

LEVEL ONE WATER-QUALITY INVENTORY AND MONITORING
BOOKER T. WASHINGTON NATIONAL MONUMENT (BOWA),
VIRGINIA



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INTRODUCTION

The U.S. Geological Survey conducted a Level 1 Water-Quality Inventory and Monitoring (WAQIM) data-collection effort for Booker T. Washington National Monument (BOWA) from August 1998 through July 1999. The primary objective of the WAQIM program was to provide the National Park Service (NPS) and BOWA with at least a nominal inventory of its natural resources and that those data are available in a data-management system consistent with park management needs. Water-quality inventory data (physical, chemical, and biological) were collected from “key” water bodies within the boundaries of BOWA. The key water bodies are those waters within park boundaries that are essential to the central cultural, historical or natural resources management themes of the parks or provide habitats to threatened or endangered plants and animals. Data were collected during the fall, winter, spring, and summer over a range of hydrologic conditions. Because of the drought conditions that persisted during the study period, variations in flow between seasons were less pronounced than during normal hydrologic conditions.

Booker T. Washington National Monument (BOWA) comprises 224 acres located about 22 miles southeast of Roanoke, Virginia. The park commemorates the life and work of Booker T. Washington and includes most of the original 207-acre farm where Washington was born into slavery. The park contains two perennial streams, Gills Creek and Jack-O-Lantern Branch. The headwaters of Gills Creek are located outside of the monument boundaries, but Jack-O-Lantern Branch originates from the outflow of three perennial springs located within the park. A key unnamed tributary enters the park and joins Jack-O-Lantern Branch on its eastern boundary.

Potential threats to water-quality in the park include: (1) encroaching development; (2) logging in areas outside of the park boundaries; (3) agricultural activities (4) animal waste from farm animals maintained within the park for living history exhibits. Data-collection sites and the parameters analyzed were selected based on the spatial distribution of land-use activities inside and immediately outside of the park’s boundaries and the nature of the potential threats to park water-quality.

DESCRIPTION OF INVENTORY PROCESS

Site Descriptions

The water-quality inventory for BOWA included the periodic collection of physical, chemical, and microbiological data from two sites on Jack-O-Lantern Branch, one site on an unnamed tributary to Jack-O-Lantern Branch, and one site on Gills Creek, (fig. 1). These sites are: (1) Jack-O-Lantern Branch near Haleford Church near Scruggs, Va (0205706010), (2) Jack-O-Lantern Branch near Mouth near Scruggs, Va (0205706030), (3) Jack-O-Lantern Branch Tributary 1 near Scruggs, Va (0205706020), and (4) Gills Creek above Jack-O-Lantern Branch near Scruggs, Va. (0205706010). Data-collection

activities were conducted in August and December 1998 and in March, June, and July 1999. Jack-O-Lantern Branch near Haleford Church (0205706010) is located immediately downstream from the confluence of the three spring-fed tributaries that form Jack-O-Lantern Branch. The surrounding area is moderately wooded with a park trail passing nearby. Access is via Farm Trail Loop, approximately 0.3 miles from the Visitor Center. The station is less than 50 feet downstream from the three springs that form the stream. This site is also located immediately downstream from the on-site septic system and the containment areas for the park's domestic animals. Jack-O-Lantern Branch near Mouth near Scruggs, Va (0205706030) is located on the southeast boundary of BOWA 40 feet upstream from the confluence with Gills Creek. The surrounding area is heavily wooded. Access is via Jack-O-Lantern Branch Trail. Jack-O-Lantern Branch Tributary 1 near Scruggs, Va (0205706020) is located on the east boundary of BOWA approximately 15 feet upstream from the confluence with Jack-O-Lantern Branch. The surrounding area is heavily wooded. Access is via Jack-O-Lantern Branch Trail, approximately 0.5 miles from Visitor Center. Gills Creek above Jack-O-Lantern Branch near Scruggs, Va (02057060) is located on the southeast boundary of BOWA approximately 35 feet upstream from the confluence with Jack-O-Lantern Branch. The surrounding area is moderately wooded on the left bank and has pasture on the right bank. Access is via Jack-O-Lantern Branch Trail, approximately 0.8 miles from Visitor Center. Gills Creek is tributary to the Blackwater River.

Description of Data Collection

Data-collection activities were conducted in August and December 1998 and in March, June, and July 1999 (table 1). Data-collection and analysis were conducted according to standard USGS protocols (U.S. Geological Survey, 1997, 1998, 1999; Rantz and others, 1982). Stream water-quality samples were collected as point samples or cross-sectional depth-integrated samples, depending on streamflow conditions. Discharge, water temperature, pH, specific conductivity, dissolved oxygen, and alkalinity were measured at every site on every visit. Water samples were collected and analyzed for nutrients and bacteria at every site on every visit. Samples were collected and analyzed for major element and trace element analysis on one visit.

Table 1. Data-collection schedule

Parameter	Data-collection period			
	August 1998	December 1998	March 1999	June/July 1999
Field parameters	X	X	X	X
Fecal bacteria	X	X	X	X
Nutrients	X	X	X	X
Major Ions	X			
Trace elements				X

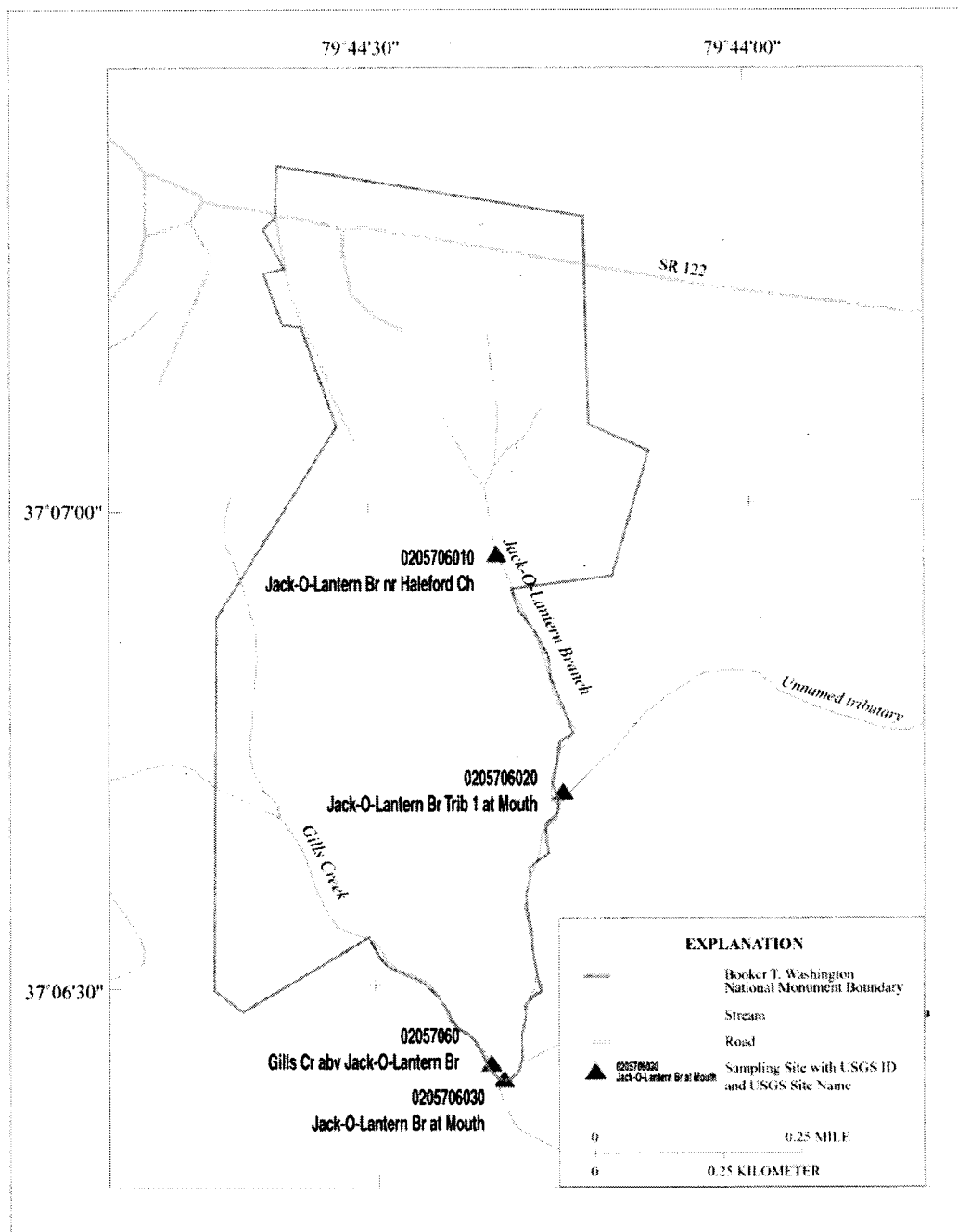


Figure 1. Map of study area and data-collection sites.

PRINCIPAL INVESTIGATORS

The principal investigators of the WAQIM program included staff of the U.S. Geological Survey (USGS), Water Resources Division (WRD) district office in Richmond, Virginia. Michael E. Lewis, Supervisory Hydrologist, supervised all work. J. Michael Gearheart, Hydrologic Technician, implemented all fieldwork. All water-quality samples collected as part of the inventory, with the exception of bacteriological samples, were submitted for analysis to the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado. Bacteriological samples were processed by field personnel at each site and analyzed in the Richmond, Virginia office of the USGS.

WATER-QUALITY RESULTS

Tables 2-6 provide all physical, microbiological, and chemical data collected as part of the BOWA WAQIM project. Four additional files of supporting documentation are included as attachments to this report:

- (1) "BOWA ATTACHMENT 1 SITES.XLS";
- (2) "BOWA ATTACHMENT 2 PARMS.DOC";
- (3) "BOWA ATTACHMENT 3 DATA.XLS", and
- (4) "README.DOC"

"BOWA Attachment 1 sites.xls" is a Microsoft Excel file that contains specific location information for each site where water-quality data were collected. "BOWA Attachment 2 parms.doc" is a Microsoft Word file that explicitly defines each water-quality parameter included in the tables of this report and also in the water-quality data spreadsheet.

"BOWA Attachment 3 data.xls" is a Microsoft Excel spreadsheet that contains all water-quality data collected during this study. "Readme.doc" is a Microsoft Word file that contains basic information related to the project, such as contact information for those who conducted the work and analyzed the samples.

Table 2. Field parameter data

[ft³/s, cubic feet per second; °C, degrees Celsius; uS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; mg/L as CaCO₃, milligrams per liter as calcium carbonate; <, less than; --, no data]

Date	Time	Discharge (ft ³ /s)	Water temperature (°C)	pH (units)	Specific conductance (uS/cm)	Dissolved oxygen (mg/L)	Alkalinity (mg/L as CaCO ₃)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)							
Aug 25, 1998	12:45	0.07	19.1	7.2	89	--	30
Dec 01, 1998	09:00	0.04	10.1	7.2	77	9.8	25
Mar 03, 1999	08:00	0.08	7.8	7.4	76	10.5	24
Jul 01, 1999	08:45	0.06	17.9	7.1	84	7.9	24.7
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)							
Aug 25, 1998	16:00	0.12	22.0	7.6	70	7.3	30
Dec 01, 1998	11:30	0.10	9.6	7.3	68	10.7	29
Mar 03, 1999	10:00	0.25	6.8	7.5	66	11.4	26
Jul 01, 1999	10:40	0.138	20.8	7.3	72	7.6	28.2
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)							
Aug 26, 1998	09:00	0.39	20.1	7.4	75	8.4	33
Dec 01, 1998	13:45	0.35	10.9	7.6	73	9.6	29
Mar 03, 1999	11:45	0.56	7.9	7.4	71	11.4	25
Jul 01, 1999	13:05	0.246	21.4	7.2	74	7.2	27.3
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)							
Aug 26, 1998	11:15	9.5	23.5	7.5	74	7.4	27
Dec 02, 1998	09:30	11	5.3	7.2	64	11.9	22
Mar 03, 1999	14:10	14	8.6	7.6	61	11.7	21
Jun 30, 1999	12:30	3.89	23.5	7.2	74	7.2	24.5

Table 3. Bacteria data.

[col/100 ml; colonies per 100 milliliters; e, estimated value; >, greater than;
K, non-ideal colony count, *, exceeds State water quality standard]

Date	Time	Total coliform (col/100 ml)	Fecal coliform (col/100 ml)	Fecal streptococcus (col/100 ml)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)				
Aug 25, 1998	12:45	>290	1,100K *	920
Dec 01, 1998	09:00	180	130K	390
Mar 03, 1999	08:00	260	29K	51K
Jul 01, 1999	08:45	>8,000	>6,000 *	>10,000
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)				
Aug 25, 1998	16:00	350	270	1,500
Dec 01, 1998	11:30	360	27K	310
Mar 03, 1999	10:00	160	31K	11K
Jul 01, 1999	10:40	5,200	3,400 *	5,900
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)				
Aug 26, 1998	09:00	2,420K	570K	>1,220
Dec 01, 1998	13:45	270	30K	42K
Mar 03, 1999	11:45	390	220	34K
Jul 01, 1999	13:05	15,000K	7,100K *	4,000
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)				
Aug 26, 1998	11:15	720	540	220
Dec 02, 1998	09:30	520K	280	390
Mar 03, 1999	14:10	410K	330K	>840
Jun 30, 1999	12:30	190	69K	173

Table 4. Nutrient data

[mg/L, milligrams per liter; N, nitrogen; P, phosphorous; <, less than; e, estimated value; --, no data]

Date	Time	Nitrogen, nitrite, dissolved (mg/L as N)	Nitrogen, nitrate + nitrite, dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, ammonia + organic, total (mg/L as N)	Nitrogen, ammonia + organic, dissolved (mg/L as N)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)						
Aug 25, 1998	12:45	0.011	0.538	0.095	<0.10	<0.10
Dec 01, 1998	09:00	<0.01	0.46	<0.02	0.3	<0.1
Mar 03, 1999	08:00	<0.01	0.64	<0.02	0.06e	<0.1
Jul 01, 1999	08:45	0.02	0.60	0.03	0.7	0.3
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)						
Aug 25, 1998	16:00	0.01	0.118	0.071	0.10	<0.1
Dec 01, 1998	11:30	<0.01	<0.05	<0.02	<0.1	<0.1
Mar 03, 1999	10:00	<0.01	0.05	<0.02	0.06e	0.05e
Jul 01, 1999	10:40	0.01	0.10	<0.02	0.2	0.1
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)						
Aug 26, 1998	09:00	0.010	0.176	0.094	<0.10	<0.10
Dec 01, 1998	13:45	<0.01	<0.05	<0.02	<0.1	<0.1
Mar 03, 1999	11:45	<0.01	0.10	0.03	0.09e	0.08e
Jul 01, 1999	13:05	0.01	0.19	<0.02	0.4	0.1
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)						
Aug 26, 1998	11:15	0.016	0.320	0.103	0.19	0.14
Dec 02, 1998	09:30	<0.01	<0.05	<0.02	0.1	0.1
Mar 03, 1999	14:10	<0.01	0.14	0.03	0.1	0.10e
Jun 30, 1999	12:30	0.06	0.54	0.08	0.4	0.4

Table 4. Nutrient data--Continued.

[mg/L, milligrams per liter; N, nitrogen; P, phosphorous;
< less than; --, no data]

Date	Time	Phosphorus, total (mg/L as P)	Phosphorus, dissolved (mg/L as P)	Orthophosphate, dissolved (mg/L as P)
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**Jack-O-Lantern Branch near Haleford Church near Scruggs, VA
(0205706010)**

Aug 25, 1998	12:45	0.012	<0.010	0.019
Dec 01, 1998	09:00	0.06	<0.05	0.01
Mar 03, 1999	08:00	0.019	0.004	<0.01
Jul 01, 1999	08:45	0.14	0.02	0.02

Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)

Aug 25, 1998	16:00	0.019	<0.01	0.015
Dec 01, 1998	11:30	<0.05	<0.05	<0.01
Mar 03, 1999	10:00	0.011	<0.004	<0.01
Jul 01, 1999	10:40	0.03	0.007	0.02

Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)

Aug 26, 1998	09:00	<0.010	<0.010	0.015
Dec 01, 1998	13:45	<0.05	<0.05	0.01
Mar 03, 1999	11:45	0.008	<0.004	<0.01
Jul 01, 1999	13:05	0.11	0.005	0.01

Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)

Aug 26, 1998	11:15	0.048	0.013	0.016
Dec 02, 1998	09:30	<0.05	<0.05	0.01
Mar 03, 1999	14:10	0.029	0.011	0.02
Jun 30, 1999	12:30	0.096	0.051	0.05

Table 5. Major-element data.

[mg/l, milligrams per liter, <, less than; --, no data]

Date	Time	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity (mg/L as CaCO ₃)	Sulfate, dissolved (mg/L as SO ₄)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)							
Aug 25, 1998	12:45	5.3	3.7	3.4	1.2	30	1.9
Dec 01, 1998	09:00	--	--	--	--	--	--
Mar 03, 1999	08:00	--	--	--	--	--	--
Jul 01, 1999	08:45	--	--	--	--	--	--
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)							
Aug 25, 1998	16:00	4.8	3.0	3.9	1.5	30	1.5
Dec 01, 1998	11:30	--	--	--	--	--	--
Mar 03, 1999	10:00	--	--	--	--	--	--
Jul 01, 1999	10:40	--	--	--	--	--	--
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)							
Aug 26, 1998	09:00	5.1	3.4	3.7	1.6	33	1.8
Dec 01, 1998	13:45	--	--	--	--	--	--
Mar 03, 1999	11:45	--	--	--	--	--	--
Jul 01, 1999	13:05	--	--	--	--	--	--
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)							
Aug 26, 1998	11:15	5.8	2.3	3.3	2.2	27	1.3
Dec 02, 1998	09:30	--	--	--	--	--	--
Mar 03, 1999	14:10	--	--	--	--	--	--
Jun 30, 1999	12:30	--	--	--	--	--	--

Table 5. Major-element data—Continued.
[mg/l, milligrams per liter, <, less than; --no data]

Date	Time	Chloride, dissolved (mg/l as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO ₂)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)				
Aug 25, 1998	12:45	4.2	<0.10	27
Dec 01, 1998	09:00	--	--	--
Mar 03, 1999	08:00	--	--	--
Jul 01, 1999	08:45	--	--	--
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)				
Aug 25, 1998	16:00	1.9	<0.10	30
Dec 01, 1998	11:30	--	--	--
Mar 03, 1999	10:00	--	--	--
Jul 01, 1999	10:40	--	--	--
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)				
Aug 26, 1998	09:00	2.4	<0.10	29
Dec 01, 1998	13:45	--	--	--
Mar 03, 1999	11:45	--	--	--
Jul 01, 1999	13:05	--	--	--
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)				
Aug 26, 1998	11:15	2.8	<0.10	16
Dec 02, 1998	09:30	--	--	--
Mar 03, 1999	14:10	--	--	--
Jun 30, 1999	12:30	--	--	--

Table 6.Trace-element data.

[ug/L, micrograms per liter; <, less than; --, no data]

Date	Time	Aluminum, total (ug/L as Al)	Arsenic, total (ug/L as As)	Barium, total (ug/L as Ba)	Beryllium, total (ug/L as Be)	Cadmium, total (ug/L as Cd)	Chromium, total (ug/L as Cr)	Cobalt, total (ug/L as Co)	Copper, total (ug/L as Cu)	Iron, total (ug/L as Fe)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)										
Aug 25, 1998	12:45	--	--	--	--	--	--	--	--	--
Dec 01, 1998	09:00	--	--	--	--	--	--	--	--	--
Mar 03, 1999	08:00	--	--	--	--	--	--	--	--	--
Jul 01, 1999	08:45	1,360	<1	67.7	<4	<1	8.3	3	27	2,570
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)										
Aug 25, 1998	16:00	--	--	--	--	--	--	--	--	--
Dec 01, 1998	11:30	--	--	--	--	--	--	--	--	--
Mar 03, 1999	10:00	--	--	--	--	--	--	--	--	--
Jul 01, 1999	10:40	198	<1	40.1	<4	<1	1.2	<1	2	698
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)										
Aug 26, 1998	09:00	--	--	--	--	--	--	--	--	--
Dec 01, 1998	13:45	--	--	--	--	--	--	--	--	--
Mar 03, 1999	11:45	--	--	--	--	--	--	--	--	--
Jul 01, 1999	13:05	1,270	<1	57.2	<4	<1	5.2	3	4	3,020
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)										
Aug 26, 1998	11:15	--	--	--	--	--	--	--	--	--
Dec 02, 1998	09:30	--	--	--	--	--	--	--	--	--
Mar 03, 1999	14:10	--	--	--	--	--	--	--	--	--
Jun 30, 1999	12:30	187	<1	22.2	<4	<1	<1.0	<1	4	754

Table 6. Trace-element data—Continued.

[ug/L, micrograms per liter; <, less than; e, estimated value; --, no data,

*, minimum reporting limit is above chronic toxicity standard]

Date	Time	Lead, total (ug/L as Pb)	Lithium, total (ug/L as Li)	Manganese total (ug/L as Mn)	Mercury, total (ug/L as Hg)	Molyb- denum, total (ug/L as Mo)	Nickel, total (ug/L as Ni)	Selenium, total (ug/L as Se)	Silver, total (ug/L as Ag)	Zinc, total (ug/L as Zn)
Jack-O-Lantern Branch near Haleford Church near Scruggs, VA (0205706010)										
Aug 25, 1998	12:45	--	--	--	--	--	--	--	--	--
Dec 01, 1998	09:00	--	--	--	--	--	--	--	--	--
Mar 03, 1999	08:00	--	--	--	--	--	--	--	--	--
Jul 01, 1999	08:45	3	<12	120	<0.1 *	<1.0	3	<1.0	<1.0	31.2e
Jack-O-Lantern Branch Tributary 1 near Scruggs, VA (0205706020)										
Aug 25, 1998	16:00	--	--	--	--	--	--	--	--	--
Dec 01, 1998	11:30	--	--	--	--	--	--	--	--	--
Mar 03, 1999	10:00	--	--	--	--	--	--	--	--	--
Jul 01, 1999	10:40	<1	<12	17.8	<0.1 *	<1.0	<1	<1.0	<1.0	<40
Jack-O-Lantern Branch at Mouth near Scruggs, VA (0205706030)										
Aug 26, 1998	09:00	--	--	--	--	--	--	--	--	--
Dec 01, 1998	13:45	--	--	--	--	--	--	--	--	--
Mar 03, 1999	11:45	--	--	--	--	--	--	--	--	--
Jul 01, 1999	13:05	3	<12	167	<0.1 *	<1.0	2	<1.0	<1.0	20.8e
Gills Creek above Jack-O-Lantern Branch near Scruggs, VA (02057060)										
Aug 26, 1998	11:15	--	--	--	--	--	--	--	--	--
Dec 02, 1998	09:30	--	--	--	--	--	--	--	--	--
Mar 03, 1999	14:10	--	--	--	--	--	--	--	--	--
Jun 30, 1999	12:30	<1	<12	54.6	<0.1 *	<1.0	<1	<1.0	<1.0	<40

GENERAL CLIMATIC AND HYDROLOGIC CONDITIONS

Most of the period of study occurred within the 1999 water year, October 1, 1998, through September 30, 1999. Published statistics (White and others, 1998, 1999) show that low streamflows across Virginia in the summer of 1998 continued to decrease during the autumn to levels below the normal range for that time of year. Normal precipitation in the winter of 1999 generally increased streamflows to levels in the normal range, but below median monthly flow. In the spring and summer of 1999, streamflows continued to decline to levels comparable to the four most severe drought periods since the early 1900's: the droughts of 1930-32, 1938-42, 1962-71, and 1980-82.

Analysis of streamflow records for two indicator gages located near the BOWA study area shows that for Back Creek near Dundee, Va. (USGS data), the annual mean streamflow for water year 1999 is 36 percent of the 26-year annual mean; and for Blackwater River near Rocky Mount, Va. (data from Virginia Department of Environmental Quality), annual mean streamflow for water year 1999 is 38 percent of the 24-year annual mean. At both gages, drought conditions were reduced somewhat during the first week of September by precipitation from Hurricane Dennis, but neither gage show much effect from Hurricane Floyd (mid-September) or from the cold front that produced a general rainfall on September 28-30. Records beginning in 1974 for Back Creek (02056650) and in 1977 for Blackwater River (02056900) show that drought conditions at both gages were not as severe as the drought of 1980-82.

EXCEEDENCES OF STATE WATER-QUALITY STANDARDS

In the BOWA study area, all water-quality measurements are within the surface water standards established by the Virginia State Water Control Board (1997), except as noted below.

Fecal coliform: Of 16 measurements of fecal coliform bacteria made in the study area, 4 measurements exceeded the standard of 1,000 bacteria per 100 milliliters (ml.). Bacteria counts of 1,120 per 100 ml. and more than 6,000 per 100 ml. were measured at station 0205706010 (Jack-O-Lantern Branch mainstem) on August 25, 1998, and July 1, 1999, respectively. One count of 3,400 bacteria per 100 ml. was measured at station 0205706020 (Tributary 1) on July 1, 1999; and one count of 7,100 bacteria per 100 ml. was measured at station 0205706030 (Jack-O-Lantern Branch mouth) on July 1, 1999.

Dissolved oxygen: Of 20 measurements of dissolved oxygen concentration made in the study area, area, 1 measurement is less than the minimum standard of 4.0 milligrams per liter (mg/L) for streamwater in the Piedmont zone. Dissolved oxygen concentration of 3.23 mg/L was measured at station 0205706010 (Jack-O-Lantern Branch mainstem) on August 25, 1998.

Copper: Of 4 measurements of copper concentration made in the study area, 1 measurement exceeded the chronic toxicity standard for freshwater aquatic life, 12 micrograms per liter (ug/L). Total copper concentration of 27.4 ug/L was measured at station 0205706010 (Jack-O-Lantern Branch mainstem) on July 1, 1999.

Mercury: Of 4 measurements of total mercury concentration made in the study area, 4 are reported as less than 0.1 micrograms per liter (ug/L), the minimum reporting level. The most restrictive standard limiting mercury concentration is the chronic toxicity limit for freshwater aquatic life, 0.012 ug/L. No inferences can be made about exceedence of this standard because the analytical determination is not meaningful in this concentration range. None of the samples, however, exceeded the acute toxicity limit for freshwater aquatic life, 2.4 ug/L.

SELECTED REFERENCES

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TABLE 1. SITES AT BOWA

Station Name	Station ID	Station Type	Description	Purpose	Latitude	Longitude
Jack-O-Lantern Branch nr Haleford Church nr Scruggs, VA	0205706010	Stream	Station is in BOWA. Surrounding area is moderately wooded with park trail passing nearby. Access is via Farm Trail Loop, approximately 0.3 miles from Visitor Center. Station is less than 50 feet below three springs that form stream.	Station was monitored as it is one of the park's key water bodies.	37° 06' 57"	79° 43' 50"
Jack-O-Lantern Branch Tributary 1 nr Scruggs, VA	0205706020	Stream	Station is on BOWA boundary. Surrounding area is heavily wooded. Access is via Jack-O-Lantern Branch Trail, approximately 0.5 miles from Visitor Center. Station is 15 feet upstream from confluence with Jack-O-Lantern Branch. Station located 1.0 mile south of State Highway 122.	Station was monitored as it is one of the park's key water bodies.	37° 06' 42"	79° 43' 45"
Jack-O-Lantern Branch at Mouth nr Scruggs, VA	0205706030	Stream	Station is on BOWA boundary. Surrounding area is heavily wooded. Access is via Jack-O-Lantern Branch Trail, approximately 0.8 miles from Visitor Center. Station is 40 feet upstream from confluence with Gills Creek.	Station was monitored as it is one of the park's key water bodies.	37° 06' 24"	79° 43' 50"

TABLE 1. SITES AT BOWA

Method of Determining Lat/Long	Map Scale	Referenced Datum	State	County	HUC	Elevation feet	Elevation Source	Elevation Datum	Secondary Name(s)
Manual map interpolation	1:24000	NAD1927	Virginia	Franklin	03010101	900	Topographic Map	Gage	none
Manual map interpolation	1:24000	NAD1927	Virginia	Franklin	03010101	850	Topographic Map	Gage	none
Manual map interpolation	1:24000	NAD1927	Virginia	Franklin	03010101	800	Topographic Map	Gage	none

TABLE 1. SITES AT BOWA

Gills Creek abv Jack-O-Lantern Branch nr Scruggs, VA	02057060	Stream	Station is in BOWA. Surrounding area is moderately wooded on left bank and has pasture on right bank. Access is via Jack-O-Lantern Branch Trail, approximately 0.8 miles from Visitor Center. Station is 35 feet upstream from confluence with Jack-O-Lantern Branch.	Station was monitored as it is one of the park's key water bodies.	37° 06' 25"	79° 43 '51"
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TABLE 1. SITES AT BOWA

Manual map interpolation	1:24000	NAD1927	Virginia	Franklin	03010101	800	Topographic Map	Gage	none
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TABLE 3. WQ PARAMETERS AT BOWA

PARAMETER NAME	Discharge (Q)
SAMPLE FRACTION	total
MEASUREMENT UNITS	cubic feet per second (cfs)
FIELD/LAB MEASUREMENT	field
VALUE TYPE	calculated
PREPARATION PROCEDURES	spin test
TRANSPORT/PRESERVATION	--
LAB ANALYTICAL PROCEDURE; SOURCE	current meter method; USGS
FIELD/LAB EQUIPMENT OR PROCEDURE	Wading rod and pygmy(P90267) or Price AA(A91114) velocity meter
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Water Temperature (WT)
SAMPLE FRACTION	total
MEASUREMENT UNITS	degrees Celsius (°C)
FIELD/LAB MEASUREMENT	field
VALUE TYPE	actual
PREPARATION PROCEDURES	calibration check w/ ASTM thermometer
TRANSPORT/PRESERVATION	--
LAB ANALYTICAL PROCEDURE; SOURCE	--
FIELD/LAB EQUIPMENT OR PROCEDURE	thermometer (YSI50B DO W#496703)
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Hydrogen Ion Activity (pH)
SAMPLE FRACTION	total

TABLE 3. WQ PARAMETERS AT BOWA

MEASUREMENT UNITS	pH units
FIELD/LAB MEASUREMENT	field
VALUE TYPE	actual
PREPARATION PROCEDURES	calibration w/ pH buffers 4, 7, 10
TRANSPORT/PRESERVATION	--
LAB ANALYTICAL PROCEDURE; SOURCE	--
FIELD/LAB EQUIPMENT OR PROCEDURE	Beckman 12 pH meter (W#563868)
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Hydrogen Ion Activity (pH)
SAMPLE FRACTION	total
MEASUREMENT UNITS	pH units
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	untreated, cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	electrometric electrode, pH, lab
DETECTION LIMIT	0.100
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Specific Conductance (SC)
SAMPLE FRACTION	total
MEASUREMENT UNITS	microsiemens per centimeter (uS/cm)
FIELD/LAB MEASUREMENT	field

TABLE 3. WQ PARAMETERS AT BOWA

VALUE TYPE	actual
PREPARATION PROCEDURES	calibration with SC standards 50 - 500
TRANSPORT/PRESERVATION	--
LAB ANALYTICAL PROCEDURE; SOURCE	--
FIELD/LAB EQUIPMENT OR PROCEDURE	Orion 122 SC meter (W#593055)
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)
PARAMETER NAME	Specific Conductance (SC)
SAMPLE FRACTION	total
MEASUREMENT UNITS	microsiemens per centimeter (uS/cm)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	untreated, cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Wheatstone Bridge, Specific conductance, lab, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Dissolved Oxygen (DO)
SAMPLE FRACTION	total
MEASUREMENT UNITS	milligrams per liter (mg/L)
FIELD/LAB MEASUREMENT	field
VALUE TYPE	actual

TABLE 3. WQ PARAMETERS AT BOWA

PREPARATION PROCEDURES	zero DO check, atmospheric calibration in water
TRANSPORT/PRESERVATION	--
LAB ANALYTICAL PROCEDURE; SOURCE	--
FIELD/LAB EQUIPMENT OR PROCEDURE	YSI 50B DO meter (W#496703)
DETECTION LIMIT	0.0
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Alkalinity
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as CaCO ₃ (mg/L as CaCO ₃)
FIELD/LAB MEASUREMENT	field
VALUE TYPE	calculated
PREPARATION PROCEDURES	filtration of water samples, 0.45 microns
TRANSPORT/PRESERVATION	--
LAB ANALYTICAL PROCEDURE; SOURCE	titration with H ₂ SO ₄
FIELD/LAB EQUIPMENT OR PROCEDURE	Hach alkalinity kit
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Acid Neutralizing Capacity (ANC)
SAMPLE FRACTION	total
MEASUREMENT UNITS	milligrams per liter as CaCO ₃ (mg/L as CaCO ₃)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	calculated
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	untreated, cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Electrometric Titration, Acid Neutralizing Capacity as CaCO ₃ , lab, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Nitrogen, ammonia
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as nitrogen (mg/L as N)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	untreated, cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry; Salicylate-hypochlorite
DETECTION LIMIT	0.02
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Nitrogen, ammonia + organic nitrogen
SAMPLE FRACTION	total
MEASUREMENT UNITS	milligrams per liter as nitrogen (mg/L as N)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	whole water sample
TRANSPORT/PRESERVATION	acidified to pH<2 with H ₂ SO ₄ , cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry; microkjeldahl digestion
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Nitrogen, ammonia + organic nitrogen
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as nitrogen (mg/L as N)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	untreated, cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry; microkjeldahl digestion
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Nitrogen, nitrite
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as nitrogen (mg/L as N)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	untreated, cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry
DETECTION LIMIT	0.01
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Nitrogen, nitrite + nitrate
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as nitrogen (mg/L as N)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	untreated, cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry, cadmium reduction-diazotization
DETECTION LIMIT	0.05
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Phosphorous
SAMPLE FRACTION	total
MEASUREMENT UNITS	milligrams per liter as phosphorous (mg/L as P)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	whole water sample
TRANSPORT/PRESERVATION	acidified to pH<2 with H ₂ SO ₄ , cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry; microkjeldahl digestion
DETECTION LIMIT	0.01
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Phosphorous
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as phosphorous (mg/L as P)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	untreated, cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry; microkjeldahl digestion
DETECTION LIMIT	0.01
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Phosphorous, phosphate, ortho
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as phosphorous (mg/L as P)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	untreated, cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S2702 NAWQA, Nutrients + Microkjeldahl P and N; Inorganics: Nutrients; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry; phosphomolybdate
DETECTION LIMIT	0.01
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Boron
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	micrograms per liter as boron (ug/L as B)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Inductively Coupled Plasma (ICP)
MAX/MIN QUANTIFICATION LIMITS	
DETECTION LIMIT	16
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Calcium
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as calcium (mg/L as Ca)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Inductively Coupled Plasma (ICP)
DETECTION LIMIT	0.02
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Chloride
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as chloride (mg/L as Cl)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Ion chromatography (IC)
MAX/MIN QUANTIFICATION LIMITS	
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Fluoride
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as fluoride (mg/L as F)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF), ion selective electrode
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Iron
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	micrograms per liter as iron (ug/L as Fe)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Inductively Coupled Plasma (ICP)
DETECTION LIMIT	10
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Magnesium
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as magnesium (mg/L as Mg)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics:

TABLE 3. WQ PARAMETERS AT BOWA

	Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Inductively Coupled Plasma (ICP)
MAX/MIN QUANTIFICATION LIMITS	
DETECTION LIMIT	0.004
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Manganese
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	micrograms per liter as manganese (ug/L as Mn)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Inductively Coupled Plasma (ICP)
DETECTION LIMIT	4
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Potassium
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as potassium (mg/L as K)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Atomic absorption (AA), flame
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Silica
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter is silica dioxide (mg/L as SiO ₂)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Automated-segmented flow (ASF) colorimetry, molybdate blue
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory
PARAMETER NAME	Sodium
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as sodium (mg/L as Na)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ , cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Inductively Coupled Plasma (ICP)
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Sulfate
SAMPLE FRACTION	dissolved
MEASUREMENT UNITS	milligrams per liter as sulfate (mg/L as SO ⁴)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S11 USGS National Water-Quality Laboratory Major Ions + Trace (Swapper); Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	Ion chromatography (IC)
DETECTION LIMIT	0.1
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Chromium
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as chromium (ug/L as Cr)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, chromium, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Arsenic
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as arsenic (ug/L as As)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, arsenic, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Cadmium
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as cadmium (ug/L as Cd)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, cadmium, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Molybdenum
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as molybdenum (ug/L as Mo)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, molybdenum, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Zinc
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as zinc (ug/L as Zn)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C

TABLE 3. WQ PARAMETERS AT BOWA

LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics; Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	ZINC WWR-ICP
MAX/MIN QUANTIFICATION LIMITS	
DETECTION LIMIT	40
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Nickel
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as nickel (ug/L as Ni)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics; Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, nickel, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Lithium
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as lithium (ug/L as Li)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw

TABLE 3. WQ PARAMETERS AT BOWA

TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	LITHIUM WWR-ICP
DETECTION LIMIT	12
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Selenium
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as selenium (ug/L as Se)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, selenium, water, WWR
DETECTION LIMIT	1.0
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Silver
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as silver (ug/L as Ag)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw

TABLE 3. WQ PARAMETERS AT BOWA

TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, silver, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Lead
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as lead (ug/L as Pb)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, lead, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Iron
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as iron (ug/L as Fe)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw

TABLE 3. WQ PARAMETERS AT BOWA

TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	IRON WWR-ICP
DETECTION LIMIT	14
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Mercury
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as mercury (ug/L as Hg)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ +K ₂ Cr ₂ O ₇ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	AA, manual cold vapor, mercury, WWR
DETECTION LIMIT	0.100
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Barium
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as barium (ug/L as Ba)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw

TABLE 3. WQ PARAMETERS AT BOWA

TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	BARIUM WWR-ICP
DETECTION LIMIT	1.2
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Beryllium
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as beryllium (ug/L as Be)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	BERYLLIUM WWR-ICP
DETECTION LIMIT	4
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Copper
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as copper (ug/L as Cu)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual

TABLE 3. WQ PARAMETERS AT BOWA

PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, copper, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Cobalt
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as cobalt (ug/L as Co)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	GFAA, cobalt, WWR
DETECTION LIMIT	1.000
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Aluminum
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as aluminum (ug/L as Al)
FIELD/LAB MEASUREMENT	lab

TABLE 3. WQ PARAMETERS AT BOWA

VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	ALUMINUM WWR-ICP
DETECTION LIMIT	28
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Manganese
SAMPLE FRACTION	total
MEASUREMENT UNITS	micrograms per liter as manganese (ug/L as Mn)
FIELD/LAB MEASUREMENT	lab
VALUE TYPE	actual
PREPARATION PROCEDURES	raw
TRANSPORT/PRESERVATION	acidified to pH<2 with HNO ₃ ; cooled to 4°C
LAB ANALYTICAL PROCEDURE; SOURCE	S197 USGS National Water-Quality Laboratory Trace Metals, WWR; Inorganics: Major Ions and Trace Metals; USGS National Water-Quality Laboratory
FIELD/LAB EQUIPMENT OR PROCEDURE	MANGANESE WWR-ICP
DETECTION LIMIT	3
PERSON/AGENCY THAT ANALYZED	USGS National Water-Quality Laboratory

PARAMETER NAME	Total Coliform (TC)
SAMPLE FRACTION	total
MEASUREMENT UNITS	colonies per 100 milliliters (col/100mL)
FIELD/LAB MEASUREMENT	field

TABLE 3. WQ PARAMETERS AT BOWA

VALUE TYPE	calculated
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	incubated, 24 hours at 35 °C
LAB ANALYTICAL PROCEDURE; SOURCE	membrane/vacuum filtration
FIELD/LAB EQUIPMENT OR PROCEDURE	hand-dip method
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Fecal Coliform (FC)
SAMPLE FRACTION	total
MEASUREMENT UNITS	colonies per 100 milliliters (col/100mL)
FIELD/LAB MEASUREMENT	field
VALUE TYPE	calculated
PREPARATION PROCEDURES	filtered, 0.65 microns
TRANSPORT/PRESERVATION	incubated, 24 hours at 44.5 °C
LAB ANALYTICAL PROCEDURE; SOURCE	membrane/vacuum filtration
FIELD/LAB EQUIPMENT OR PROCEDURE	hand-dip method
DETECTION LIMIT	--
PERSON/AGENCY WHO ANALYZED	Mike Gearheart (USGS)

PARAMETER NAME	Fecal Streptococcus (FS)
SAMPLE FRACTION	total
MEASUREMENT UNITS	colonies per 100 milliliters (col/100mL)
FIELD/LAB MEASUREMENT	field
VALUE TYPE	calculated
PREPARATION PROCEDURES	filtered, 0.45 microns
TRANSPORT/PRESERVATION	incubated, 48 hours at 35 °C
LAB ANALYTICAL PROCEDURE; SOURCE	membrane/vacuum filtration

TABLE 3. WQ PARAMETERS AT BOWA

FIELD/LAB EQUIPMENT OR PROCEDURE	hand-dip method
DETECTION LIMIT	--
PERSON/AGENCY THAT ANALYZED	Mike Gearheart (USGS)

TABLE 2. WQ DATA AT BOWA

[--, no data available]

Station Name	Station ID	Date	Time	Medium	Sampling Depth
		mm/dd/yy	hh:mm:ss		feet
Jack-O-Lantern Branch nr Haleford Church nr Scruggs, VA	0205706010	08/25/98	12:45:00	Water	0.5
Jack-O-Lantern Branch nr Haleford Church nr Scruggs, VA	0205706010	12/01/98	9:00:00	Water	0.5
Jack-O-Lantern Branch nr Haleford Church nr Scruggs, VA	0205706010	03/03/99	8:00:00	Water	0.3
Jack-O-Lantern Branch nr Haleford Church nr Scruggs, VA	0205706010	07/01/99	8:45:00	Water	0.2
Jack-O-Lantern Branch Trib 1 nr Scruggs, VA	0205706020	08/25/98	16:00:00	Water	0.2
Jack-O-Lantern Branch Trib 1 nr Scruggs, VA	0205706020	12/01/98	11:30:00	Water	0.5
Jack-O-Lantern Branch Trib 1 nr Scruggs, VA	0205706020	03/03/99	10:00:00	Water	0.3
Jack-O-Lantern Branch Trib 1 nr Scruggs, VA	0205706020	07/01/99	10:40:00	Water	--
Jack-O-Lantern Branch at Mouth nr Scruggs, VA	0205706030	08/26/98	9:00:00	Water	0.2
Jack-O-Lantern Branch at Mouth nr Scruggs, VA	0205706030	12/01/98	13:45:00	Water	0.2
Jack-O-Lantern Branch at Mouth nr Scruggs, VA	0205706030	03/03/99	11:45:00	Water	0.2
Jack-O-Lantern Branch at Mouth nr Scruggs, VA	0205706030	07/01/99	13:05:00	Water	0.3
Gills Creek abv Jack-O-Lantern Branch nr Scruggs, VA	02057060	08/26/98	11:15:00	Water	1.0
Gills Creek abv Jack-O-Lantern Branch nr Scruggs, VA	02057060	12/02/98	9:30:00	Water	1.0
Gills Creek abv Jack-O-Lantern Branch nr Scruggs, VA	02057060	03/03/99	14:10:00	Water	0.8
Gills Creek abv Jack-O-Lantern Branch nr Scruggs, VA	02057060	06/30/99	12:30:00	Water	0.4

TABLE 2. WQ DATA AT BOWA

Station ID	Sample Collector	Discharge	Specific Conductance - field	pH - field	Water Temperature
		cu ft per sec	microSiemens per cm at 25 degrees Celsius	standard pH units	degrees Celsius
0205706010	J. Michael Gearheart (USGS)	0.07	89	7.2	19.1
0205706010	J. Michael Gearheart (USGS)	0.04	77	7.2	10.1
0205706010	J. Michael Gearheart (USGS)	0.08	76	7.4	7.8
0205706010	J. Michael Gearheart (USGS)	0.06	84	7.1	17.9
0205706020	J. Michael Gearheart (USGS)	0.12	70	7.6	22.0
0205706020	J. Michael Gearheart (USGS)	0.10	68	7.3	9.6
0205706020	J. Michael Gearheart (USGS)	0.25	66	7.5	6.8
0205706020	J. Michael Gearheart (USGS)	0.14	72	7.3	20.8
0205706030	J. Michael Gearheart (USGS)	0.39	75	7.4	20.1
0205706030	J. Michael Gearheart (USGS)	0.35	73	7.6	10.9
0205706030	J. Michael Gearheart (USGS)	0.56	71	7.4	7.9
0205706030	J. Michael Gearheart (USGS)	0.246	74	7.2	21.4
02057060	J. Michael Gearheart (USGS)	9.5	74	7.5	23.5
02057060	J. Michael Gearheart (USGS)	11	64	7.2	5.3
02057060	J. Michael Gearheart (USGS)	14	61	7.6	8.6
02057060	J. Michael Gearheart (USGS)	3.89	74	7.2	23.5

TABLE 2. WQ DATA AT BOWA

Station ID	Dissolved Oxygen	Total Coliform	Fecal Coliform
	milligrams per liter	colonies per 100 ml	colonies per 100 milliliters
0205706010	--	>290	1,100 non-ideal colony count
0205706010	9.8	176	127 non-ideal colony count
0205706010	10.5	260	29 non-ideal colony count
0205706010	7.9	>8,000 non-ideal colony count	>6,000
0205706020	7.3	350	270
0205706020	10.7	360	27 non-ideal colony count
0205706020	11.4	160 estimated count	31 non-ideal colony count
0205706020	7.6	5,200	3,400
0205706030	8.4	2,420 non-ideal colony count	570 non-ideal colony count
0205706030	9.6	270	30 non-ideal colony count
0205706030	11.4	390	220
0205706030	7.2	15,000 non-ideal colony count	7,100 non-ideal colony count
02057060	7.4	720	540
02057060	11.9	520 non-ideal colony count	280
02057060	11.7	410 non-ideal colony count	331 non-ideal colony count
02057060	7.2	193	69 non-ideal colony count

TABLE 2. WQ DATA AT BOWA

Station ID	Fecal Streptococcus	Calcium - Dissolved	Magnesium - Dissolved
	colonies per 100 milliliters	<i>detection limit = 0.020</i> micrograms per liter as calcium	<i>detection limit = 0.004</i> milligrams per liter as magnesium
0205706010	920	5.3	3.7
0205706010	387	--	--
0205706010	51 non-ideal colony count	--	--
0205706010	>10,000 non-ideal colony count	--	--
0205706020	1500	4.8	3.0
0205706020	310	--	--
0205706020	11 non-ideal colony count	--	--
0205706020	5,900	--	--
0205706030	>1,220	5.1	3.4
0205706030	42 non-ideal colony count	--	--
0205706030	34	--	--
0205706030	4,000	--	--
02057060	220	5.8	2.3
02057060	390	--	--
02057060	>840	--	--
02057060	173	--	--

TABLE 2. WQ DATA AT BOWA

Station ID	Sodium - Dissolved <i>detection limit = 0.06</i> milligrams per liter as sodium	Potassium - Dissolved <i>detection limit = 0.100</i> milligrams per liter as potassium	Alkalinity - field milligrams per liter as calcium carbonate	Alkalinity - lab <i>detection limit = 1</i> milligrams per liter as calcium carbonate
0205706010	3.4	1.2	30	30
0205706010	--	--	25	--
0205706010	--	--	24	--
0205706010	--	--	24.7	--
0205706020	3.9	1.5	30	30
0205706020	--	--	29	--
0205706020	--	--	26	--
0205706020	--	--	28.2	--
0205706030	3.7	1.6	33	33
0205706030	--	--	29	--
0205706030	--	--	25	--
0205706030	--	--	27.3	--
02057060	3.3	2.2	27	27
02057060	--	--	22	--
02057060	--	--	21	--
02057060	--	--	24.5	--

TABLE 2. WQ DATA AT BOWA

Station ID	Sulfate - Dissolved <i>detection limit = 0.100</i> milligrams per liter as sulfate	Chloride - Dissolved <i>detection limit = 0.100</i> micrograms per liter as chloride	Fluoride - Dissolved <i>detection limit = 0.100</i> micrograms per liter as fluoride	Silica - Dissolved <i>detection limit = 0.100</i> milligrams per liter as silica dioxide
0205706010	1.9	4.2	<0.10	27
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706020	1.5	1.9	<0.10	30
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706030	1.8	2.4	<0.10	29
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	--	--	--	--
02057060	1.3	2.8	<0.10	16
02057060	--	--	--	--
02057060	--	--	--	--
02057060	--	--	--	--

TABLE 2. WQ DATA AT BOWA

Station ID	Nitrogen, Nitrite - Dissolved <i>detection limit = 0.010</i> milligrams per liter as nitrogen	NO2 + NO3 - Dissolved <i>detection limit = 0.050</i> milligrams per liter as nitrogen	Nitrogen Ammonia - Diss <i>detection limit = 0.10</i> milligrams per liter as nitrogen	Nitrogen, Amn & Org - Total <i>detection limit = 0.10</i> milligrams per liter as nitrogen
0205706010	0.011	0.538	0.095	<0.10
0205706010	<0.01	0.46	<0.02	0.3
0205706010	<0.01	0.64	<0.02	0.06
0205706010	0.02	0.60	0.03	0.725
0205706020	0.01	0.118	0.07	0.104
0205706020	<0.01	<0.05	<0.02	<0.1
0205706020	<0.01	0.053	<0.02	0.063
0205706020	0.01	0.103	<0.02	0.202
0205706030	0.010	0.176	0.094	<0.10
0205706030	<0.01	<0.05	<0.02	<0.1
0205706030	<0.01	0.10	0.03	0.09
0205706030	0.01	0.19	<0.02	0.4
02057060	0.016	0.320	0.103	0.19
02057060	<0.01	<0.05	<0.02	0.1
02057060	<0.01	0.14	0.03	0.1
02057060	0.06	0.54	0.08	0.4

TABLE 2. WQ DATA AT BOWA

Station ID	Nitrogen, Amn & Org - Dissolved <i>detection limit = 0.10</i> milligrams per liter as nitrogen	Phosphorous - Total <i>detection limit = 0.005</i> milligrams per liter as phosphorous
0205706010	<0.10	0.012
0205706010	<0.1	0.06
0205706010 estimated value	<0.1	0.019
0205706010	0.3	0.14
0205706020	<0.1	0.019
0205706020	<0.1	0.012
0205706020 estimated value	0.05 estimated value	0.011
0205706020	0.1	0.03
0205706030	<0.10	<0.010
0205706030	<0.1	0.02
0205706030 estimated value	0.08 estimated value	0.008
0205706030	0.1	0.11
02057060	0.14	0.048
02057060	0.1	0.03
02057060	0.10 estimated value	0.029
02057060	0.4	0.096

TABLE 2. WQ DATA AT BOWA

Station ID	Phosphorous - Dissolved <i>detection limit = 0.005</i> milligrams per liter as phosphorous	Orthophosphate - Dissolved <i>detection limit = 0.010</i> milligrams per liter as phosphorous	Aluminum - Total <i>detection limit = 28</i> micrograms per liter as aluminum
0205706010	<0.010	0.019	--
0205706010	0.02	0.01	--
0205706010	0.004	<0.01	--
0205706010	0.02	0.02	1,360
0205706020	<0.01	0.015	--
0205706020	0.012	<0.01	--
0205706020	<0.004	<0.01	--
0205706020	0.007	0.02	198
0205706030	<0.010	0.015	--
0205706030	0.01	0.01	--
0205706030	<0.004	<0.01	--
0205706030	0.005	0.01	1270
02057060	0.013	0.016	--
02057060	0.02	0.01	--
02057060	0.011	0.02	--
02057060	0.051	0.05	187

TABLE 2. WQ DATA AT BOWA

Station ID	Arsenic - Total <i>detection limit = 1.000</i> micrograms per liter as arsenic	Barium - Total <i>detection limit = 1.2</i> micrograms per liter as barium	Beryllium - Total <i>detection limit = 4</i> micrograms per liter as beryllium	Boron - Dissolved <i>detection limit = 16</i> micrograms per liter as boron
0205706010	--	--	--	<16
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	<1	67.7	<4	--
0205706020	--	--	--	<16
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	<1	40.1	<4	--
0205706030	--	--	--	<16
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	<1	57.2	<4	--
02057060	--	--	--	<16
02057060	--	--	--	--
02057060	--	--	--	--
02057060	<1	22.2	<4	--

TABLE 2. WQ DATA AT BOWA

Station ID	Cadmium - Total <i>detection limit = 1.000</i> micrograms per liter as cadmium	Chromium - Total <i>detection limit = 1.000</i> micrograms per liter as chromium	Cobalt - Total <i>detection limit = 1.000</i> micrograms per liter as cobalt	Copper - Total <i>detection limit = 1.000</i> micrograms per liter as copper
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	<1	8.3	3	27
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	<1	1.2	<1	2
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	<1	5.2	3	4
02057060	--	--	--	--
02057060	--	--	--	--
02057060	--	--	--	--
02057060	<1	<1.0	<1	4

TABLE 2. WQ DATA AT BOWA

Station ID	Iron - Total <i>detection limit = 14</i> micrograms per liter as iron	Iron - Dissolved <i>detection limit = 10.000</i> micrograms per liter as iron	Lead - Total <i>detection limit = 1.000</i> micrograms per liter as lead	Lithium - Total <i>detection limit = 12</i> micrograms per liter as lithium
0205706010	--	<10	--	--
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	2,570	--	3	<12
0205706020	--	13	--	--
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	698	--	<1	<12
0205706030	--	49	--	--
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	3,020	--	3	<12
02057060	--	20	--	--
02057060	--	--	--	--
02057060	--	--	--	--
02057060	754	--	<1	<12

TABLE 2. WQ DATA AT BOWA

Station ID	Manganese - Total <i>detection limit = 3</i> micrograms per liter as manganese	Manganese - Dissolved <i>detection limit = 3.0</i> micrograms per liter as manganese	Mercury - Total <i>detection limit = 0.100</i> micrograms per liter as mercury
0205706010	--	12	--
0205706010	--	--	--
0205706010	--	--	--
0205706010	120	--	<0.01
0205706020	--	8.6	--
0205706020	--	--	--
0205706020	--	--	--
0205706020	17.8	--	<0.01
0205706030	--	24	--
0205706030	--	--	--
0205706030	--	--	--
0205706030	167	--	<0.01
02057060	--	24	--
02057060	--	--	--
02057060	--	--	--
02057060	54.6	--	<0.01

TABLE 2. WQ DATA AT BOWA

Station ID	Molybdenum - Total <i>detection limit = 1.000</i> micrograms per liter as molybdenum	Nickel - Total <i>detection limit = 1.000</i> micrograms per liter as nickel	Selenium - Total <i>detection limit = 1.0</i> micrograms per liter as selenium	Silver - Total <i>detection limit = 1.000</i> micrograms per liter as silver
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	--	--	--	--
0205706010	<1.0	3	<1	<1
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	--	--	--	--
0205706020	<1.0	<1	<1	<1
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	--	--	--	--
0205706030	<1.0	2	<1	<1
02057060	--	--	--	--
02057060	--	--	--	--
02057060	--	--	--	--
02057060	<1.0	<1	<1	<1

TABLE 2. WQ DATA AT BOWA

Station ID	Zinc - Total
	<i>detection limit = 40</i> micrograms per liter as zinc
0205706010	--
0205706010	--
0205706010	--
0205706010	31.2
0205706020	--
0205706020	--
0205706020	--
0205706020	<40
0205706030	--
0205706030	--
0205706030	--
0205706030	20.8
02057060	--
02057060	--
02057060	--
02057060	<40