 12.5 miles downstream of the Hinton gage and 23.9 miles upstream of the Thurmond gage. Local residents commonly visit the site.

Between 2004 and 2006 fecal coliform density ranged from 6 to 4350 FC/100 ml (mean 383, geometric mean 92, median 96).

**Figure 21. Meadow Creek**



## Glade Creek, site N22

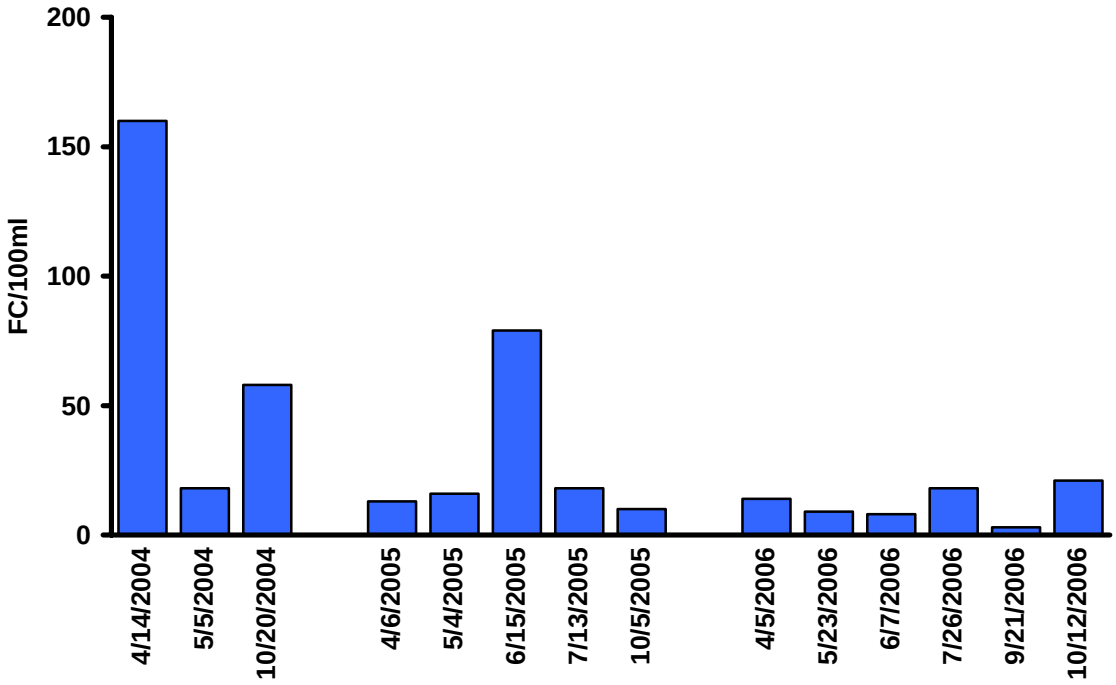
None of the 14 samples (0%) collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 22).

Since 1995, 4 of 58 samples (7%) exceeded 200 FC/100 ml.

This site is on stream left near the mouth of the creek, and adjacent to the National Park Service Glade Creek Trail Head. Glade Creek enters the New River about 17.6 miles downstream of the Hinton gage and 18.8 miles upstream from the Thurmond gage. Anglers, hikers and picnickers are commonly seen at this site.

Between 2004 and 2006 fecal coliform bacteria density ranged from 3 to 160 FC/100 ml (mean 32, geometric mean 19, median 17).

**Figure 22. Glade Creek**



## Mill Creek, site N23

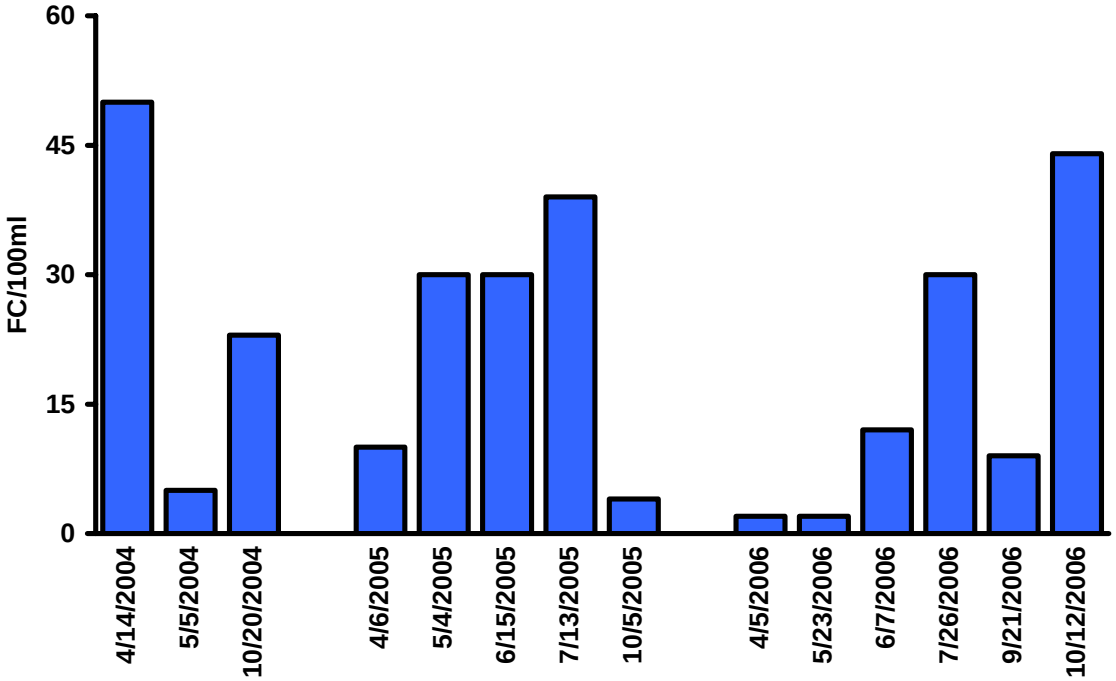
None of the 14 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 23).

Since 1994, 0 of 25 samples (0%) exceeded 200 FC/100 ml.

This site is on stream left above the Glade Creek Road bridge that crosses Mill Creek. Mill Creek enters the New River 19.7 miles downstream of the Hinton gage and 16.7 miles upstream of the Thurmond gage. Hikers and sightseers frequent this area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 2 to 50 FC/100 ml (mean 21, geometric mean 13, median 18).

**Figure 23. Mill Creek**



## Laurel Creek at Quinnimont, site N07

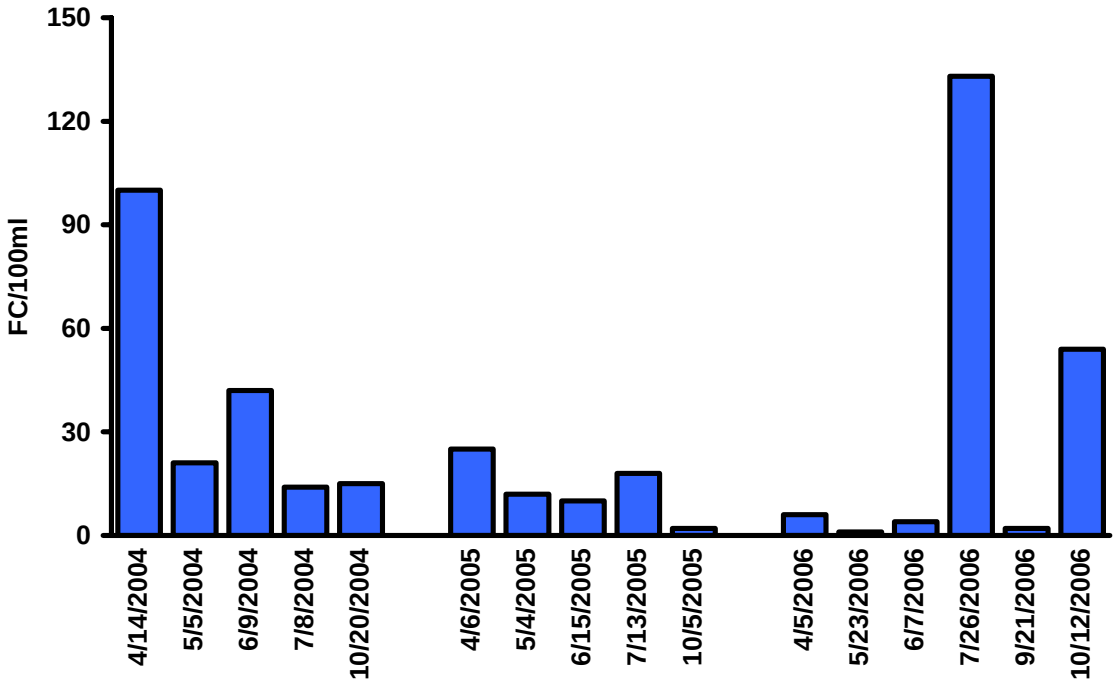
None of the 16 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 24).

Since 1990, 8 of 128 (6%) samples exceeded 200 FC/100 ml.

Through 2005 this site was near the mouth on stream right just downstream of a railroad bridge adjacent to the CSX Quinnimont railroad yard. Starting in 2006 the site was moved upstream to a ford due to access problems caused by downed trees and increased railroad traffic. Laurel Creek enters the New River about 22.2 miles downstream from the Hinton gage and 14.2 miles upstream from the Thurmond gage. Railroad personnel are the only people commonly seen in the area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 1 to 133FC/100 ml (mean 29, geometric mean 13, median 15).

**Figure 24. Laurel Creek at Quinnimont**



**Piney Creek at McCreery, site N09**

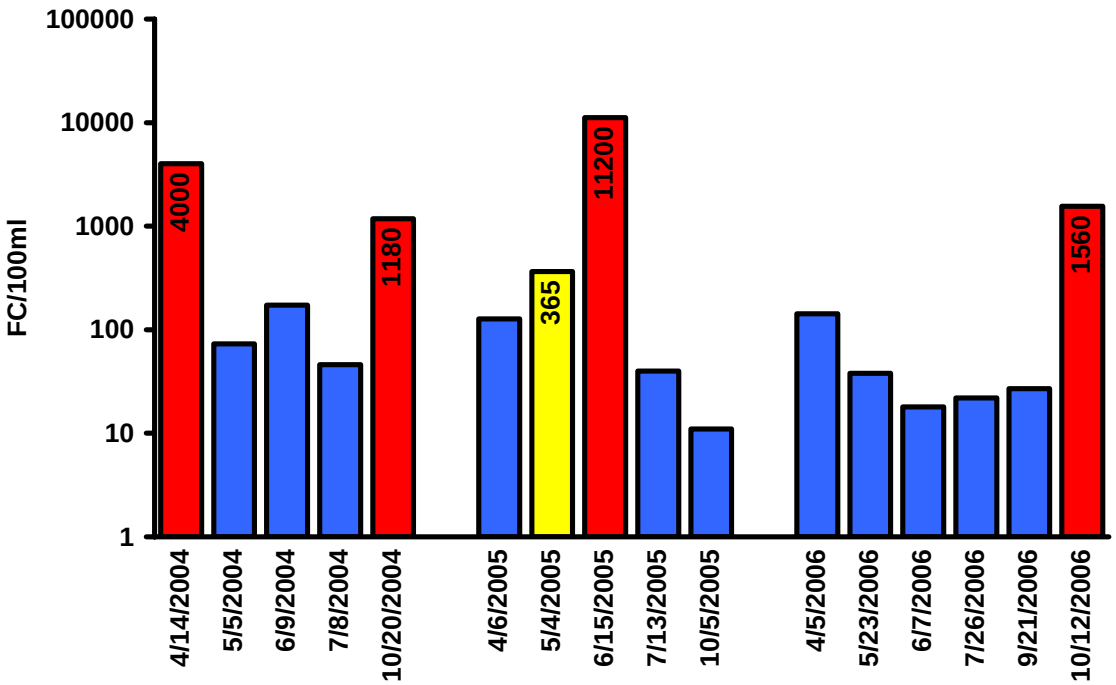
Five of the 16 (31%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and four (25%) of these samples exceeded 400 FC/100ml (Fig. 25).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 42 of 129 samples (33%) exceeded 200 FC/100 ml.

This site is on stream left near the mouth of Piney Creek, about 200 meters upstream of the State Route 41 bridge. Piney Creek enters the New River on river left just downstream of a National Park Service public access. Piney Creek enters the New River about 25.0 miles downstream from the Hinton gage and 11.4 miles upstream from the Thurmond gage. Rafters, including commercial outfitters use this access, and anglers are commonly seen near the mouth of Piney Creek.

Between 2004 and 2006 fecal coliform bacteria density ranged from 11 to 11200 FC/100 ml (mean 1189, geometric mean 149, median 100).

**Figure 25. Piney Creek**



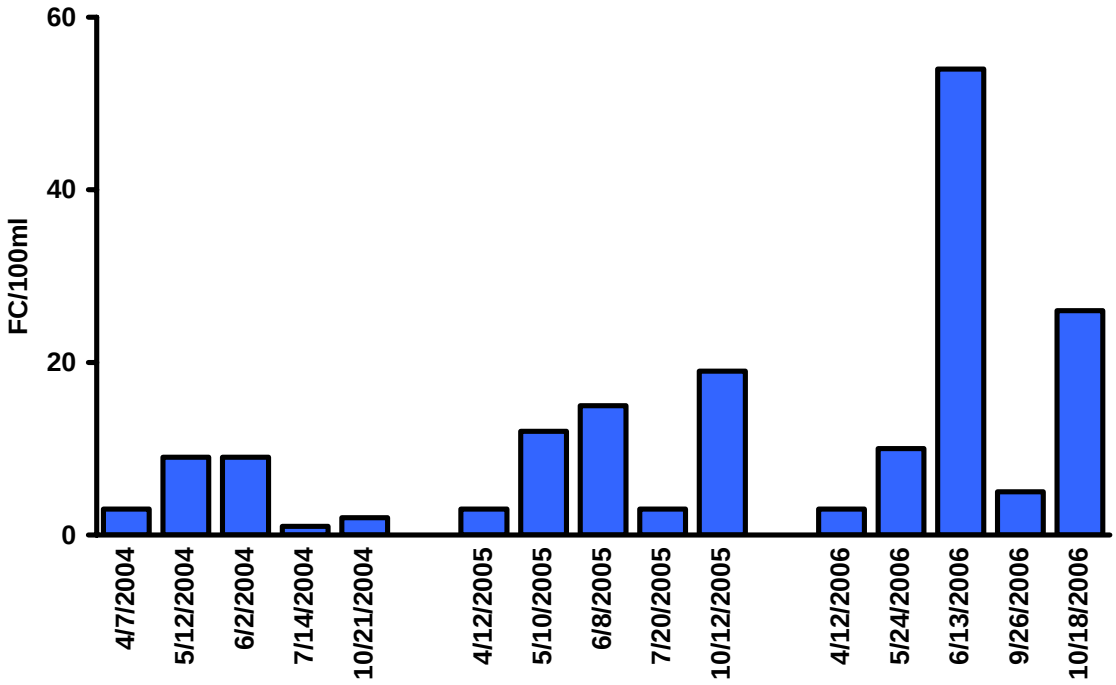
## Slater Creek at McKendree Road, site N25

None of the 15 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 26).

Since 1997, 0 of 39 samples (0%) have exceeded 200 FC/100 ml.

This site is about 0.53 miles upstream of the mouth on stream right just upstream of the McKendree Road (County Route 25) bridge across the creek. Slater Creek enters the New River at the community of Thayer, about 31.8 miles downstream of the Hinton gage and 4.6 miles upstream of the Thurmond gage. Rafters, anglers and picnickers commonly use the National Park Service day- use area near the mouth of Slater Creek. Between 2004 and 2006 fecal coliform bacteria density ranged from 1 to 54 FC/100 ml (mean 12, geometric mean 7, median 9).

**Figure 26. Slater Creek at McKendree Road**



## Slater Creek at Mouth, site N31

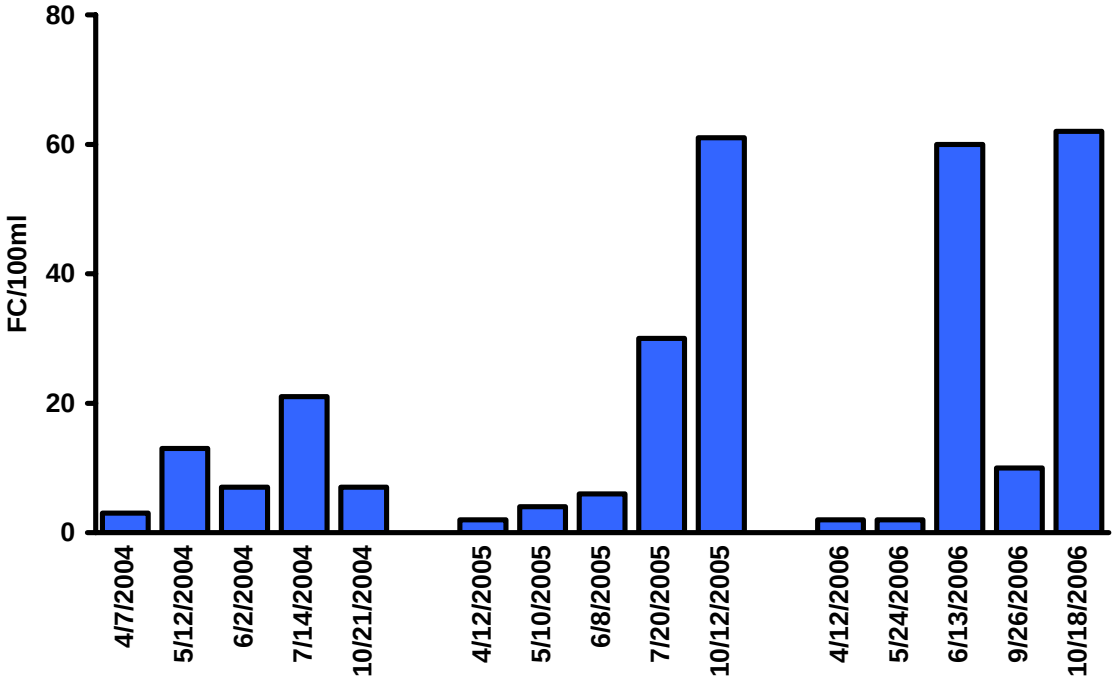
None of the 15 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100ml (Fig. 27).

Since monitoring of this site began in 2002, none of the 22 (0%) samples has exceeded 200 FC/100ml.

This site is located on stream right at the mouth of Slater Creek. Vehicle access is by McKendree Road (County Route 25) to Thayer. Near its mouth, Slater Creek flows through the community of Thayer and a National Park Service public river access and day- use area. Rafters, anglers and picnickers are commonly seen in this area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 2 to 62 FC/100 ml (mean 19, geometric mean 10, median 7).

**Figure 27. Slater Creek at mouth**



## Buffalo Creek at McKendree Road, site N24

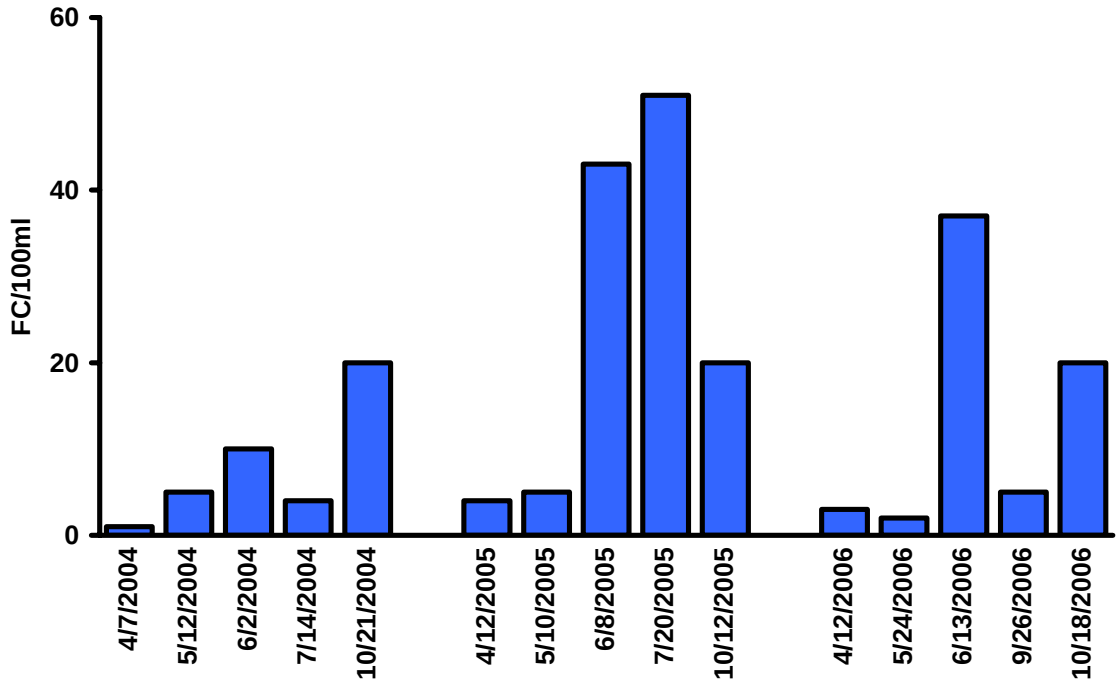
None of the 15 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 28).

Since 1997, 0 of 38 (0%) samples exceeded 200 FC/100 ml.

Before 2004 this site was located just upstream of the McKendree Road bridge on stream right. Starting in 2004 the sample was taken from stream left as high flows led to changes that precluded safe sampling on stream right. Buffalo Creek enters the New River about 32.6 miles downstream of the Hinton gage and 3.8 miles upstream of the Thurmond gage. Buffalo Creek contains a reproducing population of brook trout and is designated "Fly Fishing Only" by the West Virginia Division of Natural Resources. Anglers and hikers visit this site. Rafters and anglers visit the mouth of the creek where it enters the New River.

Between 2004 and 2006 fecal coliform bacteria density ranged from 1 to 51 FC/100 ml (mean 15, geometric mean 8, median 5).

**Figure 28. Buffalo Creek at McKendree Road**



## Dunloup Creek, site N11

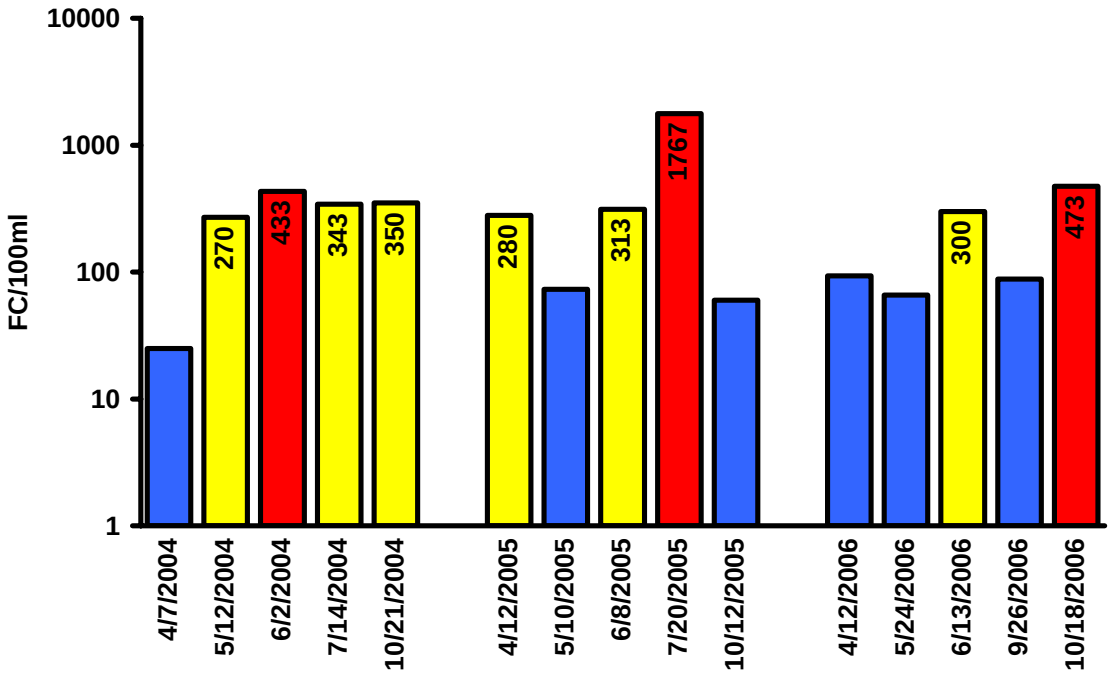
Nine of the 15 (60%) samples taken between 2004 and 2006 exceeded 200 FC/100 ml and three (20%) of the samples exceeded 400 FC/100ml (Fig. 29).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 68 of 142 (48%) samples exceeded 200 FC/100 ml.

This site is on stream left, just downstream of the County Route 25 bridge near the NPS Thurmond- Minden Trailhead parking area. Anglers visit this stream to pursue put-and- take trout stocked by the West Virginia Division of Natural Resources and a local chapter of Trout Unlimited. Hikers, cyclists and sightseers also visit this area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 25 to 1767 FC/100 ml (mean 329, geometric mean 192, median 280).

**Figure 29. Dunloup Creek**



## Arbuckle Creek, site N31

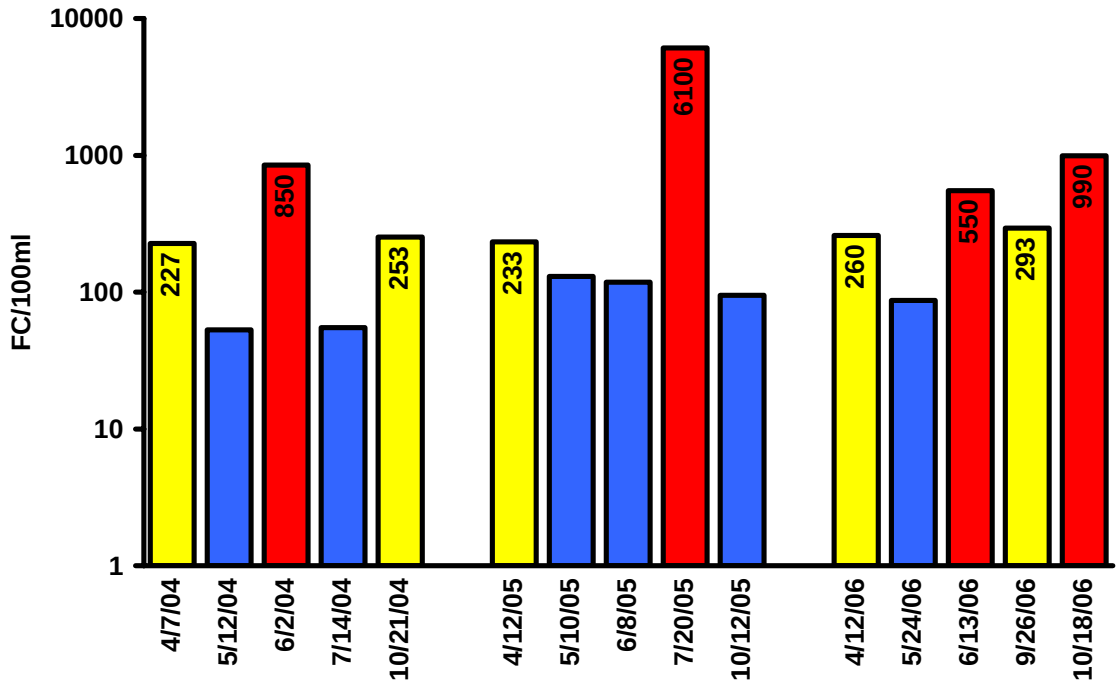
Nine of the 15 (60%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and four (27%) of the samples exceeded 400 FC/100ml (Fig. 30).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 74 of 128 samples (58%) have exceeded 200 FC/100 ml.

Prior to the July 2001 floods the samples were taken from stream right underneath the Thurmond- Minden Trail bridge that crosses the creek near its mouth. After the floods the site was moved to stream left, just downstream of the bridge. The floods also resulted in relocation of the staff gage further upstream near the community of Minden. Arbuckle Creek enters the New River approximately 37.2 miles downstream of the Hinton gage and 0.8 miles downstream of the Thurmond gage. Anglers, hikers and mountain bikers commonly visit this area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 53 to 6100 FC/100 ml (mean 686, geometric mean 252, median 233).

**Figure 30. Arbuckle Creek**



## Coal Run, site N15

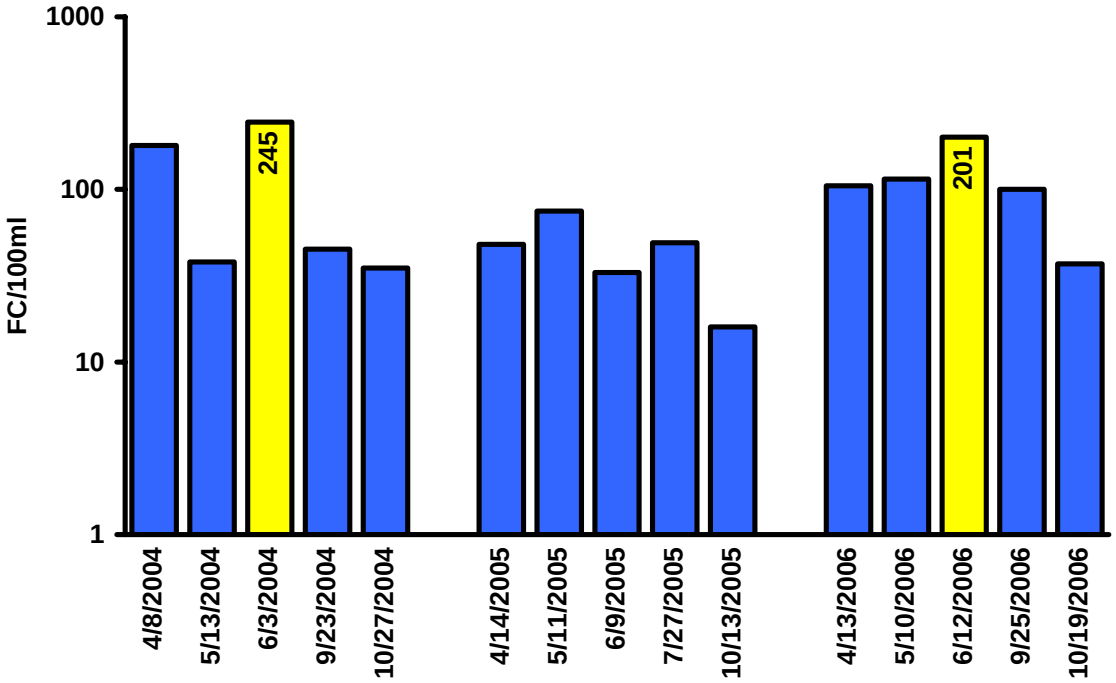
Two of the fifteen (13%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 31).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 45 of 129 samples (35%) exceeded 200 FC/100 ml.

The site is on stream left underneath an old railroad trestle across Coal Run near its mouth, just off the National Park Service Cunard to Kaymoor Trail. Anglers and hikers are commonly seen in this area.

Between 2004 and 2006 fecal coliform bacteria density ranged from 16 to 245 FC/100 ml (mean 88, geometric mean 67, median 49).

**Figure 31. Coal Run**



## Keeney Creek above Winona, site N00

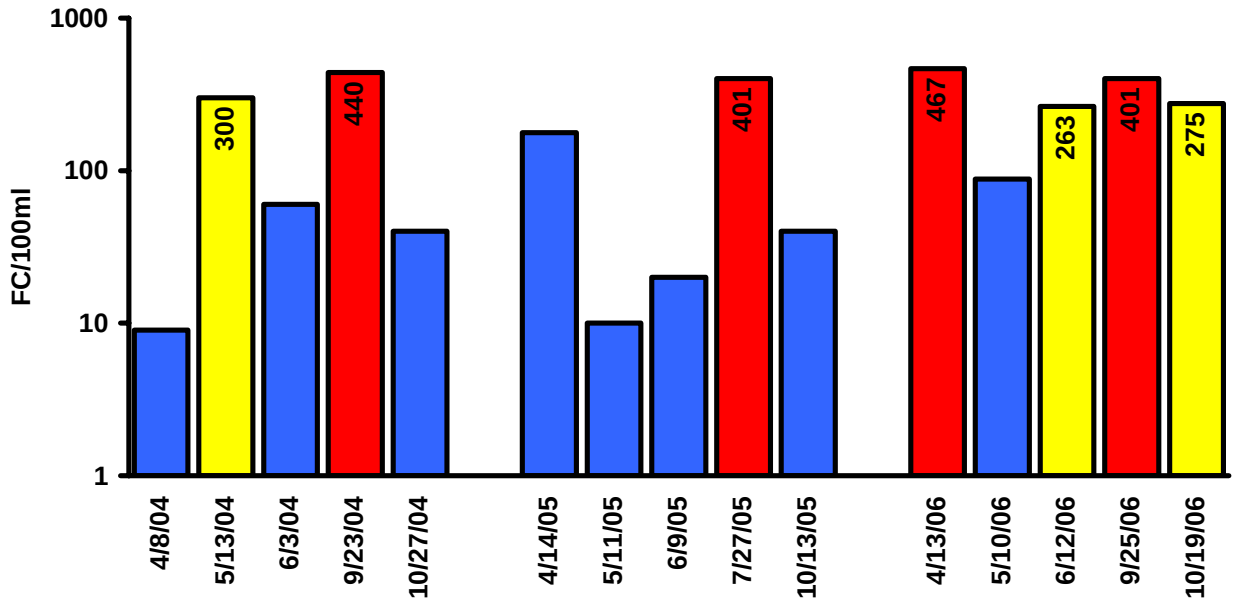
Seven of the 15 (47%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and four (27%) of the samples exceeded 400 FC/100ml (Fig. 32).

Water quality at this site is unsatisfactory for contact recreation. Since 2003, 9 of 20 samples (45%) have exceeded 200 FC/100 ml.

This site is on stream left, just downstream of a bridge across the creek in the lower end of the community of Winona. This site is 1.1 miles upstream from the Keeney Creek below Winona (N38) site. Nearby residents are often seen near the creek, minnow traps and toys are commonly seen in and near the creek at the sampling site.

Between 2004 and 2006 fecal coliform bacteria density ranged from 9 to 467 FC/100 ml (mean 199, geometric mean 104, median 177).

**Figure 32. Keeney Creek above Winona**



## Keeney Creek at Winona, site N16

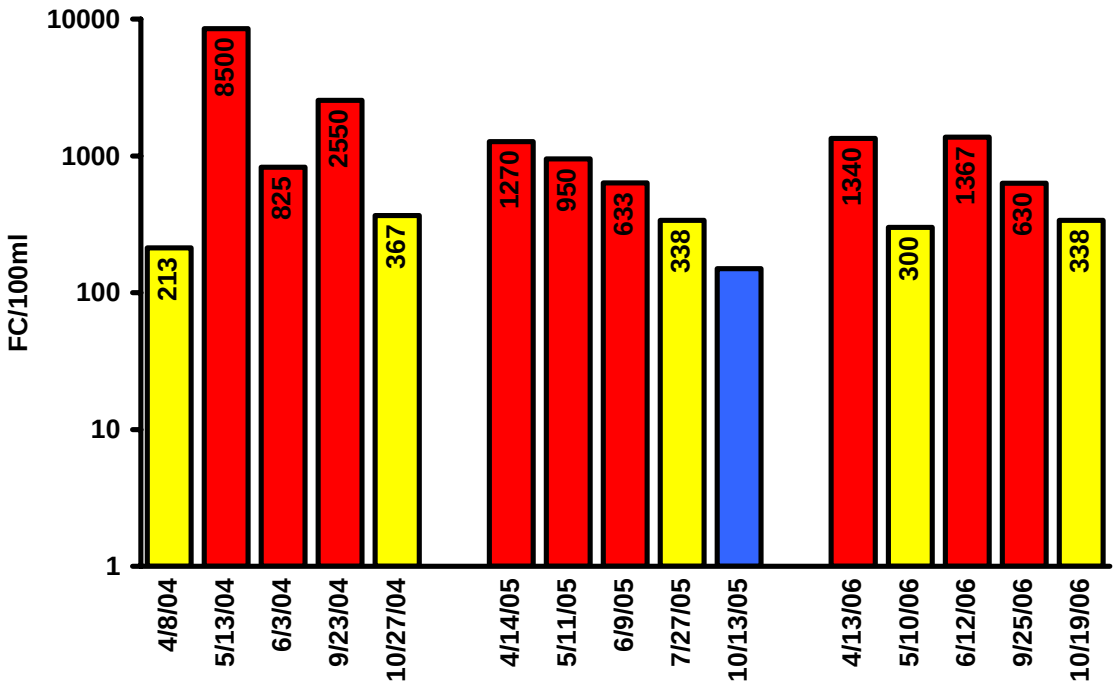
Fourteen of the 15 (93%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and nine (60%) of the samples exceeded 400 FC/100ml (Fig. 33).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 123 of 129 samples (95%) have exceeded 200 FC/100 ml.

This site is on stream left, just downstream of a bridge across the creek in the lower end of the community of Winona. This site is 1.1 miles upstream from the Keeney Creek below Winona (N38) site. Nearby residents are often seen near the creek, minnow traps and toys are commonly seen in and near the creek at the sampling site.

Between 2004 and 2006 fecal coliform bacteria density ranged from 150 to 8500 FC/100 ml (mean 1318, geometric mean 714, median 633).

**Figure 33. Keeney Creek at Winona**



## Keeney Creek below Winona, site N38

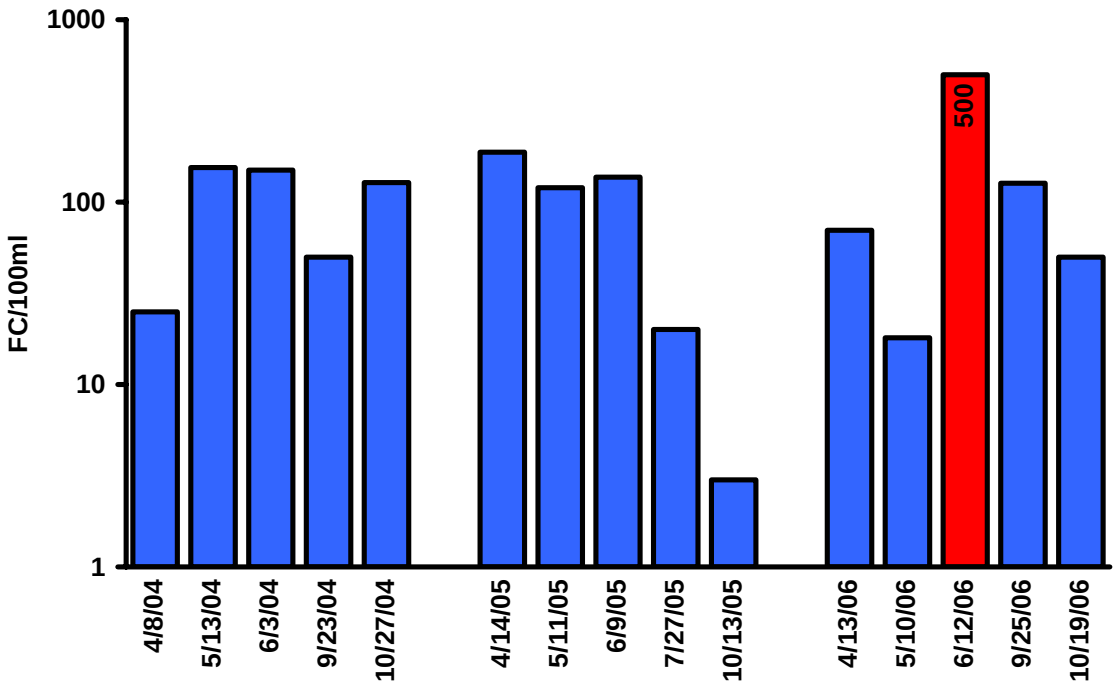
One of the 15 (7%) samples collected during 2004-2006 exceeded both 200 FC/100ml and 400 FC/100ml (Figure 34).

Since monitoring began in 2003, six of the 21 (29%) samples exceeded 200 FC/100ml.

This site is inside the National Park Service boundary about 1.1 miles downstream from the community of Winona. The site is located on stream right, just upstream of the third bridge (working downstream from Winona) on County Route 85 (Keeney Creek Road) that crosses Keeney Creek. Earlier versions of this site were located upstream at the second bridge across the creek, first on stream right and later on stream left. Nearby residents are often seen near the creek.

During 2004 to 2006 fecal coliform bacteria density ranged from 3 to 500 FC/100 ml (mean 116, geometric mean 68, median 120).

**Figure 34. Keeney Creek below Winona**



## Wolf Creek, site N18

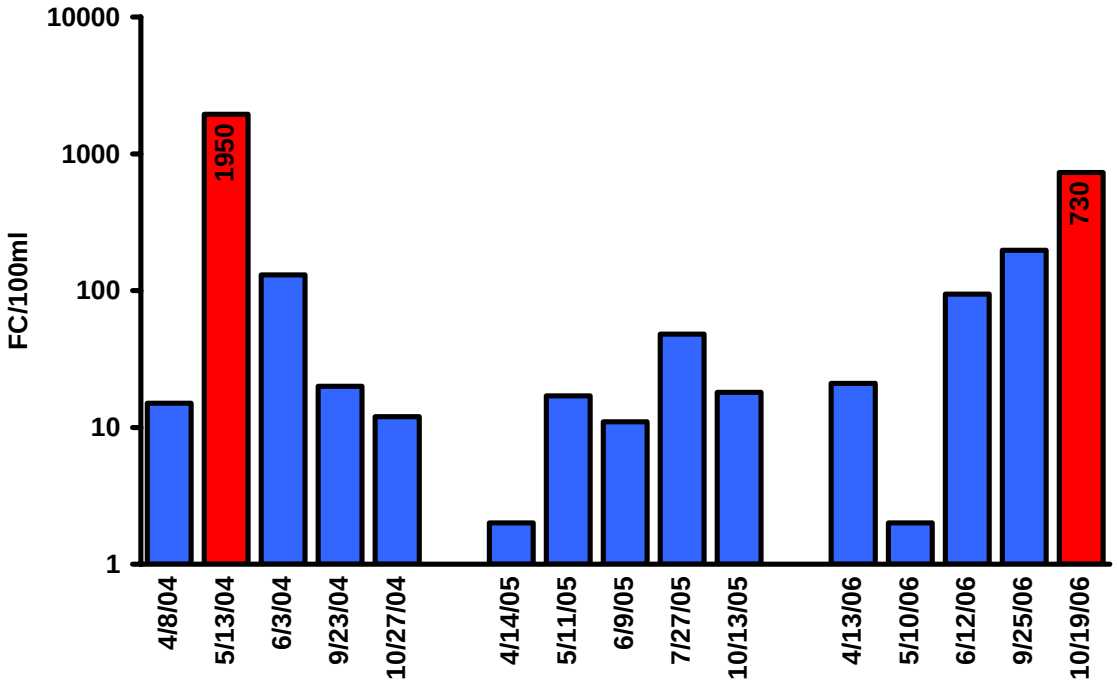
Two of the 15 (13%) samples collected between 2004 and 2006 exceeded both 200 FC/100 ml and 400 FC/100 ml (Fig. 35).

Since 1990, 31 of 130 samples (24%) have exceeded 200 FC/100 ml.

This site is located on stream right, just downstream of the bridge for the upper Fayette Station parking area. Wolf Creek enters the New River about 50.1 miles downstream of the Hinton gage and 13.7 miles downstream of the Thurmond gage.

Between 2004 and 2006 fecal coliform bacteria density ranged from 2 to 1950 FC/100 ml (mean 218, geometric mean 35, median 20).

**Figure 35. Wolf Creek**



**Marr Branch, site N19**

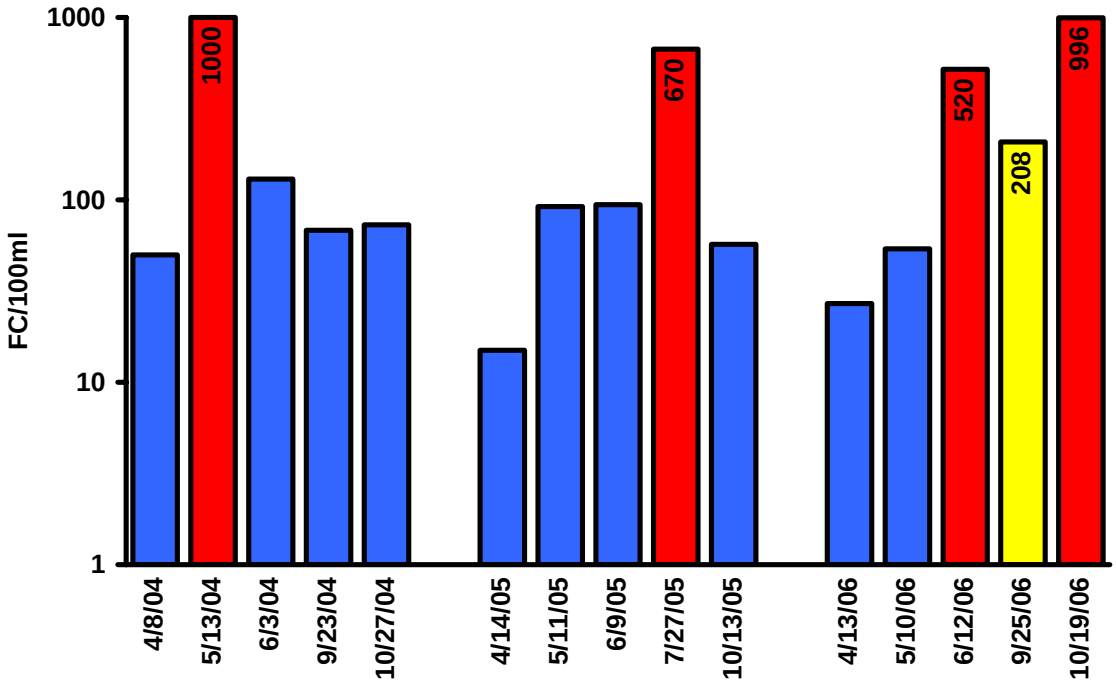
Five of the 15 (33%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and four (27%) of the samples exceeded 400 FC/100 ml (Fig. 36).

Water quality at this site is unsatisfactory for contact recreation. Since 1990, 85 of 128 (66%) samples have exceeded 200 FC/100 ml.

This site is on stream right just off Fayette Station Road (County Route 82) below the Rivers Inc. complex. Guests of Rivers Inc. are sometimes seen at this site. Marr Branch enters the New River 50.9 miles downstream of the Hinton gage and 14.5 miles downstream of the Thurmond gage. Anglers and rafters are common visitors near Marr Branch's confluence with the New River.

Between 2004 and 2006 fecal coliform bacteria density ranged from 15 to 1000 FC/100 ml (mean 270, geometric mean 124, median 92).

**Figure 36. Marr Branch**



## SPRINGS

### Claremont Mine Spring, site N27

None of the 15 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml.

Since 1996, 0 of 36 samples (0%) have exceeded 200 FC/100 ml.

Water at this site exits a poorly reclaimed coal gob pile through a metal pipe next to a ditch along McKendree Road (County Route 25). This water eventually enters the New River via culverts. Samples were collected from the discharge of the metal pipe. It is not known if water leaves the gob pile by other routes. The site is about 34.5 miles downstream of the Hinton gage and 1.9 miles upstream of the Thurmond gage.

Between 2004 and 2006 fecal coliform bacteria density ranged from 0 to 2 FC/100 ml (mean 0.2, median 0). It is unknown if people use this water for any purpose. The presence of fecal coliform bacteria in two samples (Appendix A) indicates that it is unsuitable for human consumption without appropriate treatment.

### Ajax Mine Spring, site N28

None of the 15 (0%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml. The presence of fecal coliforms in three samples indicates that this water is not suitable for human domestic use without treatment.

Since 1995, none of the 66 samples (0.0%) have exceeded 200 FC/100 ml.

This site is on Fayette Station Road (County Route 82), on a steep slope on the river-right side of New River Gorge. The water originates from the former Ajax Mine. Water flows continuously from a large hose into a ditch along Fayette Station Road, and eventually to the New River. A sizable, but unknown, number of area residents collect water from this site for household use. During dry periods this may be the only water reliably available to area residents that normally depend on wells and cisterns.

Water can be collected from three small (faucet sized) spigots, and one larger spigot with an attached hose about three inches in diameter. Samples were usually taken from the large hose, but came from one of the smaller spigots if the hose was in use at the time of sample collection.

Between 2004 and 2006 fecal coliform bacteria density ranged from 0 to 1 FC/100 ml (mean 0.18, median 0). Fecal coliforms were detected on only three dates (Appendix A).

## GAULEY RIVER NATIONAL RECREATION AREA

### GAULEY RIVER MAINSTEM

### Gauley River below Summersville Dam, site G01

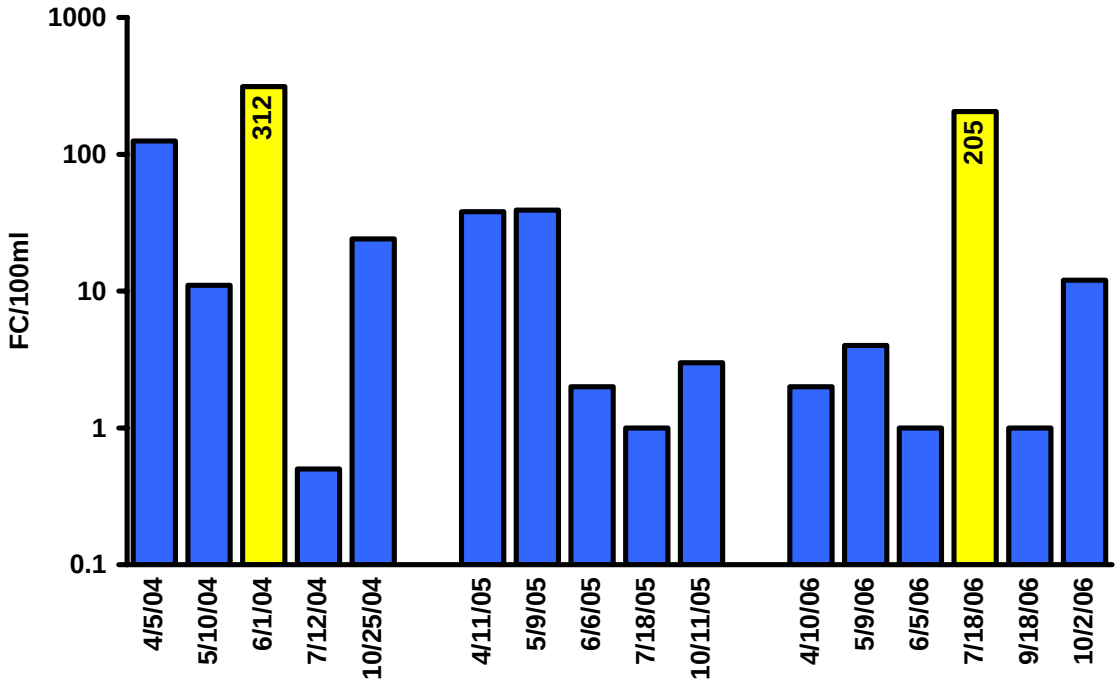
Two of the 16 (12.5%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml (Fig. 37).

Since 1991, 5 of 123 samples (4%) have exceeded 200 FC/100 ml.

The sampling site is on river right just below Summersville Dam, and is about 600 feet upstream of the Summersville Dam gage. No streams enter the Gauley River between the sampling site and the gage. Typical visitors include boaters, anglers, campers and sightseers.

Between 2004 and 2006 fecal coliform bacteria density ranged from 0.5 to 312 FC/100 ml (mean 49, geometric mean 9, median 8).

**Figure 37. Gauley River below Summersville Dam**



## Gauley River above Mason Branch, site G06

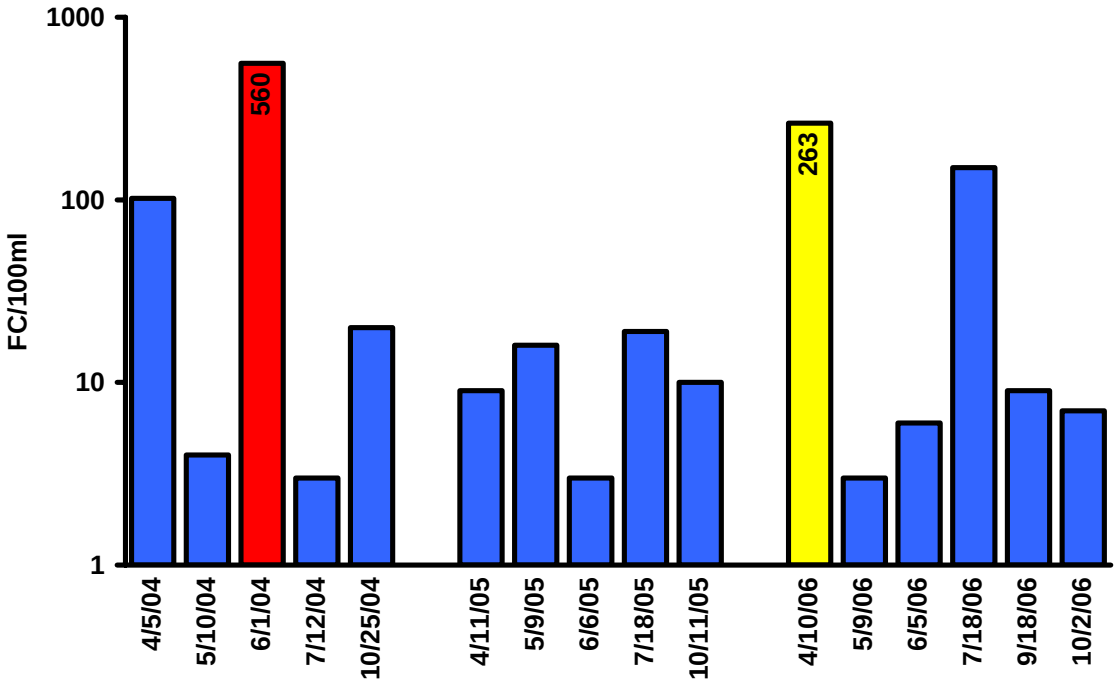
Two of the 16 (12.5%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and one (6%) of the samples exceeded 400 FC/100ml (Fig. 38).

Since 1996, 6 of 59 samples (10%) have exceeded 200 FC/100 ml.

The sampling site is on river right upstream of a Gauley River access at the mouth of Mason Branch, and is about 8.6 miles downstream of the Summersville Dam gage. Ten tributaries (six perennial and four intermittent) enter the Gauley River between the gage and this site. Typical visitors include boaters, anglers and campers.

Between 2004 and 2006 fecal coliform bacteria density ranged from 3 to 560 FC/100 ml (mean 74, geometric mean 17, median 10).

**Figure 38. Gauley River above Mason Branch**



## Gauley River above Swiss, site G04

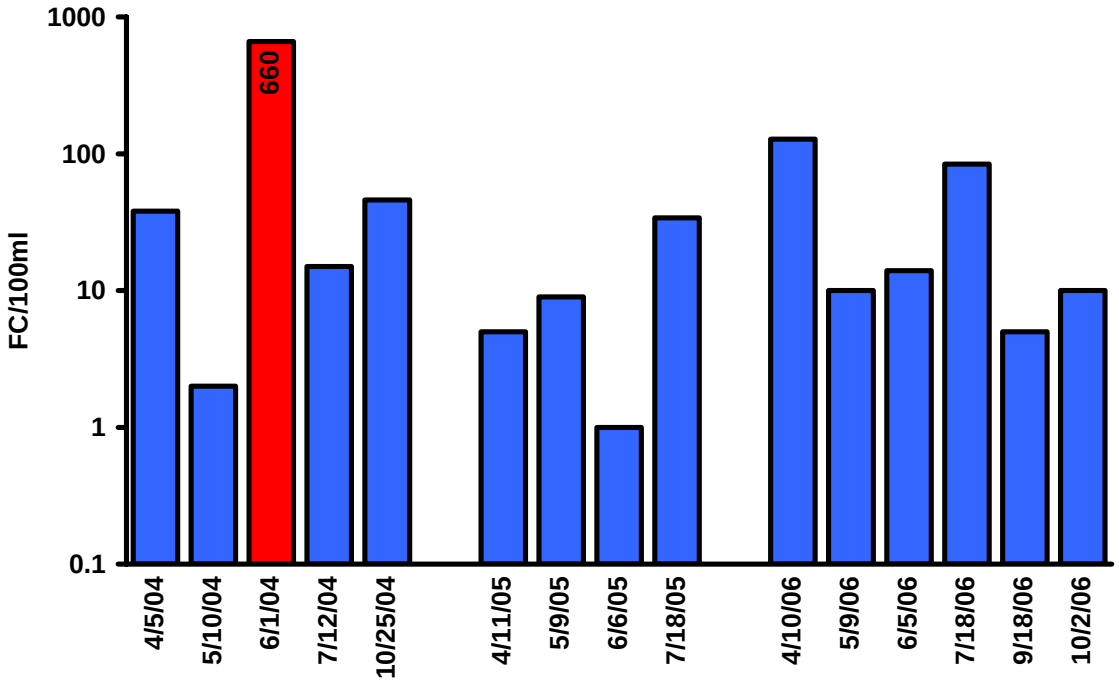
One of the 15 (7%) samples collected between 2004 and 2006 exceeded both 200 FC/100 ml and 400 FC/100 ml (Fig. 39).

Since 1991, 7 of 120 samples (6%) have exceeded 200 FC/100 ml.

The sampling site is on river right, upstream of the community of Swiss and just upstream from the mouth of Laurel Creek. The site is about 14.1 miles downstream from the Summersville Dam gage. There are 44 tributaries (17 perennial and 27 intermittent) between the gage and the site. The area is popular for swimming, angling and camping.

Between 2004 and 2006 fecal coliform bacteria density ranged from 1 to 660 FC/100 ml (mean 71, geometric mean 17, median 14). No sample was collected on 10/11/2005 as a train blocked access to the site.

**Figure 39. Gauley River above Swiss**



## GAULEY RIVER TRIBUTARIES

### Meadow River, site G05

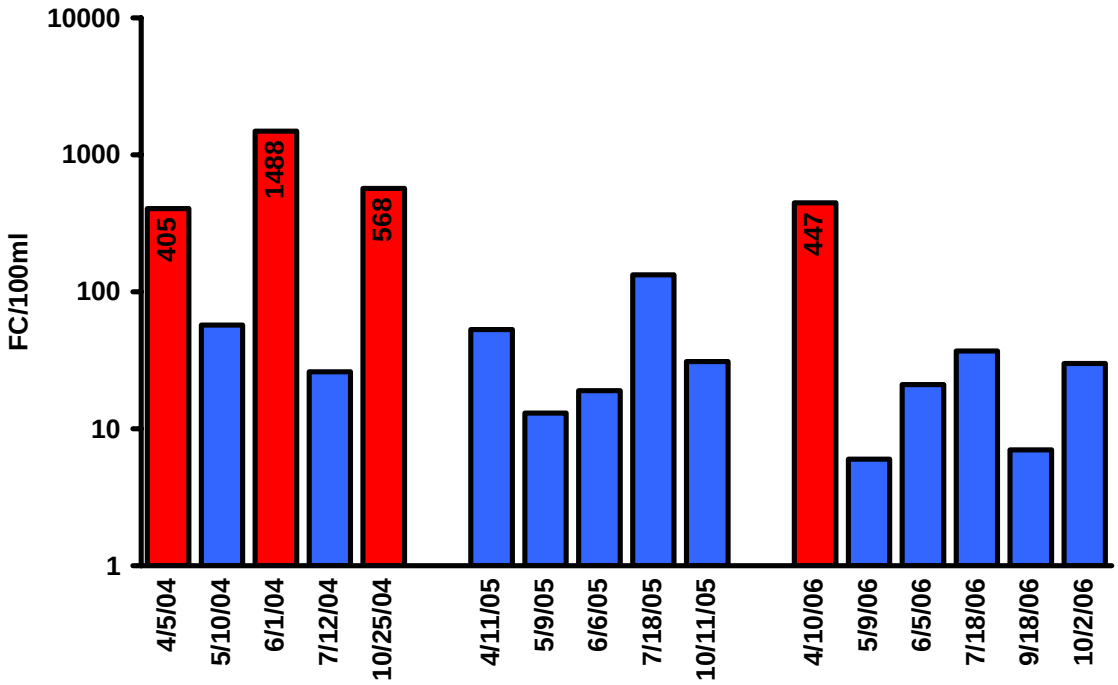
Four of the 16 (25%) samples collected between 2004 and 2006 exceeded both 200 FC/100 ml and 400 FC/100 ml (Fig. 40).

Since 1991, 11 of 97 samples (11%) have exceeded 200 FC/100 ml.

The sampling site is on river right upstream of Anglins Creek and the Wilderness Public Service District water treatment plant. This site is about 8.9 miles upstream of the Meadow River gage. Fourteen tributaries (11 perennial and 3 intermittent) enter the Meadow River between this site and the gage. Meadow River enters the Gauley River about 4.9 miles downstream from the Summersville Dam gage. Anglers are the primary visitors to this site, which is outside the Gauley River National Recreation Area boundary.

Between 2004 and 2006 fecal coliform bacteria density ranged from 6 to 1488 FC/100 ml (mean 209, geometric mean 57, median 34).

**Figure 40. Meadow River**



## Peters Creek at ford, site G07

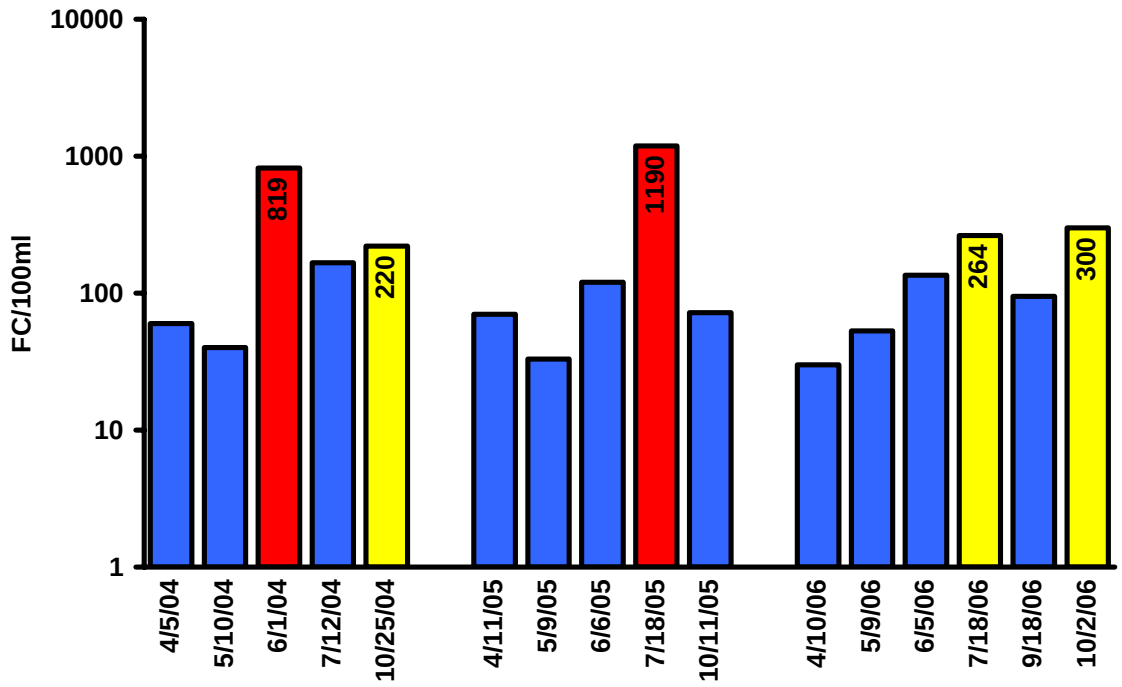
Five of the 16 (31%) samples collected between 2004 and 2006 exceeded 200 FC/100 ml and two (12.5%) of the samples exceeded 400 FC/100 ml (Fig. 41).

Since 1996, 20 of 62 samples (32%) have exceeded 200 FC/100 ml.

The sampling site is on stream left about 1.5 miles upstream from the mouth of the creek. Peters Creek enters the Gauley River about 6.5 miles downstream from the Summersville Dam gage. Four wheel drive enthusiasts are typical visitors to the sample site, while anglers, campers and boaters are typical visitors at the mouth of Peters Creek.

Between 2004 and 2006 fecal coliform bacteria density ranged from 30 to 1190 FC/100 ml (mean 229, geometric mean 123, median 108).

**Figure 41. Peters Creek**



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# DISCUSSION

## BLUESTONE NATIONAL SCENIC RIVER

Bluestone River mainstem sites exceeded the West Virginia standard for contact recreation far more during 2004- 2006 (31- 44%) than they had in previous years (10- 14%). This trend was not noted among the tributary sites, where the rate of exceeding the standard in 2004- 2006 (12.5%) was similar to the long- term trend (about 14%).

While Bluestone National Scenic River is relatively remote, with little adjacent development or population centers, the upstream communities of Bluefield and Princeton may be sources of the increased fecal contamination noted in 2004- 2006. Other potential sources include livestock and wildlife, but the less frequent and lower maximum values in the tributary streams (as compared to the mainstem Bluestone River) strongly suggest a human source.

## NEW RIVER GORGE NATIONAL RIVER

Water quality below Bluestone Dam continues to be relatively good (Fig. 10). The April 5, 2005 sample is the only one in four years to exceed 200FC/100ml. This indicates that the potential exists for good water quality throughout New River Gorge National River.

As the New River enters New River Gorge National River, the inflow of contaminated tributaries and inadequate sewage disposal or treatment along the river begins to influence New River water quality. It is still too early in our monitoring of the Greenbrier River to determine its influence on New River water quality.

Extension of a sewer line to the lower reaches of Madam Creek appears to have dramatically benefited water quality in this stream (Fig. 19). From 1990 through 2004, 114 out of 121 (94%) of the samples exceeded 200FC/100ml, and all 22 samples taken from 2001- 2004 exceeded 400FC/100ml, often by an order or two of magnitude (see Wilson *et al*. 2006). Since 2004, only 4 of 11 (36%) of the samples exceeded 200FC/100ml, and only 2 (18%) exceeded 400FC/100ml. While a 36% rate of exceedance would not normally be considered good, this is still nearly 1/3 of the former rate. This decrease in frequency of exceedance, combined with the decrease in magnitude of individual samples (from thousands or tens of thousands of FC/100ml to hundreds of FC/100ml) illustrates the kind of "overnight" improvement in water quality that is possible given the application of effective sewage treatment.

For New River sites as far downstream as Thurmond (Figs. 11- 15), rates of exceeding the contact recreation standard were slightly greater in 2004- 2006 than the long term average. Given the relatively small sample size for the 2004- 2006 monitoring effort (one sample over three years exceeding the standard can make the difference), this

increase is probably not significant. The two lowest New River sites (Figs. 16, 17) exceeded the contact recreation standard at a lower frequency than their historical average. Again, the small sample size probably implies that this difference is not significant.

Downstream of Madam Creek, most New River tributaries had rates of exceeding the contact recreation standard that were similar to their historical rates. Notable exceptions include apparent improvements in Meadow Creek (Fig. 21), Wolf Creek (Fig. 35), Marr Branch (Fig. 36), and particularly Coal Run (Fig. 31). It is too early too tell if the apparent improvement at Keeney Creek below Winona (Fig.34) is real or the artifact of a small sample size.

The three sites on Keeney Creek reveal an interesting problem. Water quality is poor above Winona (Fig. 32), decreases markedly in Winona (Fig. 33), and has improved dramatically by the time Keeney Creek reaches the New River Gorge National River boundary (Fig. 34). While it is expected that water quality should decrease as Keeney Creek enters the unsewered community of Winona, it is surprising that water quality improves so much at the park boundary. Potential reasons for this improvement include bacteria die- off, deposition of bacteria onto stream sediments (see Bohn and Buckhouse 1985), and bacteria being aerosolized in mists. The exact reason(s) are unknown, and the National Park Service hopes to investigate this phenomenon as time and funding become available.

The rate of exceeding the contact recreation standard in Dunloup Creek was greater than the historical average (Fig. 29). While this may be an artifact of a small sample size, this apparent increase illustrates the need to make planned improvements to sewage infrastructure and housing density in the Dunloup Creek watershed.

There is still a group of clean water streams in the central area of New River Gorge National River. These streams include Glade Creek (Fig. 22), Mill Creek (Fig. 23), Laurel Creek (Fig. 24), Dowdy Creek (not sampled in 2004- 2006, but see Fig. 29 in Wilson *et al*. 2006), Slater Creek (Figs. 26- 27), and Buffalo Creek (Fig. 28). Except for Glade and Laurel Creeks, these streams drain relatively small and sparsely inhabited watersheds. Even in Glade and Laurel Creek watersheds, human population density is low, and either dispersed (Laurel Creek) or limited to the upper headwaters (Glade Creek).

## GAULEY RIVER NATIONAL RECREATION AREA

Patterns in the rate of exceeding the contact recreation standard in Gauley River National Recreation Area during 2004- 2006 (Figs. 37- 41) were similar to historical patterns. Slight differences are probably insignificant and due to small sample sizes.

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**Bluestone National Scenic River**

| Mainstem | | | Tributaries | | |
|---|---|---|---|---|---|
| **Site Name** | **Date** | **FC/100ml** | **Site Name** | **Date** | **FC/100ml** |
| Bluestone River below Mountain Creek | 4/12/2004 | 29 | Mountain Creek | 4/12/2004 | 36 |
| Bluestone River below Mountain Creek | 5/3/2004 | 240 | Mountain Creek | 5/3/2004 | 56 |
| Bluestone River below Mountain Creek | 6/7/2004 | 275 | Mountain Creek | 6/7/2004 | 122 |
| Bluestone River below Mountain Creek | 7/6/2004 | 500 | Mountain Creek | 7/6/2004 | 38 |
| Bluestone River below Mountain Creek | 9/13/2004 | 53 | Mountain Creek | 9/13/2004 | 55 |
| Bluestone River below Mountain Creek | 4/4/2005 | 1275 | Mountain Creek | 4/4/2005 | 43 |
| Bluestone River below Mountain Creek | 5/2/2005 | 838 | Mountain Creek | 5/2/2005 | 59 |
| Bluestone River below Mountain Creek | 6/20/2005 | 14 | Mountain Creek | 6/20/2005 | 6 |
| Bluestone River below Mountain Creek | 7/11/2005 | 120 | Mountain Creek | 7/11/2005 | 47 |
| Bluestone River below Mountain Creek | 10/3/2005 | 14 | Mountain Creek | 10/3/2005 | 3 |
| Bluestone River below Mountain Creek | 4/3/2006 | 26 | Mountain Creek | 4/3/2006 | 56 |
| Bluestone River below Mountain Creek | 5/17/2006 | 5 | Mountain Creek | 5/17/2006 | 7 |
| Bluestone River below Mountain Creek | 6/28/2006 | 3260 | Mountain Creek | 6/28/2006 | 430 |
| Bluestone River below Mountain Creek | 7/19/2006 | 7150 | Mountain Creek | 7/19/2006 | 420 |
| Bluestone River below Mountain Creek | 9/19/2006 | 68 | Mountain Creek | 9/19/2006 | 33 |
| Bluestone River below Mountain Creek | 10/10/2006 | 76 | Mountain Creek | 10/10/2006 | 12 |
| Bluestone River above Little Bluestone River | 4/12/2004 | 21 | Little Bluestone River | 4/12/2004 | 27 |
| Bluestone River above Little Bluestone River | 5/3/2004 | 171 | Little Bluestone River | 5/3/2004 | 244 |
| Bluestone River above Little Bluestone River | 6/7/2004 | 240 | Little Bluestone River | 6/7/2004 | 75 |
| Bluestone River above Little Bluestone River | 7/6/2004 | 388 | Little Bluestone River | 7/6/2004 | 169 |
| Bluestone River above Little Bluestone River | 9/13/2004 | 116 | Little Bluestone River | 9/13/2004 | 158 |
| Bluestone River above Little Bluestone River | 4/4/2005 | 1313 | Little Bluestone River | 4/4/2005 | 110 |
| Bluestone River above Little Bluestone River | 5/2/2005 | 1025 | Little Bluestone River | 5/2/2005 | 85 |
| Bluestone River above Little Bluestone River | 6/20/2005 | 28 | Little Bluestone River | 6/20/2005 | 120 |
| Bluestone River above Little Bluestone River | 7/11/2005 | 90 | Little Bluestone River | 7/11/2005 | 100 |
| Bluestone River above Little Bluestone River | 10/3/2005 | 10 | Little Bluestone River | 10/3/2005 | 14 |
| Bluestone River above Little Bluestone River | 4/3/2006 | 12 | Little Bluestone River | 4/3/2006 | 42 |
| Bluestone River above Little Bluestone River | 5/17/2006 | 9 | Little Bluestone River | 5/17/2006 | 23 |
| Bluestone River above Little Bluestone River | 6/28/2006 | 4175 | Little Bluestone River | 6/28/2006 | 1075 |
| Bluestone River above Little Bluestone River | 7/19/2006 | 7300 | Little Bluestone River | 7/19/2006 | 24 |
| Bluestone River above Little Bluestone River | 9/19/2006 | 11 | Little Bluestone River | 9/19/2006 | 7 |
| Bluestone River above Little Bluestone River | 10/10/2006 | 83 | Little Bluestone River | 10/10/2006 | 8 |
| Bluestone River above Mouth | 4/12/2004 | 20 | | | |
| Bluestone River above Mouth | 5/3/2004 | 138 | | | |
| Bluestone River above Mouth | 6/7/2004 | 170 | | | |
| Bluestone River above Mouth | 7/6/2004 | 283 | | | |
| Bluestone River above Mouth | 9/13/2004 | 78 | | | |
| Bluestone River above Mouth | 4/4/2005 | 975 | | | |
| Bluestone River above Mouth | 5/2/2005 | 900 | | | |
| Bluestone River above Mouth | 6/20/2005 | 30 | | | |
| Bluestone River above Mouth | 7/11/2005 | 93 | | | |
| Bluestone River above Mouth | 10/3/2005 | 8 | | | |
| Bluestone River above Mouth | 4/3/2006 | 18 | | | |
| Bluestone River above Mouth | 5/17/2006 | 4 | | | |
| Bluestone River above Mouth | 6/28/2006 | 3140 | | | |
| Bluestone River above Mouth | 7/19/2006 | 7550 | | | |
| Bluestone River above Mouth | 9/19/2006 | 18 | | | |
| Bluestone River above Mouth | 10/10/2006 | 76 | | | |

## New River Gorge National River - Mainstem

| Site Name | Date | FC/100ml |
|---|---|---|
| New River below Bluestone Dam | 4/13/2004 | 37 |
| New River below Bluestone Dam | 5/4/2004 | 114 |
| New River below Bluestone Dam | 6/8/2004 | 63 |
| New River below Bluestone Dam | 7/7/2004 | 15 |
| New River below Bluestone Dam | 7/22/2004 | 23 |
| New River below Bluestone Dam | 9/14/2004 | 75 |
| New River below Bluestone Dam | 4/5/2005 | 470 |
| New River below Bluestone Dam | 5/3/2005 | 69 |
| New River below Bluestone Dam | 6/14/2005 | 41 |
| New River below Bluestone Dam | 7/12/2005 | 16 |
| New River below Bluestone Dam | 10/4/2005 | 3 |
| New River below Bluestone Dam | 4/4/2006 | 1 |
| New River below Bluestone Dam | 5/22/2006 | 4 |
| New River below Bluestone Dam | 6/6/2006 | 22 |
| New River below Bluestone Dam | 7/25/2006 | 130 |
| New River below Bluestone Dam | 9/20/2006 | 8 |
| New River below Bluestone Dam | 10/11/2006 | 14 |
| New River at Brooks Falls | 4/13/2004 | 2333 |
| New River at Brooks Falls | 5/4/2004 | 83 |
| New River at Brooks Falls | 6/8/2004 | 55 |
| New River at Brooks Falls | 7/7/2004 | 15 |
| New River at Brooks Falls | 7/22/2004 | 46 |
| New River at Brooks Falls | 9/14/2004 | 43 |
| New River at Brooks Falls | 4/5/2005 | 430 |
| New River at Brooks Falls | 5/3/2005 | 63 |
| New River at Brooks Falls | 6/14/2005 | 20 |
| New River at Brooks Falls | 7/12/2005 | 11 |
| New River at Brooks Falls | 10/4/2005 | 9 |
| New River at Brooks Falls | 4/4/2006 | 13 |
| New River at Brooks Falls | 5/22/2006 | 5 |
| New River at Brooks Falls | 6/6/2006 | 15 |
| New River at Brooks Falls | 7/25/2006 | 29 |
| New River at Brooks Falls | 9/20/2006 | 7 |
| New River at Brooks Falls | 10/11/2006 | 13 |
| New River below Sandstone Falls | 4/13/2004 | 692 |
| New River below Sandstone Falls | 5/4/2004 | 90 |
| New River below Sandstone Falls | 6/8/2004 | 60 |
| New River below Sandstone Falls | 7/7/2004 | 39 |
| New River below Sandstone Falls | 7/22/2004 | 708 |
| New River below Sandstone Falls | 9/14/2004 | 37 |
| New River below Sandstone Falls | 4/5/2005 | 230 |
| New River below Sandstone Falls | 5/3/2005 | 33 |
| New River below Sandstone Falls | 6/14/2005 | 18 |
| New River below Sandstone Falls | 7/12/2005 | 30 |
| New River below Sandstone Falls | 10/4/2005 | 7 |
| New River below Sandstone Falls | 4/4/2006 | 4 |
| New River below Sandstone Falls | 5/22/2006 | 5 |
| New River below Sandstone Falls | 6/6/2006 | 21 |
| New River below Sandstone Falls | 7/25/2006 | 15 |
| New River below Sandstone Falls | 9/20/2006 | 10 |
| New River below Sandstone Falls | 10/11/2006 | 15 |
| New River below Laurel Creek | 4/14/2004 | 2600 |
| New River below Laurel Creek | 5/5/2004 | 250 |
| New River below Laurel Creek | 6/9/2004 | 77 |
| New River below Laurel Creek | 7/8/2004 | 16 |
| New River below Laurel Creek | 10/20/2004 | 87 |
| New River below Laurel Creek | 4/6/2005 | 250 |
| New River below Laurel Creek | 5/4/2005 | 45 |
| New River below Laurel Creek | 6/15/2005 | 36 |
| New River below Laurel Creek | 7/13/2005 | 29 |
| New River below Laurel Creek | 10/5/2005 | 10 |
| New River below Laurel Creek | 4/5/2006 | 14 |
| New River below Laurel Creek | 5/23/2006 | 7 |
| New River below Laurel Creek | 6/7/2006 | 14 |
| New River below Laurel Creek | 7/26/2006 | 7 |
| New River below Laurel Creek | 9/21/2006 | 9 |
| New River below Laurel Creek | 10/12/2006 | 19 |
| New River below Piney Creek | 4/14/2004 | 2200 |
| New River below Piney Creek | 5/5/2004 | 123 |
| New River below Piney Creek | 6/9/2004 | 47 |
| New River below Piney Creek | 7/8/2004 | 13 |
| New River below Piney Creek | 10/20/2004 | 50 |
| New River below Piney Creek | 4/6/2005 | 215 |
| New River below Piney Creek | 5/4/2005 | 33 |
| New River below Piney Creek | 6/15/2005 | 38 |
| New River below Piney Creek | 7/13/2005 | 14 |
| New River below Piney Creek | 10/5/2005 | 3 |
| New River below Piney Creek | 4/5/2006 | 11 |
| New River below Piney Creek | 5/23/2006 | 7 |
| New River below Piney Creek | 6/7/2006 | 8 |
| New River below Piney Creek | 7/26/2006 | 7 |
| New River below Piney Creek | 9/21/2006 | 7 |
| New River below Piney Creek | 10/12/2006 | 26 |

Continued on next page

## New River Gorge National River - Mainstem (continued)

| Site Name | Date | FC/100ml | Site Name | Date | FC/100ml |
|---|---|---|---|---|---|
| New River at Thurmond | 4/7/2004 | 8 | New River above Wolf Creek | 4/8/2004 | 30 |
| New River at Thurmond | 5/12/2004 | 33 | New River above Wolf Creek | 5/13/2004 | 17 |
| New River at Thurmond | 6/2/2004 | 1133 | New River above Wolf Creek | 6/3/2004 | 400 |
| New River at Thurmond | 7/14/2004 | 13 | New River above Wolf Creek | 9/23/2004 | 57 |
| New River at Thurmond | 10/21/2004 | 75 | New River above Wolf Creek | 10/27/2004 | 20 |
| New River at Thurmond | 4/12/2005 | 16 | New River above Wolf Creek | 4/14/2005 | 10 |
| New River at Thurmond | 5/10/2005 | 6 | New River above Wolf Creek | 5/11/2005 | 10 |
| New River at Thurmond | 6/8/2005 | 11 | New River above Wolf Creek | 6/9/2005 | 6 |
| New River at Thurmond | 7/20/2005 | 116 | New River above Wolf Creek | 7/27/2005 | 7 |
| New River at Thurmond | 10/12/2005 | 25 | New River above Wolf Creek | 10/13/2005 | 10 |
| New River at Thurmond | 4/12/2006 | 35 | New River above Wolf Creek | 4/13/2006 | 10 |
| New River at Thurmond | 5/24/2006 | 7 | New River above Wolf Creek | 5/10/2006 | 10 |
| New River at Thurmond | 6/13/2006 | 73 | New River above Wolf Creek | 6/12/2006 | 81 |
| New River at Thurmond | 9/26/2006 | 9 | New River above Wolf Creek | 9/25/2006 | 15 |
| New River at Thurmond | 10/18/2006 | 306 | New River above Wolf Creek | 10/19/2006 | 105 |
| New River above Coal Run | 4/8/2004 | 6 | | | |
| New River above Coal Run | 5/13/2004 | 18 | | | |
| New River above Coal Run | 6/3/2004 | 200 | | | |
| New River above Coal Run | 9/23/2004 | 55 | | | |
| New River above Coal Run | 10/27/2004 | 10 | | | |
| New River above Coal Run | 4/14/2005 | 11 | | | |
| New River above Coal Run | 5/11/2005 | 5 | | | |
| New River above Coal Run | 6/9/2005 | 6 | | | |
| New River above Coal Run | 7/27/2005 | 61 | | | |
| New River above Coal Run | 10/13/2005 | 9 | | | |
| New River above Coal Run | 4/13/2006 | 16 | | | |
| New River above Coal Run | 5/10/2006 | 11 | | | |
| New River above Coal Run | 6/12/2006 | 173 | | | |
| New River above Coal Run | 9/25/2006 | 27 | | | |
| New River above Coal Run | 10/19/2006 | 150 | | | |

## New River Gorge National River - Tributaries

| Site Name | Date | FC/100ml |
|---|---|---|
| Greenbrier River at Willowwood | 4/13/2004 | 1167 |
| Greenbrier River at Willowwood | 5/4/2004 | 425 |
| Greenbrier River at Willowwood | 6/8/2004 | 280 |
| Greenbrier River at Willowwood | 7/7/2004 | 28 |
| Greenbrier River at Willowwood | 7/22/2004 | 31 |
| Greenbrier River at Willowwood | 9/14/2004 | 48 |
| Greenbrier River at Willowwood | 4/5/2005 | 110 |
| Greenbrier River at Willowwood | 5/3/2005 | 203 |
| Greenbrier River at Willowwood | 6/14/2005 | 148 |
| Greenbrier River at Willowwood | 7/12/2005 | 59 |
| Greenbrier River at Willowwood | 10/4/2005 | 16 |
| Greenbrier River at Willowwood | 4/4/2006 | 47 |
| Greenbrier River at Willowwood | 5/22/2006 | 15 |
| Greenbrier River at Willowwood | 6/6/2006 | 25 |
| Greenbrier River at Willowwood | 7/25/2006 | 82 |
| Greenbrier River at Willowwood | 9/20/2006 | 20 |
| Greenbrier River at Willowwood | 10/11/2006 | 31 |
| Madam Creek | 4/13/2004 | 1900 |
| Madam Creek | 5/4/2004 | 6733 |
| Madam Creek | 6/8/2004 | 13650 |
| Madam Creek | 7/7/2004 | 6700 |
| Madam Creek | 7/22/2004 | 37600 |
| Madam Creek | 9/14/2004 | 7200 |
| Madam Creek | 4/5/2005 | 75 |
| Madam Creek | 5/3/2005 | 300 |
| Madam Creek | 6/14/2005 | 488 |
| Madam Creek | 7/12/2005 | 375 |
| Madam Creek | 10/4/2005 | 25 |
| Madam Creek | 4/4/2006 | 160 |
| Madam Creek | 5/22/2006 | 30 |
| Madam Creek | 6/6/2006 | 600 |
| Madam Creek | 7/25/2006 | 30 |
| Madam Creek | 9/20/2006 | 25 |
| Madam Creek | 10/11/2006 | 43 |
| Lick Creek | 4/13/2004 | 3800 |
| Lick Creek | 5/4/2004 | 167 |
| Lick Creek | 6/8/2004 | 135 |
| Lick Creek | 7/7/2004 | 34 |
| Lick Creek | 7/22/2004 | 72 |
| Lick Creek | 9/14/2004 | 68 |
| Lick Creek | 4/5/2005 | 25 |
| Lick Creek | 5/3/2005 | 175 |
| Lick Creek | 6/14/2005 | 136 |
| Lick Creek | 7/12/2005 | 85 |
| Lick Creek | 10/4/2005 | 83 |
| Lick Creek | 4/4/2006 | 420 |
| Lick Creek | 5/22/2006 | 42 |
| Lick Creek | 6/6/2006 | 102 |
| Lick Creek | 7/25/2006 | 212 |
| Lick Creek | 9/20/2006 | 103 |
| Lick Creek | 10/11/2006 | 90 |
| Meadow Creek | 4/13/2004 | 4350 |
| Meadow Creek | 5/4/2004 | 128 |
| Meadow Creek | 6/8/2004 | 120 |
| Meadow Creek | 7/7/2004 | 163 |
| Meadow Creek | 7/22/2004 | 17 |
| Meadow Creek | 9/14/2004 | 14 |
| Meadow Creek | 4/5/2005 | 145 |
| Meadow Creek | 5/3/2005 | 185 |
| Meadow Creek | 6/14/2005 | 820 |
| Meadow Creek | 7/12/2005 | 175 |
| Meadow Creek | 10/4/2005 | 19 |
| Meadow Creek | 4/4/2006 | 65 |
| Meadow Creek | 5/22/2006 | 6 |
| Meadow Creek | 6/6/2006 | 96 |
| Meadow Creek | 7/25/2006 | 83 |
| Meadow Creek | 9/20/2006 | 81 |
| Meadow Creek | 10/11/2006 | 50 |
| Glade Creek | 4/14/2004 | 160 |
| Glade Creek | 5/5/2004 | 18 |
| Glade Creek | 10/20/2004 | 58 |
| Glade Creek | 4/6/2005 | 13 |
| Glade Creek | 5/4/2005 | 16 |
| Glade Creek | 6/15/2005 | 79 |
| Glade Creek | 7/13/2005 | 18 |
| Glade Creek | 10/5/2005 | 10 |
| Glade Creek | 4/5/2006 | 14 |
| Glade Creek | 5/23/2006 | 9 |
| Glade Creek | 6/7/2006 | 8 |
| Glade Creek | 7/26/2006 | 18 |
| Glade Creek | 9/21/2006 | 3 |
| Glade Creek | 10/12/2006 | 21 |

Continued on next page

## New River Gorge National River - Tributaries (continued)

| Site Name | Date | FC/100ml |
|---|---|---|
| Mill Creek | 4/14/2004 | 50 |
| Mill Creek | 5/5/2004 | 5 |
| Mill Creek | 10/20/2004 | 23 |
| Mill Creek | 4/6/2005 | 10 |
| Mill Creek | 5/4/2005 | 30 |
| Mill Creek | 6/15/2005 | 30 |
| Mill Creek | 7/13/2005 | 39 |
| Mill Creek | 10/5/2005 | 4 |
| Mill Creek | 4/5/2006 | 2 |
| Mill Creek | 5/23/2006 | 2 |
| Mill Creek | 6/7/2006 | 12 |
| Mill Creek | 7/26/2006 | 30 |
| Mill Creek | 9/21/2006 | 9 |
| Mill Creek | 10/12/2006 | 44 |
| Laurel Creek at Quinnimont | 4/14/2004 | 100 |
| Laurel Creek at Quinnimont | 5/5/2004 | 21 |
| Laurel Creek at Quinnimont | 6/9/2004 | 42 |
| Laurel Creek at Quinnimont | 7/8/2004 | 14 |
| Laurel Creek at Quinnimont | 10/20/2004 | 15 |
| Laurel Creek at Quinnimont | 4/6/2005 | 25 |
| Laurel Creek at Quinnimont | 5/4/2005 | 12 |
| Laurel Creek at Quinnimont | 6/15/2005 | 10 |
| Laurel Creek at Quinnimont | 7/13/2005 | 18 |
| Laurel Creek at Quinnimont | 10/5/2005 | 2 |
| Laurel Creek at Quinnimont | 4/5/2006 | 6 |
| Laurel Creek at Quinnimont | 5/23/2006 | 1 |
| Laurel Creek at Quinnimont | 6/7/2006 | 4 |
| Laurel Creek at Quinnimont | 7/26/2006 | 133 |
| Laurel Creek at Quinnimont | 9/21/2006 | 2 |
| Laurel Creek at Quinnimont | 10/12/2006 | 54 |
| Piney Creek at McCreery | 4/14/2004 | 4000 |
| Piney Creek at McCreery | 5/5/2004 | 73 |
| Piney Creek at McCreery | 6/9/2004 | 173 |
| Piney Creek at McCreery | 7/8/2004 | 46 |
| Piney Creek at McCreery | 10/20/2004 | 1180 |
| Piney Creek at McCreery | 4/6/2005 | 127 |
| Piney Creek at McCreery | 5/4/2005 | 365 |
| Piney Creek at McCreery | 6/15/2005 | 11200 |
| Piney Creek at McCreery | 7/13/2005 | 40 |
| Piney Creek at McCreery | 10/5/2005 | 11 |
| Piney Creek at McCreery | 4/5/2006 | 143 |
| Piney Creek at McCreery | 5/23/2006 | 38 |
| Piney Creek at McCreery | 6/7/2006 | 18 |
| Piney Creek at McCreery | 7/26/2006 | 22 |
| Piney Creek at McCreery | 9/21/2006 | 27 |
| Piney Creek at McCreery | 10/12/2006 | 1560 |
| Slater Creek at McKendree Road | 4/7/2004 | 3 |
| Slater Creek at McKendree Road | 5/12/2004 | 9 |
| Slater Creek at McKendree Road | 6/2/2004 | 9 |
| Slater Creek at McKendree Road | 7/14/2004 | 1 |
| Slater Creek at McKendree Road | 10/21/2004 | 2 |
| Slater Creek at McKendree Road | 4/12/2005 | 3 |
| Slater Creek at McKendree Road | 5/10/2005 | 12 |
| Slater Creek at McKendree Road | 6/8/2005 | 15 |
| Slater Creek at McKendree Road | 7/20/2005 | 3 |
| Slater Creek at McKendree Road | 10/12/2005 | 19 |
| Slater Creek at McKendree Road | 4/12/2006 | 3 |
| Slater Creek at McKendree Road | 5/24/2006 | 10 |
| Slater Creek at McKendree Road | 6/13/2006 | 54 |
| Slater Creek at McKendree Road | 9/26/2006 | 5 |
| Slater Creek at McKendree Road | 10/18/2006 | 26 |
| Slater Creek at mouth | 4/7/2004 | 3 |
| Slater Creek at mouth | 5/12/2004 | 13 |
| Slater Creek at mouth | 6/2/2004 | 7 |
| Slater Creek at mouth | 7/14/2004 | 21 |
| Slater Creek at mouth | 10/21/2004 | 7 |
| Slater Creek at mouth | 4/12/2005 | 2 |
| Slater Creek at mouth | 5/10/2005 | 4 |
| Slater Creek at mouth | 6/8/2005 | 6 |
| Slater Creek at mouth | 7/20/2005 | 30 |
| Slater Creek at mouth | 10/12/2005 | 61 |
| Slater Creek at mouth | 4/12/2006 | 2 |
| Slater Creek at mouth | 5/24/2006 | 2 |
| Slater Creek at mouth | 6/13/2006 | 60 |
| Slater Creek at mouth | 9/26/2006 | 10 |
| Slater Creek at mouth | 10/18/2006 | 62 |

Continued on next page

## New River Gorge National River - Tributaries (continued)

| Site Name | Date | FC/100ml |
|---|---|---|
| Buffalo Creek at McKendree Road | 4/7/2004 | 1 |
| Buffalo Creek at McKendree Road | 5/12/2004 | 5 |
| Buffalo Creek at McKendree Road | 6/2/2004 | 10 |
| Buffalo Creek at McKendree Road | 7/14/2004 | 4 |
| Buffalo Creek at McKendree Road | 10/21/2004 | 20 |
| Buffalo Creek at McKendree Road | 4/12/2005 | 4 |
| Buffalo Creek at McKendree Road | 5/10/2005 | 5 |
| Buffalo Creek at McKendree Road | 6/8/2005 | 43 |
| Buffalo Creek at McKendree Road | 7/20/2005 | 51 |
| Buffalo Creek at McKendree Road | 10/12/2005 | 20 |
| Buffalo Creek at McKendree Road | 4/12/2006 | 3 |
| Buffalo Creek at McKendree Road | 5/24/2006 | 2 |
| Buffalo Creek at McKendree Road | 6/13/2006 | 37 |
| Buffalo Creek at McKendree Road | 9/26/2006 | 5 |
| Buffalo Creek at McKendree Road | 10/18/2006 | 20 |
| Dunloup Creek | 4/7/2004 | 25 |
| Dunloup Creek | 5/12/2004 | 270 |
| Dunloup Creek | 6/2/2004 | 433 |
| Dunloup Creek | 7/14/2004 | 343 |
| Dunloup Creek | 10/21/2004 | 350 |
| Dunloup Creek | 4/12/2005 | 280 |
| Dunloup Creek | 5/10/2005 | 73 |
| Dunloup Creek | 6/8/2005 | 313 |
| Dunloup Creek | 7/20/2005 | 1767 |
| Dunloup Creek | 10/12/2005 | 60 |
| Dunloup Creek | 4/12/2006 | 93 |
| Dunloup Creek | 5/24/2006 | 66 |
| Dunloup Creek | 6/13/2006 | 300 |
| Dunloup Creek | 9/26/2006 | 88 |
| Dunloup Creek | 10/18/2006 | 473 |
| Arbuckle Creek | 4/7/2004 | 227 |
| Arbuckle Creek | 5/12/2004 | 53 |
| Arbuckle Creek | 6/2/2004 | 850 |
| Arbuckle Creek | 7/14/2004 | 55 |
| Arbuckle Creek | 10/21/2004 | 253 |
| Arbuckle Creek | 4/12/2005 | 233 |
| Arbuckle Creek | 5/10/2005 | 130 |
| Arbuckle Creek | 6/8/2005 | 118 |
| Arbuckle Creek | 7/20/2005 | 6100 |
| Arbuckle Creek | 10/12/2005 | 95 |
| Arbuckle Creek | 4/12/2006 | 260 |
| Arbuckle Creek | 5/24/2006 | 87 |
| Arbuckle Creek | 6/13/2006 | 550 |
| Arbuckle Creek | 9/26/2006 | 293 |
| Arbuckle Creek | 10/18/2006 | 990 |
| Coal Run | 4/8/2004 | 180 |
| Coal Run | 5/13/2004 | 38 |
| Coal Run | 6/3/2004 | 245 |
| Coal Run | 9/23/2004 | 45 |
| Coal Run | 10/27/2004 | 35 |
| Coal Run | 4/14/2005 | 48 |
| Coal Run | 5/11/2005 | 75 |
| Coal Run | 6/9/2005 | 33 |
| Coal Run | 7/27/2005 | 49 |
| Coal Run | 10/13/2005 | 16 |
| Coal Run | 4/13/2006 | 105 |
| Coal Run | 5/10/2006 | 115 |
| Coal Run | 6/12/2006 | 201 |
| Coal Run | 9/25/2006 | 100 |
| Coal Run | 10/19/2006 | 37 |
| Keeney Creek above Winona? | 4/8/2004 | 9 |
| Keeney Creek above Winona? | 5/13/2004 | 300 |
| Keeney Creek above Winona? | 6/3/2004 | 60 |
| Keeney Creek above Winona? | 9/23/2004 | 440 |
| Keeney Creek above Winona? | 10/27/2004 | 40 |
| Keeney Creek above Winona? | 4/14/2005 | 177 |
| Keeney Creek above Winona? | 5/11/2005 | 10 |
| Keeney Creek above Winona? | 6/9/2005 | 20 |
| Keeney Creek above Winona? | 7/27/2005 | 401 |
| Keeney Creek above Winona? | 10/13/2005 | 40 |
| Keeney Creek above Winona? | 4/13/2006 | 467 |
| Keeney Creek above Winona? | 5/10/2006 | 88 |
| Keeney Creek above Winona? | 6/12/2006 | 263 |
| Keeney Creek above Winona? | 9/25/2006 | 401 |
| Keeney Creek above Winona? | 10/19/2006 | 275 |

Continued on next page

## New River Gorge National River - Tributaries (continued)

| Site Name | Date | FC/100ml |
|---|---|---|
| Keeney Creek at Winona | 4/8/2004 | 213 |
| Keeney Creek at Winona | 5/13/2004 | 8500 |
| Keeney Creek at Winona | 6/3/2004 | 825 |
| Keeney Creek at Winona | 9/23/2004 | 2550 |
| Keeney Creek at Winona | 10/27/2004 | 367 |
| Keeney Creek at Winona | 4/14/2005 | 1270 |
| Keeney Creek at Winona | 5/11/2005 | 950 |
| Keeney Creek at Winona | 6/9/2005 | 633 |
| Keeney Creek at Winona | 7/27/2005 | 338 |
| Keeney Creek at Winona | 10/13/2005 | 150 |
| Keeney Creek at Winona | 4/13/2006 | 1340 |
| Keeney Creek at Winona | 5/10/2006 | 300 |
| Keeney Creek at Winona | 6/12/2006 | 1367 |
| Keeney Creek at Winona | 9/25/2006 | 630 |
| Keeney Creek at Winona | 10/19/2006 | 338 |
| Keeney Creek below Winona | 4/8/2004 | 25 |
| Keeney Creek below Winona | 5/13/2004 | 155 |
| Keeney Creek below Winona | 6/3/2004 | 150 |
| Keeney Creek below Winona | 9/23/2004 | 50 |
| Keeney Creek below Winona | 10/27/2004 | 128 |
| Keeney Creek below Winona | 4/14/2005 | 188 |
| Keeney Creek below Winona | 5/11/2005 | 120 |
| Keeney Creek below Winona | 6/9/2005 | 137 |
| Keeney Creek below Winona | 7/27/2005 | 20 |
| Keeney Creek below Winona | 10/13/2005 | 3 |
| Keeney Creek below Winona | 4/13/2006 | 70 |
| Keeney Creek below Winona | 5/10/2006 | 18 |
| Keeney Creek below Winona | 6/12/2006 | 500 |
| Keeney Creek below Winona | 9/25/2006 | 127 |
| Keeney Creek below Winona | 10/19/2006 | 50 |
| Wolf Creek | 4/8/2004 | 15 |
| Wolf Creek | 5/13/2004 | 1950 |
| Wolf Creek | 6/3/2004 | 130 |
| Wolf Creek | 9/23/2004 | 20 |
| Wolf Creek | 10/27/2004 | 12 |
| Wolf Creek | 4/14/2005 | 2 |
| Wolf Creek | 5/11/2005 | 17 |
| Wolf Creek | 6/9/2005 | 11 |
| Wolf Creek | 7/27/2005 | 48 |
| Wolf Creek | 10/13/2005 | 18 |
| Wolf Creek | 4/13/2006 | 21 |
| Wolf Creek | 5/10/2006 | 2 |
| Wolf Creek | 6/12/2006 | 94 |
| Wolf Creek | 9/25/2006 | 197 |
| Wolf Creek | 10/19/2006 | 730 |
| Marr Branch | 4/8/2004 | 50 |
| Marr Branch | 5/13/2004 | 1000 |
| Marr Branch | 6/3/2004 | 130 |
| Marr Branch | 9/23/2004 | 68 |
| Marr Branch | 10/27/2004 | 73 |
| Marr Branch | 4/14/2005 | 15 |
| Marr Branch | 5/11/2005 | 92 |
| Marr Branch | 6/9/2005 | 94 |
| Marr Branch | 7/27/2005 | 670 |
| Marr Branch | 10/13/2005 | 57 |
| Marr Branch | 4/13/2006 | 27 |
| Marr Branch | 5/10/2006 | 54 |
| Marr Branch | 6/12/2006 | 520 |
| Marr Branch | 9/25/2006 | 208 |
| Marr Branch | 10/19/2006 | 996 |

## New River Gorge National River - Springs

| Site Name | Date | FC/100ml | Site Name | Date | FC/100ml |
|---|---|---|---|---|---|
| Ajax Mine Spring | 4/8/2004 | 0 | Claremont Mine Spring | 4/7/2004 | 0 |
| Ajax Mine Spring | 5/13/2004 | 0 | Claremont Mine Spring | 5/12/2004 | 0 |
| Ajax Mine Spring | 6/3/2004 | 0 | Claremont Mine Spring | 6/2/2004 | 2 |
| Ajax Mine Spring | 9/23/2004 | 0.7 | Claremont Mine Spring | 7/14/2004 | 0 |
| Ajax Mine Spring | 10/27/2004 | 1 | Claremont Mine Spring | 10/21/2004 | 0 |
| Ajax Mine Spring | 4/14/2005 | 0 | Claremont Mine Spring | 4/12/2005 | 0 |
| Ajax Mine Spring | 5/11/2005 | 0 | Claremont Mine Spring | 5/10/2005 | 0 |
| Ajax Mine Spring | 6/9/2005 | 0 | Claremont Mine Spring | 6/8/2005 | 0 |
| Ajax Mine Spring | 7/27/2005 | 0 | Claremont Mine Spring | 7/20/2005 | 0 |
| Ajax Mine Spring | 10/13/2005 | 0 | Claremont Mine Spring | 10/12/2005 | 0 |
| Ajax Mine Spring | 4/13/2006 | 0 | Claremont Mine Spring | 4/12/2006 | 0 |
| Ajax Mine Spring | 5/10/2006 | 0 | Claremont Mine Spring | 5/24/2006 | 0 |
| Ajax Mine Spring | 6/12/2006 | 1 | Claremont Mine Spring | 6/13/2006 | 1 |
| Ajax Mine Spring | 9/25/2006 | 0 | Claremont Mine Spring | 9/26/2006 | 0 |
| Ajax Mine Spring | 10/19/2006 | 0 | Claremont Mine Spring | 10/18/2006 | 0 |

**Gauley River National Recreation Area**

| Mainstem | | | Tributaries | | |
|---|---|---|---|---|---|
| **Site Name** | **Date** | **FC/100ml** | **Site Name** | **Date** | **FC/100ml** |
| Gauley River below Summersville Dam | 4/5/2004 | 125 | Meadow River | 4/5/2004 | 405 |
| Gauley River below Summersville Dam | 5/10/2004 | 11 | Meadow River | 5/10/2004 | 57 |
| Gauley River below Summersville Dam | 6/1/2004 | 312 | Meadow River | 6/1/2004 | 1488 |
| Gauley River below Summersville Dam | 7/12/2004 | 0.5 | Meadow River | 7/12/2004 | 26 |
| Gauley River below Summersville Dam | 10/25/2004 | 24 | Meadow River | 10/25/2004 | 568 |
| Gauley River below Summersville Dam | 4/11/2005 | 38 | Meadow River | 4/11/2005 | 53 |
| Gauley River below Summersville Dam | 5/9/2005 | 39 | Meadow River | 5/9/2005 | 13 |
| Gauley River below Summersville Dam | 6/6/2005 | 2 | Meadow River | 6/6/2005 | 19 |
| Gauley River below Summersville Dam | 7/18/2005 | 1 | Meadow River | 7/18/2005 | 133 |
| Gauley River below Summersville Dam | 10/11/2005 | 3 | Meadow River | 10/11/2005 | 31 |
| Gauley River below Summersville Dam | 4/10/2006 | 2 | Meadow River | 4/10/2006 | 447 |
| Gauley River below Summersville Dam | 5/9/2006 | 4 | Meadow River | 5/9/2006 | 6 |
| Gauley River below Summersville Dam | 6/5/2006 | 1 | Meadow River | 6/5/2006 | 21 |
| Gauley River below Summersville Dam | 7/18/2006 | 205 | Meadow River | 7/18/2006 | 37 |
| Gauley River below Summersville Dam | 9/18/2006 | 1 | Meadow River | 9/18/2006 | 7 |
| Gauley River below Summersville Dam | 10/2/2006 | 12 | Meadow River | 10/2/2006 | 30 |
| Gauley River above Mason Branch | 4/5/2004 | 102 | Peters Creek at Ford | 4/5/2004 | 60 |
| Gauley River above Mason Branch | 5/10/2004 | 4 | Peters Creek at Ford | 5/10/2004 | 40 |
| Gauley River above Mason Branch | 6/1/2004 | 560 | Peters Creek at Ford | 6/1/2004 | 819 |
| Gauley River above Mason Branch | 7/12/2004 | 3 | Peters Creek at Ford | 7/12/2004 | 167 |
| Gauley River above Mason Branch | 10/25/2004 | 20 | Peters Creek at Ford | 10/25/2004 | 220 |
| Gauley River above Mason Branch | 4/11/2005 | 9 | Peters Creek at Ford | 4/11/2005 | 70 |
| Gauley River above Mason Branch | 5/9/2005 | 16 | Peters Creek at Ford | 5/9/2005 | 33 |
| Gauley River above Mason Branch | 6/6/2005 | 3 | Peters Creek at Ford | 6/6/2005 | 120 |
| Gauley River above Mason Branch | 7/18/2005 | 19 | Peters Creek at Ford | 7/18/2005 | 1190 |
| Gauley River above Mason Branch | 10/11/2005 | 10 | Peters Creek at Ford | 10/11/2005 | 72 |
| Gauley River above Mason Branch | 4/10/2006 | 263 | Peters Creek at Ford | 4/10/2006 | 30 |
| Gauley River above Mason Branch | 5/9/2006 | 3 | Peters Creek at Ford | 5/9/2006 | 53 |
| Gauley River above Mason Branch | 6/5/2006 | 6 | Peters Creek at Ford | 6/5/2006 | 135 |
| Gauley River above Mason Branch | 7/18/2006 | 150 | Peters Creek at Ford | 7/18/2006 | 264 |
| Gauley River above Mason Branch | 9/18/2006 | 9 | Peters Creek at Ford | 9/18/2006 | 95 |
| Gauley River above Mason Branch | 10/2/2006 | 7 | Peters Creek at Ford | 10/2/2006 | 300 |
| Gauley River above Swiss | 4/5/2004 | 38 | | | |
| Gauley River above Swiss | 5/10/2004 | 2 | | | |
| Gauley River above Swiss | 6/1/2004 | 660 | | | |
| Gauley River above Swiss | 7/12/2004 | 15 | | | |
| Gauley River above Swiss | 10/25/2004 | 46 | | | |
| Gauley River above Swiss | 4/11/2005 | 5 | | | |
| Gauley River above Swiss | 5/9/2005 | 9 | | | |
| Gauley River above Swiss | 6/6/2005 | 1 | | | |
| Gauley River above Swiss | 7/18/2005 | 34 | | | |
| Gauley River above Swiss | 4/10/2006 | 128 | | | |
| Gauley River above Swiss | 5/9/2006 | 10 | | | |
| Gauley River above Swiss | 6/5/2006 | 14 | | | |
| Gauley River above Swiss | 7/18/2006 | 84 | | | |
| Gauley River above Swiss | 9/18/2006 | 5 | | | |
| Gauley River above Swiss | 10/2/2006 | 10 | | | |