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OBED WILD AND SCENIC RIVER

WATER QUALITY REPORT

Michael Rikard

Hydrologist

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Obed Wild and Scenic River

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In order to determine the current status of the waters of the Obed Wild and Scenic River (OBRI), and with future management practices in mind, a water quality monitoring program was developed and implemented for OBRI in November, 1982. The objectives of the monitoring program were as follows:

- 1) collect background water quality data
- 2) identify areas of existing and potential water quality problems
- 3) monitor changes in water quality over time
- 4) provide data for effective natural resource management and for the determination of future needs
- 5) help maintain or improve water quality for visitor protection
- 6) help protect the aesthetic, ecological, and recreational values of the area

Water Quality Concerns

Because the Obed Wild and Scenic River consists only of a narrow corridor along the Obed River, Emory River, and Clear Creek activities occurring outside the park area greatly influence the waters of OBRI. Coal mining, oil and gas drilling, sewage discharge, agricultural and forestry practices, and garbage disposal, and all the associated problems have affected the water quality of OBRI.

Coal mining is a major source of water pollution in OBRI. Acid runoff from both active and abandoned mines and increased sedimentation from erosion of mine spoils and unimproved dirt roads are impacts associated with coal mining. Impacts from mining can be elevated levels of sulfate, iron, manganese, aluminum, and sediment. These conditions are not only deleterious to aquatic life, but they reduce a streams aesthetic values and render it less desirable even for noncontact recreation.

Oil and gas drilling also causes water quality problems. However, because the concomitant impacts occur primarily during the drilling process, they are sporadic and therefore difficult to document. Nonetheless, such drilling by-products as brine water, oil, acid, sudsing agents, and other chemicals often end

up in nearby streams, As with surface mining, land clearing and road building result in further erosion of soil and increased sedimentation in the waterways.

The sewage treatment plant in Crossville, Tennessee, is another source of pollution entering the OBRI watershed. The sewage treatment plant has had problems in the past with by-passing of effluents. This problem has been corrected, although, the Obed River still exhibits the influences of discharge of treated sewage.

Agricultural and forestry practices also impact the waters of OBRI. Affects from these practices include increased sedimentation, elevated dissolved solids content, and increased bacteria levels.

Water Quality Monitoring Program

Twelve sampling sites were established on the OBRI. The sites were scheduled to be sampled on a monthly basis. However, because of conflicting duties, inclement weather, and vehicle break-downs this schedule could not always be maintained. Table 1 contains a list of the sites and their location.

Table 1. Sampling sites for the Obed Wild and Scenic River

<u>Stream</u>	<u>Site #</u>	<u>Location</u>
Clear Creek	CC-1	Lilly Bridge
Clear Creek	CC-2	Barnett Bridge
Clear Creek	CC-3	Norris Ford
Daddys Creek	DC-2	Devils Breakfast Table
Emory River	ER-1	Nemo Bridge, above Rock Creek
Emory River	ER-2	above Emory-Obed Junction
Otter Creek	OC-1	at road crossing in Catoosa WMA
Obed River	OR-1	Obed Junction below Daddys Creek
Obed River	OR-2	Potters Ford
Obed River	OR-3	Adams Bridge
Rock Creek	RC-1	mouth near Nemo Bridge
White Creek	WH-1	mouth near Barnett Bridge

Fifteen water quality parameters were selected as necessary to identify water quality concerns and to meet the water monitoring objectives described earlier. Table 2 summarizes these fifteen parameters and the methods of analysis used for each. Temperature, pH, conductivity, and dissolved oxygen were determined in the field; all other parameters were determined in the laboratory at the Big South Fork National River and Recreation Area. Bacteria analysis only was performed at site OR-2.

Table 2. Field and laboratory procedures used for analysis of the 15 water quality parameters used in the study.

<u>Parameter</u>	<u>Method of Analysis</u>
Temperature and Dissolved Oxygen	YSI Model 58 Dissolved Oxygen-Temperature Meter (field analysis)
pH	Orion Model 399 A/F pH Meter with Combination Electrode (field analysis)
Conductivity	Beckman Model RB-5 and RB-6 Conductivity Meter (field analysis)
Alkalinity	Hach Digital Titrator using Sulfuric Acid and Bromcresol Green-Methyl Red Indicator (laboratory analysis)
Acidity	Hach Digital Titrator using Sodium Hydroxide and Phenolphthalein Indicator (laboratory analysis)
Hardness	Hach Digital Titrator using EDTA Tetrasodium Salt and "ManVer" Hardness Indicator (laboratory analysis)
Chloride	Hach Digital Titrator using Mercuric Nitrate and Diphenylcarbazone Indicator (laboratory analysis)
Iron, Sulfate, and Manganese	Bausch & Lomb Spectronic 20 using Bausch & Lomb "Spectrokits" (laboratory analysis)
Turbidity	Hach Model 2100 Turbidimeter (laboratory analysis)
Total Coliform, Fecal Coliform, and Fecal Streptococcus	Membrane Filtration using ENDO, MF-C, and Azide Media (laboratory analysis)

Water Quality Parameters

Temperature

Temperature is a water quality parameter that directly affects aquatic life, especially since oxygen becomes less soluble in water as water temperature increases. Increased temperatures accelerate the biodegradation of organic material both in the overlying water and in bottom deposits, thus increasing demands on the oxygen resources of a given system. These increased demands can lead to total oxygen depletion and noxious septic conditions. Temperature also affects the self-purification phenomenon in water bodies and therefore the aesthetic and

sanitary qualities that exist.

pH

A pH measurement quantifies the hydrogen ion activity in a water sample. It is mathematically related to hydrogen ion activity according to the expression: $\text{pH} = -\log_{10}(\text{H}^+)$, where (H^+) is the hydrogen ion activity. Measurement of pH is based on a scale of 0 to 14 where 7 is neutral, less than 7 acidic, and greater than 7 alkaline. Because pH is a logarithmic function, a change from pH 7.0 to pH 6.0 is a ten-fold increase in acidity, and a change from pH 7.0 to 5.0 is a 100-fold increase in acidity. The pH for naturally-occurring unpolluted waters within OBRI normally ranges from 6.0 to 8.0.

In OBRI, pH is affected by the presence of acid mine drainage, which is formed through a complex series of chemical reactions. During the course of mining activities, pyrite (ferrous sulfate) is exposed to air and oxidizes to ferric sulfate. Hydrolysis of the ferric sulfate leads to the formation of ferric hydroxide ($\text{Fe}(\text{OH})_3$) and sulfuric acid (H_2SO_4). Further reactions result in a mixture of sulfuric acid, iron compounds, acid salts, and other elements. This mixture is known as acid mine drainage.

Specific Electrical Conductance

Specific electrical conductance, or conductivity, is a measure of the capacity of water to convey an electrical current. It is an indication of the concentration of ionized substances, which constitute much of the total dissolved solids in streams. As such, conductivity is a good indicator of a variety of impacts on water quality.

Dissolved Oxygen

Dissolved oxygen historically has been a constituent of major interest in water quality investigations. It is generally considered to be significant in the protection of aesthetic qualities of water as well as in the maintenance of fish populations and other aquatic life. Dissolved oxygen concentrations are an important gauge of existing water quality and the ability of a water body to support a well-balanced aquatic environment.

Alkalinity

Alkalinity is the sum total of components in the water that tend to elevate the pH of the water. Examples of commonly occurring constituents of natural waters that increase the alkalinity are carbonates, bicarbonates, phosphates, and hydroxides. Alkalinity is a measure of the buffering capacity of the water or the water's ability of buffer against acids and avoid depressed pH levels. Since pH has a direct affect on organisms and influences the toxicity of certain pollutants in the water, the buffering capacity is important.

Acidity

Acidity is an expression of a water's capacity to donate hydrogen ions. In other words, it is the strength of the acids in water or the water's corrosiveness. Natural waters of OBRI should have an acidity value approximately equal to or less than that of alkalinity.

Hardness

Water hardness is caused by the polyvalent metallic and alkaline earth ions dissolved in water. In fresh waters these are principally calcium and magnesium (divalent), although other metals such as iron, strontium, and manganese may contribute. Hardness is commonly reported as an equivalent concentration of calcium carbonate (CaCO_3).

Chloride

Chloride is an ion normally associated with sewage treatment, the use of road salt, or brine water from drilling activities. Thus, elevated chloride levels can indicate pollution from these sources.

Iron and Manganese

Natural waters contain variable but minor amounts of iron. Manganese is found in various salts and minerals, frequently in association with iron compounds, but does not occur naturally as a metal. As the principal metals associated with acid mine drainage, iron and manganese serve as indicators of mining impacts on water.

Sulfate

Sulfate is widely distributed in nature and may be present in natural waters in concentrations ranging from a few to several thousand milligrams per liter. Mine drainage wastes may contribute large amounts of sulfate through pyrite oxidation.

Turbidity

Turbidity measures an optical property of the water sample which results from the scattering and absorption of light by the particulate matter present. The amount of turbidity registered is dependent on such variables as size, shape and refractive indices of the particles. Turbidity occurs in most surface waters as a result of suspended clay, silt, finely divided organic and inorganic matter, plankton, and other microorganisms.

Bacterial Analyses

Bacterial analyses are used as an indication of sewage impacts. Total coliform bacteria are an index of levels of enteric organisms present in water but include certain non-enteric organisms as well. Fecal coliform and fecal streptococci normally occur in the fecal waste of humans and other warm-blooded animals.

Discussion

Because OBRI does not have any totally forested, unimpacted watersheds the waters of OBRI experience influences of varying degrees from the activities mentioned earlier. However, Table 3 lists the water quality conditions typically observed in natural, unpolluted streams in the Big South Fork National River and Recreation Area an adjacent watershed of similar topography and geology.

Table 3. The water quality conditions typically observed in natural, unpolluted streams in the BISO area.

<u>Parameter</u>	<u>Typical Levels</u>
Temperature	0 to 25°C
pH	6.0 to 8.0
Conductivity	<60 umhos/cm in limestone-affected waters <30 umhos/cm in waters unaffected by limestone
Dissolved Oxygen	>5.0 mg/l
Alkalinity	>Acidity <10 mg/l in waters unaffected by limestone
Hardness	<30 mg/l in limestone-affected waters <15 mg/l in waters unaffected by limestone
Chloride	<5.0 mg/l
Iron	<0.2 mg/l
Manganese	<0.5 mg/l
Sulfate	<10 mg/l
Turbidity	<10 NTU

Clear Creek

Clear Creek experienced slightly elevated levels of conductivity, mean equal to 53 umhos/cm, indicating probable runoff from agriculture and/or forestry practices. Elevated levels of fecal streptococcus also indicate probable runoff from agriculture. Sites CC-1 and CC-2 experienced a small increase in chloride during low flow months (September and October) suggesting impacts from either brine water or sewage. Sulfate levels above 10 mg/l were also measured Clear Creek showing minor runoff from coal mines. Turbidity levels rose moderately, >10 NTU's, during storm events but otherwise remained low.

Daddys Creek

Elevated levels of conductivity, hardness, and fecal streptococcus, means equal to 73 umhos/cm, 28.4 mg/l, and 10156 colonies/100ml respectively, show impacts from agricultural and/or forestry practices are occurring on Daddys Creek. However, these impacts are taking place several miles upstream of the sampling site as the stream flows through the Catoosa Wildlife Management Area before reaching the sampling site. Turbidity increased slightly during storm events but otherwise remained low, below 5 NTU's. No mining or drilling impacts were indicated by the data collected on Daddys Creek.

Emory River

Emory River experiences impacts from mining activities as shown by elevated levels of sulfate, ranging between <10 to 32 mg/l. However, sulfates levels are lower at ER-1 than at site ER-2 due to a dilution factor from the Obed River. Mining impacts have also increased conductivity and hardness levels, with means of 68 umhos/cm and 32.5 mg/l respectively at site ER-2. pH, however, remained near neutral. Turbidity has also been affected by mining with a maximum reading of 78.0 NTU's at site ER-2.

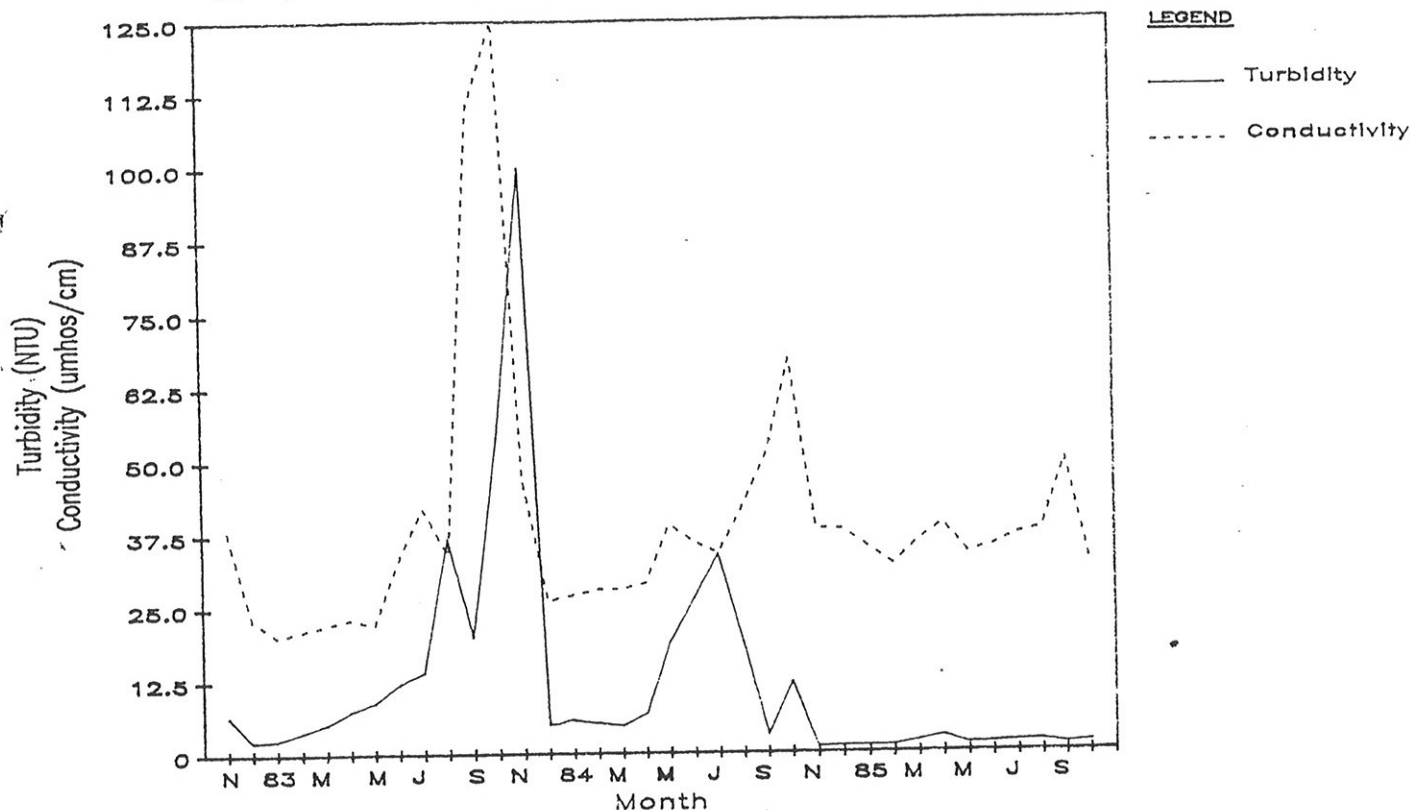
Otter Creek

Otter Creek has been affected by the Fairfield Glades development upstream. Conductivity and turbidity levels rose sharply during the summer and fall of 1983 (Fig. 1). During this time the bottom of Otter Creek became covered with silt. Fairfield Glades has since corrected their disturbance. The silt is now being washed out of Otter Creek and turbidity levels have dropped considerably. Otter Creek experiences no other problems.

Obed River

The major influence on the Obed River is the sewage treatment plant at Crossville, TN. Fecal coliform and fecal streptococcus counts are high at site OR-3 with means of 288 and 14095 colonies/100ml respectively. As the Obed River flows downstream bacteria counts are reduced to a mean of 50 and 7054 colonies/100ml for fecal coliform and fecal streptococcus at site

Figure 1. A comparison of turbidity and conductivity levels on Otter Creek for the period of November, 1982, through October, 1985.



OR-1. During the summer and fall of 1983 site OR-3 experienced small increases in sulfate above 10 mg/l with a maximum reading of 16 mg/l. Conductivity also increased during this period with readings of 135, 187, and 195 umhos/cm. This indicates slight impacts from mining but this was the only time sulfate levels increased.

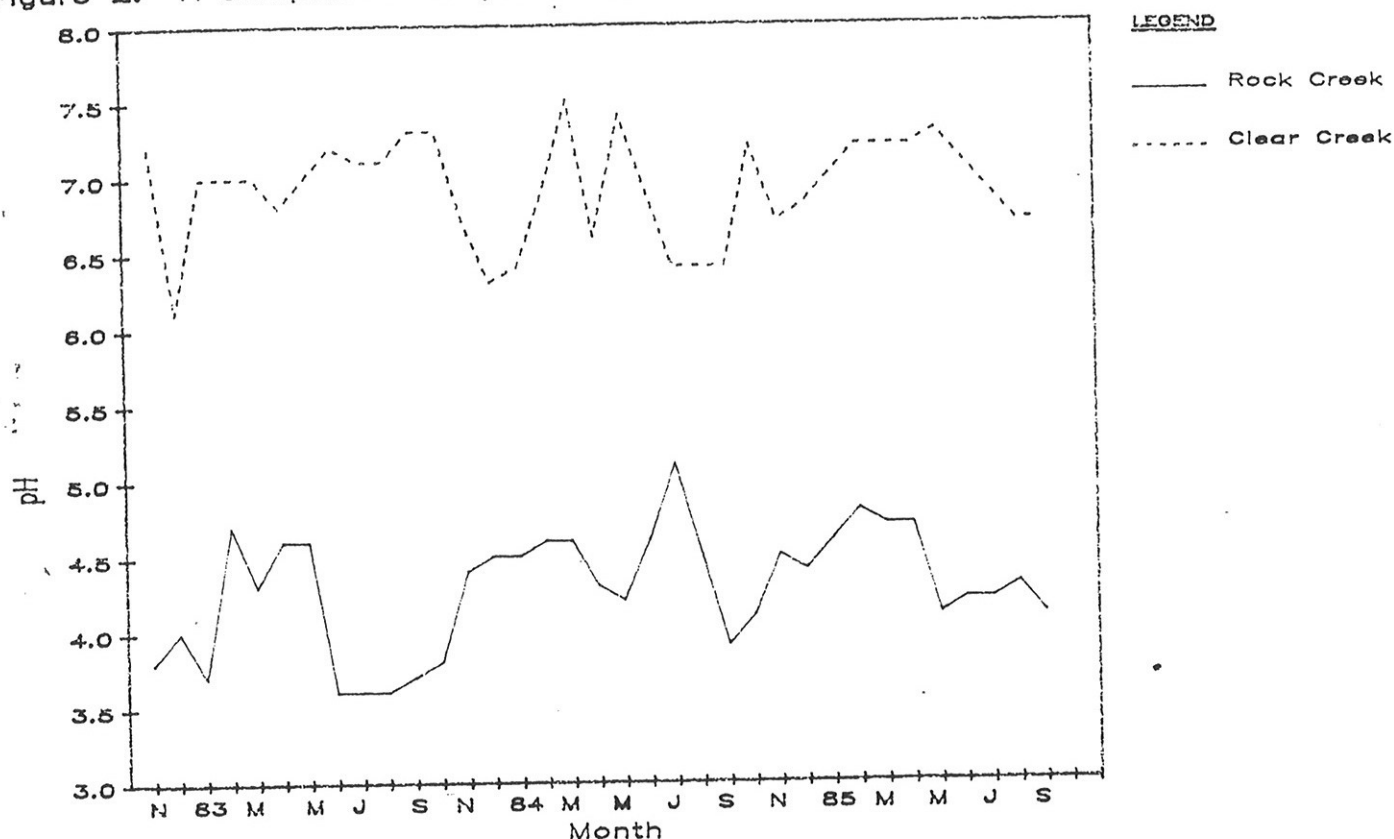
Rock Creek

Rock Creek is extremely degraded by acid mine drainage. Alkalinity and pH readings had a mean of 0.6 mg/l and 4.3, respectively, indicating severe impacts on water quality. Iron, manganese, sulfate, and conductivity readings were also elevated. It is doubtful if little or any aquatic life can survive in this stream. A comparison of pH for a severely impacted stream, Rock Creek, and a slightly impacted stream, Clear Creek, is shown in figure 2.

White Creek

White Creek experienced moderate levels of conductivity and hardness with means of 52 umhos/cm and 14.6 mg/l, respectively, indicating only slight impacts, probably from agriculture and forestry practices. Sulfate levels remain below 10 mg/l, except for one reading of 15 mg/l, suggesting no influences from mining.

Figure 2. A comparison of pH for Rock Creek and Clear Creek, site CC-1.

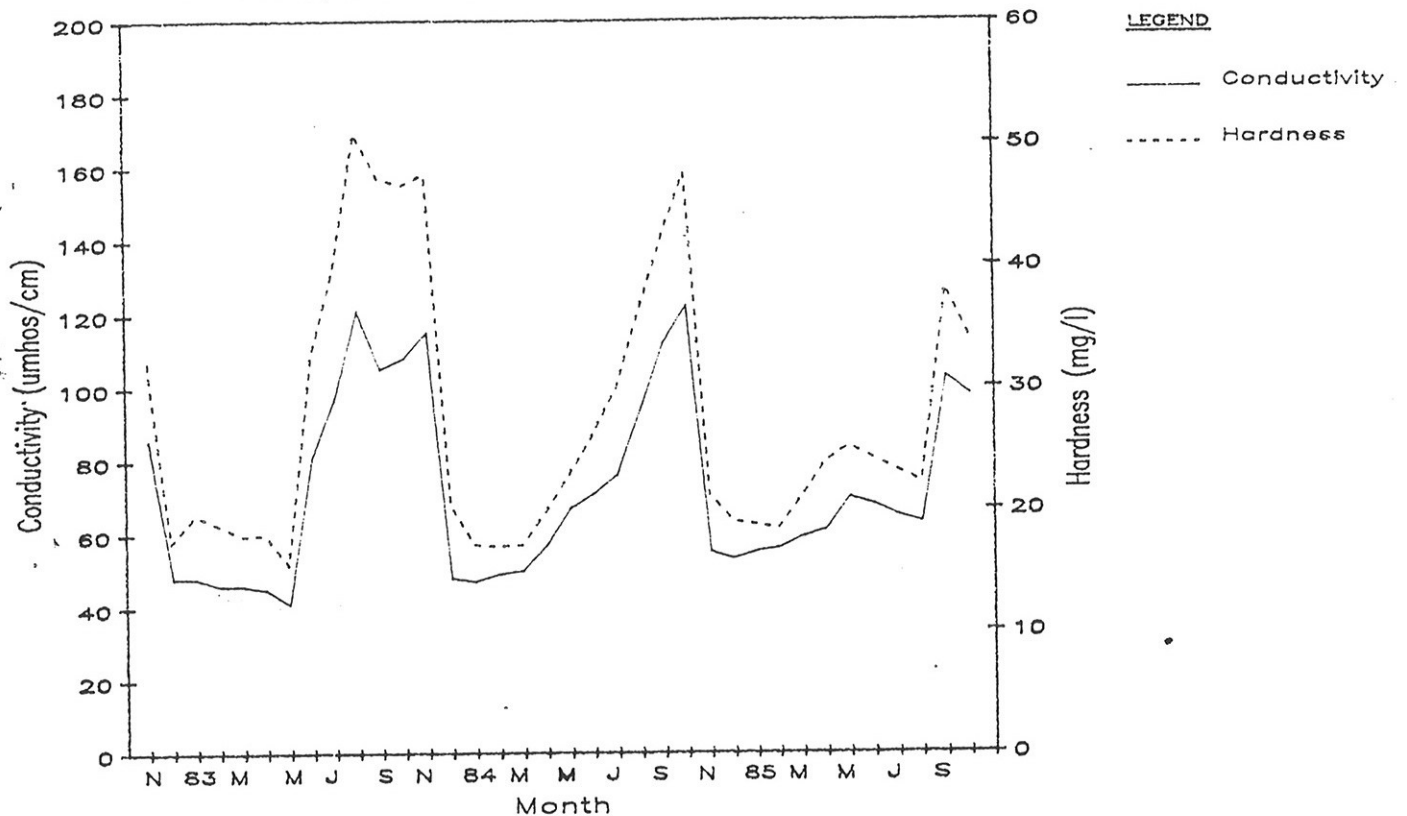


Bacteria levels were also low indicating no problems from sewage discharge. Although erosion problems were being created upstream by a construction project at Lavender bridge during 1985, turbidity readings did not increase. It is possible that the samples were taken at low flows at which time turbidity would not be expected to increase.

Seasonal Fluctuations

As one would expect, levels of many of the water quality parameters fluctuated seasonally. Hardness, conductivity, and alkalinity, for example, are all related to total dissolved solids (TDS), and they become more concentrated at low flows during late summer and early fall. This is because a higher proportion of ground-water flow is in the streams during dry periods, and ground water typically has higher TDS levels than surface runoff. Further, low flows are less diluted. Figure 3 shows hardness and conductivity trends over time for Daddys Creek. The relationship to seasonal flow changes can clearly be seen in figure 3 as conductivity and hardness increase dramatically during the low-flow periods of late summer and early fall.

Figure 2. A comparison of the seasonal fluctuations of conductivity and hardness for Daddys Creek, site DC-2.



Recommendations

It is recommended that the water quality monitoring program at the Obed Wild and Scenic River remain the same. No monitoring stations or frequency of sampling should be changed. OBRI has a grave potential for impacts on water quality since it owns little land and there are many activities taking place outside the boundary that could effect the water quality. The present relationship between the National Park Service and the Tennessee Department of Health and Environment, Division of Water Management should be maintained so that the water quality in the area of the Obed Wild and Scenic will not be degraded further.

Complete laboratory analysis is needed for selected sites at recurring intervals. This data would give a more complete and accurate measurement of metals and would substantiate other data.

One major drawback to the present monitoring program is that most water quality data could not be correlated to stream flow because this data was not available. As water quality in general and seasonal fluctuations in particular are related to stream flow, it is recommended that staff gauges be established at selected sites and that rating curves be developed for these sites so that stream flow can be determined when a sample is taken.

STATION NAME Clear Creek, Site CC 1 (Lilly Bridge)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SD4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
				u/mhos												#/	#/	#/
	hours	C		/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml

11-10-82	1605	8.5	7.2	63	11.3	10.8	10.3	17.7		<0.2					1.0			
12-08-83	1610	10.1	6.1	41	11.2	7.0	5.4	13.6		<0.2	<10				2.0			
01-05-83	1710	5.9	7.0	38	12.4	5.0	5.7	13.4		<0.2	<10				2.6			
02-02-83	1635	9.3	7.0	20	11.5	6.0	5.2	11.4		<0.2	<10				27.0			
03-17-83	1610	11.2	7.0	38	10.6	5.7	5.5	11.3		<0.2	<10	<0.5			1.5			
04-14-83	1525	13.4	6.8	36	10.5	5.8	4.1	11.8	4.0	<0.2	<10	<0.5			1.9	32	16	220
05-10-83	1545	14.4	7.0	32	9.8	5.0	5.1	9.6	4.0	<0.2	<10	<0.5			4.0			
06-27-83	1515	26.9	7.2	52	7.9	9.6	5.1	14.7	4.0	<0.2	<10	<0.5			1.3	5	20	
07-18-83	1520	27.1		78	7.4	15.0	7.4	17.4	7.5	<0.2	<10	<0.5			1.0			
08-16-83	1900	25.1	7.1	77	7.7	18.2	12.9	18.5	6.5	<0.2	<10	<0.5			1.9	40	0	11400
09-19-83	1535	24.6	7.3	108	7.8	28.0	10.1	14.7	11.0	<0.2	<10	<0.5			1.0			
10-05-83	1525	20.7	7.3	87	8.2											200	45	2200
11-15-83	1430	8.7	6.7	99	11.0	25.2	7.7	19.0	9.5	<0.2	17	<0.5			1.0			
12-08-83	1530	6.6	6.3	41	12.0	5.2	5.9	14.3	4.0	<0.2	11	<0.5			2.3	0	0	
01-31-84	1450	3.7	6.4	41	12.7	3.4	5.1	12.5	4.0	<0.2	<10	<0.5			1.4	4	6	
03-27-84	1420	10.3	7.5	45	11.5	4.5	6.0	11.7	3.5	<0.2	<10	<0.5			1.3			
04-30-84	1535	15.3	6.6	36	9.7	5.9	7.2	10.6	3.5	<0.2	<10	<0.5			7.0	110	20	2400
05-30-84	1415	17.5	7.4	47	9.1	7.1	6.8	14.1	3.0	<0.2	<10	<0.5			1.9	180	100	18800
07-18-84	1515	23.3	6.4	53	8.2	11.7	6.4	15.2	5.0	<0.2	<10	<0.5			9.7	80		10800
09-19-84	800	16.2	6.4	100	8.6	20.6	13.9	13.2	11.0	<0.2	<10	<0.5			0.5			
10-17-84	1510	19.2	7.2	96	8.9	24.6	10.6	15.2	10.0	<0.2	<10	<0.5			0.6	7	1	
11-15-84	1435	6.9	6.7	45	11.5	6.1	6.4	12.6	5.0	<0.2	<10	<0.5			1.0			
12-19-84	1450	11.1	6.8	48	10.2	7.7	4.8	13.4	4.5	<0.2	<10	<0.5			1.5	2	0	14
02-20-85	1540	4.6	7.2	43	12.8	4.5	5.1	12.1	4.0	<0.2	<10	<0.5			1.5			
04-02-85	1305	12.2	7.2	43	10.4	6.2	5.8	11.9	5.5	<0.2	<10	<0.5			1.8	0	0	560
05-30-85	1530	23.1	7.3	61	8.4	9.1	5.8	16.3	7.0	<0.2	<10	<0.5			0.7	970	220	1000
08-27-85	1425	18.8	6.7	45	8.7	7.0	5.5	13.2	4.0	<0.2	<10	<0.5			15.0			
09-30-85	1415	17.0	6.7	58	9.3	12.2	9.8	17.1	4.0	<0.2	<10	<0.5			5.6			
10-24-85	1440	17.9		58	9.0	10.5	5.8	16.1	6.0	<0.2	<10	<0.5			0.9			

MEAN

14.8 6.9 56 9.9 10.3 7.0 14.0 5.7

3.5

125

36

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STATION NAME Clear Creek, Site CC 2 (Barnett Bridge)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL #/	F COL #/	F STRP #/
	hours	C		uhmos /cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml

11-10-82	1420	7.5	7.0	32	10.9	8.3	10.5	17.8		<0.2			1.1					
12-08-82	1310	9.2	6.0	38	11.0	7.2	5.3	13.8		<0.2	<10		2.2					
01-05-83	1305	4.9	6.4	32	11.9	5.1	6.0	11.4		<0.2	<10		2.2					
02-02-83	1410	9.1	6.8	41	11.7	5.1	5.7	13.5		<0.2	<10		38.0					
03-17-83	1335	10.7	6.9	35	11.0	5.5	6.2	11.5		<0.2	<10	<0.5	1.9					
04-14-83	1300	12.8	6.8	32	10.5	5.0	5.6	9.1	4.0	<0.2	<10	<0.5	2.0					
05-10-83	1300	12.5	6.8	29	10.4	5.0	5.3	9.9	4.0	<0.2	<10	<0.5	4.2			30	16	372
06-27-83	1415	25.0	7.3	51	7.8	10.9	7.2	16.9	5.0	<0.2	<10	<0.5	1.3			0	0	
07-18-83	1245	26.0		60	8.0	13.3	9.1	18.0	4.5	<0.2	<10	<0.5	1.9			0	0	
08-16-83	1505	24.0	6.5	56	7.3	10.7	11.3	19.7	3.0	<0.2	12	<0.5	1.6			0	100	4000
09-19-83	1245	22.0	6.5	62	7.3	15.6	6.7	18.8	5.0	<0.2	<10	<0.5	1.0			0	100	4000
10-15-83	1230	19.7	7.1	62	8.2	13.4	8.1	61.6	5.0	<0.2	<10	<0.5	5.3			112	20	11200
11-15-83	1155	6.9	6.6	115	11.1	9.6	7.3	33.0	12.5	<0.2	17	<0.5	4.9			112	20	11200
12-08-83	1220	6.4	6.3	40	12.0	5.0	6.7	15.0	4.0	<0.2	<10	<0.5	1.8			3	0	
01-31-84	1225	3.5	6.3	46	12.5	3.6	4.7	14.0	4.0	<0.2	<10	<0.5	1.6			7	6	
03-27-84	1205	9.8	6.7	43	11.0	3.5	5.0	12.2	3.5	<0.2	<10	<0.5	0.9					
04-30-84	1255	14.7	6.4	37	9.7	6.6	6.4	12.8	3.0	<0.2	<10	<0.5	24.0					
05-30-84	1155	15.8	7.0	51	9.5	7.1	7.2	14.8	3.0	<0.2	<10	<0.5	2.1			310	260	4800
07-18-84	1255	20.8	6.9	42	8.6	9.4	8.8	13.5	3.0	<0.2	<10	<0.5	6.3			250	170	23200
09-12-84	1110	20.3	6.9	54	8.4	10.5	5.1	14.7	5.0	<0.2	<10	<0.5	1.0			40		5200
09-19-84	1020																	
10-17-84	1225	18.0	6.9	59	8.0	12.6	9.8	17.5	6.5	<0.2	<10	<0.5	1.5			11	0	
11-15-84	1215	6.8	6.5	45	11.5	5.6	7.2	14.8	4.5	<0.2	<10	<0.5	0.7					
12-19-84	1215	10.8	7.0	48	10.9	14.4	4.2	13.4	4.5	<0.2	<10	<0.5	0.6					
02-20-85	1320	4.0	7.0	51	12.6	4.9	5.6	14.4	4.5	<0.2	<10	<0.5	1.2			2	0	6
04-02-85	1125	10.6	7.0	48	10.8	5.6	3.3	14.8	5.0	<0.2	<10	<0.5	1.9					
05-30-85	1240	20.9	6.9	55	8.6	6.0	5.7	17.1	4.0	<0.2	<10	<0.5	0.8			10	0	100
08-27-85	1215	19.2	6.9	52	8.6	9.0	5.7	16.1	4.5	<0.2	<10	<0.5	6.6			370	550	800
09-30-85	1200	14.9	6.6	62	9.7	9.8	7.5	19.7	4.5	<0.2	<10	<0.5	0.8					
10-24-85	1225	17.5	6.6	55	8.7	8.0	4.9	17.1	5.5	<0.2	<10	<0.5	0.9					

MEAN

13.9 6.7 49 9.9 8.1 6.6 17.1 4.7

4.1

88

94

5520

STATION NAME Clear Creek, Site CC 3 (Norris Ford)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SD4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
				u/mhos												#/	#/	#/
	hours	C		/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml
12-07-82	1420	9.7	5.4	45	11.3	6.9	10.3	13.8		<0.2	<10		1.6					
01-05-84	1435	5.4	6.5	42	12.5	5.0	5.8	14.1		<0.2	<10		1.8					
03-17-83	1435	11.2	6.7	44	10.5	5.5	5.1	11.8		<0.2	<10	<0.5	1.5					
04-14-83	1400	13.0	6.6	41	10.3	4.8	5.1	13.6	4.0	<0.2	<10	<0.5	2.0					
05-10-83	1400	12.7	6.7	36	10.0	5.5	5.7	12.2	4.0	<0.2	<10	<0.5	1.9			62	14	450
07-18-83	1345	25.2		63	8.0	8.4	6.4	21.1	3.0	<0.2	15	<0.5	1.8			0	10	
08-16-83	1655	23.8	6.7	57	6.8	13.8	10.2	20.3	3.0	<0.2	10	<0.5	2.2					
09-19-83	1350	21.4	6.4	65	6.1	12.8	6.5	20.4	7.0	<0.2	<10	<0.5	1.0			30	10	10400
10-05-83	1335	18.4	6.8	61	7.5	11.0	7.6	20.4	4.0	<0.2	<10	<0.5	1.0					
11-15-83	1250	7.0	6.6	122	10.7	39.5	10.1	21.1	6.5	<0.2	<10	<0.5	2.0			224	607	68000
12-08-83	1335	6.2	6.7	42	11.5	5.4	4.9	14.9	4.0	<0.2	<10	<0.5	2.1					
01-31-84	1325	2.7	6.4	51	13.1	3.3	4.8	14.4	4.5	<0.2	<10	<0.5	2.6			6	2	
03-27-84	1330	9.0	6.8	44	11.4													
04-30-84	1415	14.7	6.4	44	9.6	6.4	6.1	13.1	3.0	<0.2	<10	<0.5	13.0					
05-30-84	1300	14.3	6.9	56	9.4	8.6	7.6	16.9	3.0	<0.2	<10	<0.5	18.0			1000	590	18600
07-16-84	1350	19.7	6.5	50	8.3	11.3	9.8	15.8	4.0	<0.2	<10	<0.5	8.7			730		24800
09-19-84	940	15.2	6.8	57	7.5	11.9	10.1	17.0	6.0	<0.2	<10	<0.5	1.3			20		7200
10-17-84	1320	17.0	6.7	70	6.9	11.7	9.6	19.7	8.0	<0.2	<10	<0.5	0.9					
12-19-84	1315	11.0	6.5	52	10.7	6.0	4.9	15.5	4.5	<0.2	<10	<0.5	0.7					
02-20-85	1415	3.7	7.0	52	12.6	4.9	5.6	14.4	4.5	<0.2	<10	<0.5	1.2			5	0	12
04-02-85	1025	9.4	6.6	49	10.7	5.8	4.3	13.4	5.0	<0.2	<10	<0.5	2.4					
05-30-85	1350	19.6	6.9	55	8.6	6.3	4.6	16.6	4.5	<0.2	<10	<0.5	1.0			25	10	280
08-27-85	1310	18.1	6.8	32	8.8	8.9	5.8	15.2	5.0	<0.2	<10	<0.5	5.0			660	340	1000
09-30-85	1245	14.8	6.5	68	8.9	11.2	8.2	21.3	5.0	<0.2	<10	<0.5	1.3					
10-24-85	1315	16.8		58	8.3	8.4	4.9	16.1	5.5	<0.2	<10	<0.5	1.1					

MEAN 13.6 6.6 54 9.6 9.3 6.8 16.4 4.7

3.2

251 158 14527

STATION NAME Daddys Creek, Site DC 2 (Devils Breakfast Table)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
				uhmos												#/	#/	#/
	hours	C		/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml

11-10-82	1145	7.7	7.2	86	11.3	24.5	12.7	32.1		<0.2					1.1			
12-08-82	1040	9.8	6.7	48	11.1	13.2	7.7	17.3		<0.2	<10				3.2			
01-05-83	1040	5.5	6.6	48	12.3	12.3	6.0	19.6		<0.2	<10							
02-02-83	1100	9.3	7.1	46	11.4	10.5	5.4	18.8		<0.2	<10				58.0			
03-17-83	1055	11.4	7.5	46	11.0	13.1	5.3	17.9		<0.2	<10				2.1			
04-14-83	1045	13.7	7.2	45	10.4	13.4	5.5	18.0	2.9	<0.2	<10	<0.5			3.3			
05-10-83	1000	12.4	7.4	41	10.4	11.6	6.5	15.5	2.5	<0.2	<10	<0.5			5.6	15	72	639
06-27-83	1135	25.7	7.5	81	7.2	27.1	8.1	32.7	4.0	<0.2	<10	<0.5			1.0			
07-18-83	1020	26.2		97	6.9	34.4	9.3	39.6	4.0	<0.2	<10	<0.5			1.5	35	50	
08-16-83	1115	23.9	7.0	121	7.1	44.7	15.9	50.9	3.5	<0.2	<10	<0.5			1.0			
09-19-83	1025	22.3	7.5	105	8.1	43.9	10.3	47.1	3.0	<0.2	<10	<0.5			0.6	170	150	7000
10-05-83	1030	19.1	7.3	108	8.7	43.1	11.3	46.5	3.0	<0.2	<10	<0.5			0.7			
11-15-83	1005	7.8	6.8	115	11.2	40.0	12.9	47.4	4.0	<0.2	<10	<0.5			0.6	76	4	3800
12-08-83	1010	6.6	6.3	48	12.2	10.2	6.8	20.3	3.0	<0.2	<10	<0.5			2.7			
01-31-84	1020	2.9	6.6	47	12.8	10.8	5.8	17.1	2.0	<0.2	<10	<0.5			3.0	285	19	
03-27-84	1015	9.4	7.3	50	11.6	11.0	4.5	17.0	2.5	<0.2	<10	<0.5			1.4	17	26	
04-30-84	1115	14.5	6.8	57	10.0	13.8	7.0	19.8	3.5	<0.2	<10	<0.5			16.0			
05-30-84	1020	15.6	6.8	67	9.5	21.5	8.7	22.9	2.5	<0.2	<10	<0.5			1.7	100	30	5800
07-18-84	1030	19.7	5.8	76	8.7	25.0	9.4	29.9	3.0	0.80	<10	<0.5			44.0	380	2080	67600
09-12-84	950	20.6	7.5	112	8.2	41.7	14.0	42.4	3.5	<0.2	<10	<0.5			0.6			
09-19-84	1110															40		4000
10-17-84	1050	17.4	7.2	122	8.3	40.0	13.3	47.5	5.0	<0.2	<10	<0.5			0.9			
11-15-84	1015	6.8	6.7	55	11.7	7.4	8.7	21.1	3.0	<0.2	<10	<0.5			1.8	32	2	
12-19-84	1030	11.3	6.7	53	10.7	14.4	5.6	19.0	2.5	<0.2	<10	<0.5			0.8			
02-20-85	1100	4.3	7.3	56	12.3	10.5	4.3	18.4	4.0	<0.2	<10	<0.5			1.7	30	0	81
04-02-85	1200	12.4	7.2	61	10.3	15.2	6.3	23.9	3.0	<0.2	<10	<0.5			2.6			
05-30-85	1020	20.3	7.3	70	8.0	21.2	8.5	25.2	4.0	<0.2	<10	<0.5			1.0	0	10	480
08-27-85	1040	18.6	7.3	63	8.9	14.5	6.2	22.2	3.0	<0.2	<10	<0.5			13.0	390	580	2000
09-30-85	1035	15.1	7.0	103	9.1	31.7	9.4	38.1	4.5	<0.2	<10	<0.5			0.7			
10-24-85	1045	17.6		98	9.3	28.1	8.8	34.2	6.5	<0.2	<10	<0.5			1.3			

MEAN

14.1 7.0 73 10.0 22.4 8.4 28.4 3.4

6.1

121 252 10156

STATION NAME Emory River, Site ER 1 (Nemo Bridge above Rock Creek)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SD4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
				u/mhos												#/	#/	#/
	hours	C		/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml

11-10-82	1050	8.0	6.5	80	11.3	19.2	10.5	28.8		<0.2			1.3					
12-08-82	930	10.4	6.2	38	11.2	9.2	7.7	16.4		<0.2	10		3.5					
01-05-83	935	5.8	6.0	43	11.9	8.1	5.8	16.6		<0.2	<10		2.4					
02-02-83	925	8.4	7.0	42	11.6	8.0	5.4	16.2		<0.2	11		66.0					
03-17-83	950	11.2	7.1	46	10.8	8.4	6.0	17.0		<0.2	<10	<0.5	2.0					
04-14-83	1005	13.0	7.0	42	10.6	8.7	5.4	14.9	3.8	<0.2	<10	<0.5	3.3					
05-10-83	905	13.0	7.0	39	10.1	8.2	5.0	14.0	3.5	<0.2	<10	<0.5	6.7			175	65	1165
06-27-83	915	24.7	7.4	90	7.8	16.8	8.4	24.8	4.5	<0.2	10	<0.5	2.0					
07-18-83	940	27.5		85	7.4	19.2	10.3	25.2	6.0	<0.2	<10	<0.5	1.0			20	0	
08-16-83		23.5	7.4	140	7.7	38.5	13.0	51.8	9.5	<0.2	16	<0.5	2.0					
09-19-83	925	22.8	7.0	95	7.8	30.0	8.9	30.3	6.5	<0.2	<10	<0.5	0.8			20	0	4400
10-05-83	945	20.5	6.4	75	8.1	27.5	8.6	30.1	7.0	<0.2	<10	<0.5	1.0					
11-15-83	925	8.3	6.6	122	11.4	26.6	9.0	38.3	7.5	<0.2	15	<0.5	0.9			56	14	2400
12-08-83	930	6.7	6.2	47	12.2	7.2	5.7	17.2	3.5	<0.2	<10	<0.5	8.1					
01-31-84	935	3.3	6.6	45	12.8	7.8	5.7	16.3	2.5	<0.2	<10	<0.5	1.9			265	14	
03-27-84	930	9.5	7.1	45	10.8	8.5	6.4	16.4	3.0	<0.2	<10	<0.5	2.0			22	6	
04-30-84	1030	14.4	6.4	48	9.8	9.1	8.0	15.5	25.0	<0.2	<10	<0.5	21.0					
05-30-84	940	16.9	7.1	56	9.1	12.9	7.6	18.7	2.5	<0.2	10	<0.5	3.7			120	100	9600
07-18-84	945	21.9	6.1	64	8.2	16.0	12.2	20.4	3.0	0.35	<10	<0.5	17.0			270		29000
09-12-84	910	22.1	6.9	92	8.1	26.3	10.2	29.6	5.0	<0.2	<10	<0.5	1.4					
09-19-84	1140															60		5200
10-17-84	1005	18.8	6.9	117	9.0	32.9	7.9	38.6	6.0	<0.2	<10	<0.5	1.0					
11-15-84	940	6.7	6.5	53	12.1	11.4	9.8	19.7	4.0	<0.2	<10	<0.5	1.4					
12-19-84	955	11.3	6.6	55	10.6	10.7	6.6	17.0	4.5	<0.2	<10	<0.5	0.8					
02-20-85	1010	3.6	7.1	50	12.4	8.0	4.8	15.7	3.5	<0.2	<10	<0.5	1.4			22	9	138
04-01-85	1115	13.4	7.0	50	10.2	10.2	4.5	16.8	3.0	<0.2	<10	<0.5	1.6					
05-30-85	945	21.1	7.1	65	8.0	14.1	5.8	20.8	4.5	<0.2	<10	<0.5	0.9			10	0	340
08-27-85	1005	18.8	6.9	58	8.9	12.9	6.8	19.5	3.0	<0.2	<10	<0.5	17.0			1060	560	2400
09-30-85	1000	16.7	7.0	77	9.4	20.8	6.6	25.9	5.0	<0.2	<10	<0.5	5.4					
10-24-85	1010	18.2		78	8.6	19.1	9.0	25.7	7.0	<0.2	<10	<0.5	1.0					

MEAN

14.5 6.8 67 9.9 15.7 7.6 22.7 5.6

6.2

175

77

6071

STATION NAME Emory River, Site ER 2 (above Obed River)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
				u/mos												#/	#/	#/
	hours	C		/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml

11-10-82	955	6.2	6.2	90	12.1	16.2	12.5	40.8		<0.2			1.9					
12-08-82	830	9.5	6.2	57	12.0	10.8	7.3	25.5		<0.2	18		4.5					
01-05-83	845	5.0	5.9	66	12.1	10.0	7.5	26.0		<0.2	20		3.5					
02-02-83	840	9.5	7.0	52	11.3	7.7	5.5	20.0		<0.2	19		78.0					
03-17-83	910	11.2	7.0	66	10.9	10.7	5.8	25.0		<0.2	19		2.6					
04-14-83	910	13.4	7.0	60	10.3	9.7	6.5	22.3	2.9	<0.2	20	<0.5	5.3					
05-10-83	810	12.1	7.0	53	10.2	9.1	6.3	21.0	2.5	<0.2	16	<0.5	6.1			100	65	350
06-27-83	1030	26.2	7.0	74	7.9	20.4	8.1	33.5	4.0	<0.2	19	<0.5	1.7					
07-18-83	845	23.8	7.1	135	7.8	26.7	7.3	48.5	4.0	<0.2	25	<0.5	0.9			0	5	
08-16-83	945	25.6	7.4	84	6.7	25.1	13.0	51.8	9.5	<0.2	<10	<0.5	2.9					
09-19-83	835	19.7	7.3	131	8.0	42.1	10.2	51.1	7.0	<0.2	14	<0.5	0.8			240	10	38600
10-05-83	900	18.8	6.7	115	8.4	32.2	10.4	42.8	7.0	<0.2	13	<0.5	1.0					
11-15-83	840	7.5	6.2	140	11.3	24.0	9.1	54.7	3.0	<0.2	32	<0.5	8.3			92	97	15400
12-08-83	845	6.1	6.2	95	12.5	9.5	5.7	26.4	1.5	<0.2	17	<0.5	3.8					
01-31-84	850	3.0	6.9	65	13.1	7.9	6.3	23.1	2.0	<0.2	18	<0.5	3.2			84	54	
03-27-84	855	9.3	6.9	64	11.1	8.1	9.3	25.0	1.5	<0.2	19	<0.5	3.5			160	50	
04-30-84	950	13.7	6.4	47	10.2	8.6	7.9	20.0	1.5	<0.2	17	<0.5	17.0					
05-30-84	905	13.6	7.1	52	9.9	9.2	6.3	18.1	1.5	<0.2	12	<0.5	12.0			590	80	8200
07-18-84	855	20.9	6.0	88	8.6	20.6	11.2	37.5	2.0	1.20	14	<0.5	54.0			910		
09-12-84	840	20.1	7.0	192	8.4	30.3	10.5	50.5	5.0	<0.2	26	<0.5	4.2					
10-17-84	930	17.8	6.7	149	8.8	38.8	13.6	54.9	6.5	<0.2	<10	<0.5	1.2					
11-15-84	910	6.7	6.6	71	12.7	10.6	8.7	27.1	2.5	<0.5	18	<0.5	2.0			23	8	
12-19-84	920	11.9	6.2	78	10.7	13.3	8.2	27.4	2.5	<0.2	19	<0.5	1.3					
02-20-85	930	4.0	6.5	55	12.2	7.1	6.3	23.2	2.0	<0.2	17	<0.5	3.0			62	40	257
04-01-85	1030	12.4	7.0	70	12.5	11.0	6.1	25.4	2.0	<0.2	10	<0.5	4.3					
05-30-85	915	19.7	7.3	80	9.5	15.2	6.1	33.3	3.0	<0.2	17	<0.5	1.4			15	0	220
08-27-85	935	18.8	6.6	73	8.9	12.7	7.2	22.6	2.0	<0.2	19	<0.5	14.0			500	200	600
09-30-85	930	14.8	7.0	87	9.5	20.7	4.3	28.8	3.5	0.20	<10	<0.5	2.7					
10-24-85	935	17.7		103	8.8	22.1	10.2	35.0	6.0	<0.2	18	<0.5	1.4					

MEAN 13.8 6.7 86 10.2 16.9 8.2 32.5 3.5 8.5 231 51 9090

STATION NAME Otter Creek, Site DC 1 (at road crossing in Catoosa WMA)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
	hours	C		u/mhos /cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	#/ 100ml	#/ 100ml	#/ 100ml

11-10-82	1225	8.1	7.2	38	11.2	11.0	10.0	14.8		<0.2			6.6					
12-08-82	1110	9.3	6.8	23	11.0	6.8	6.3	11.3		<0.2	<10		2.2					
01-05-83	1105	5.2	5.9	20	11.8	4.6	5.9	7.5		<0.2	<10		2.5					
03-17-83	1120	10.4	7.0	22	10.8	5.9	5.2	8.9		<0.2	<10	<0.5	5.2					
04-14-83	1110	12.9	6.9	23	10.1	5.8	5.6	9.8	2.8	<0.2	<10	<0.5	7.4					
05-10-83	1030	11.3	6.9	22	10.2	6.6	5.6	9.3	2.5	<0.2	<10	<0.5	8.9			7	13	
06-27-83	1240	21.0	7.0	33	8.4	12.0	8.1	11.4	2.5	<0.2	<10	<0.5	12.0					
07-18-83	1050	22.3		42	7.1	15.0	8.5	15.6	2.0	<0.2	<10	<0.5	14.0			0	45	
08-16-83	1235	20.6	6.7	34	7.8	11.1	12.1	13.1	1.5	<0.2	<10	<0.5	37.0					
09-19-83	1110	19.1	7.4	110	3.8	47.2	5.6	54.5	2.0	<0.2	<10	<0.5	20.0			110	20	11000
10-05-83	1055	17.5	7.8	125	6.7	44.2	12.5	46.4	1.5	<0.2	<10	<0.5	54.0					
11-15-83	1030	7.0	6.7	47	11.1	8.9	7.2	15.1	2.5	<0.2	<10	<0.5	100.0			8	217	40000
12-08-83	1045	6.4	6.3	26	12.0	6.7	5.7	12.0	1.5	<0.2	<10	<0.5	4.8					
01-31-84	1040	2.4	6.8	27	12.7	5.9	5.2	10.6	2.0	<0.2	<10	<0.5	5.7			4	3	
03-27-84	1035	9.3	5.8	28	10.6	6.5	5.3	11.4	1.5	<0.2	16	<0.5	4.6			7	5	
04-30-84	1140	13.7	6.4	29	9.7	7.0	5.3	11.2	1.1	<0.2	<10	<0.5	6.7					
05-30-84	1040	12.4	7.2	39	9.4	12.6	8.5	14.4	1.5	<0.2	<10	<0.5	19.0			850	40	33000
07-18-84	1100	19.1	6.6	34	8.5	13.2	8.0	14.0	1.0	0.85	<10	<0.5	34.0			100	70	19600
09-12-84	1010	17.2	6.9	51	8.0	19.0	8.6	17.3	2.0	<0.2	<10	<0.5	2.8					
09-19-84	1100															140		2800
10-17-84	1110	15.5	7.0	67	8.2	19.0	11.5	24.3	3.5	<0.2	<10	<0.5	12.0					
11-15-84	1035	7.5	6.8	38	11.5	7.1	6.8	10.5	2.0	<0.2	<10	<0.5	0.8			37	13	
12-19-84	1045	11.0	6.9	38	10.5	6.7	5.2	9.2	1.5	<0.2	<10	<0.5	1.0					
02-20-85	1120	3.7	7.1	32	12.8	5.4	3.7	9.9	2.0	<0.2	<10	<0.5	1.0			4	2	15
04-01-85	1230	11.2	7.1	39	10.5	8.3	4.0	13.4	3.5	<0.2	<10	<0.5	2.6					
05-30-85	1040	16.1	7.0	34	8.9	9.6	5.0	12.8	2.0	<0.2	<10	<0.5	1.2			35	0	340
08-27-85	1100	17.8	6.6	38	8.8	8.2	5.1	12.3	2.5	<0.2	<10	<0.5	1.8			610	110	300
09-30-85	1050	11.3	6.6	50	10.0	13.8	8.2	18.9	3.0	<0.2	<10	<0.5	1.1					
10-24-85	1105	16.2		32	8.7	8.5	7.3	10.8	2.5	<0.2	<10	<0.5	1.5					

MEAN 12.7 6.8 41 9.7 12.0 7.0 15.4 2.1 13.2 147 45 13382

STATION NAME Obed River, Site OR 1 (Obed Junction)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
	hours	C		uhmos	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	#/100ml	#/100ml	#/100ml
11-10-82	1530	8.3	7.3	86	10.8	24.5	12.6	28.7		<0.2			1.9					
12-08-82	1525	10.5	6.9	35	11.2	13.8	8.0	18.0		<0.2	<10		3.1					
01-05-83	1635	6.0	7.4	44	12.5	9.6	5.6	17.0		<0.2	<10		3.4					
02-02-83	1555	9.3	7.2	37	11.2	9.7	5.0	19.0		<0.2	<10		57.0					
03-17-83	1535	11.7	7.4	42	10.6	11.2	5.6	14.8		<0.2	<10	<0.5	2.0					
04-14-83	1455	14.1	7.2	40	10.3	9.7	5.6	13.3	2.6	<0.2	<10	<0.5	3.0					
05-10-83	1510	14.4	7.4	38	10.1	9.4	5.6	13.9	3.5	<0.2	<10	<0.5				195	35	285
06-27-83	1540	27.0	7.4	70	8.6	21.4	7.8	25.1	4.0	<0.2	<10	<0.5	1.3					
07-18-83	1450	26.1		78	6.8	24.4	11.8	29.1	4.0	<0.2	<10	<0.5	1.0			0	10	
08-16-83		25.4	7.3	95	7.1	32.2	13.6	36.4	4.0	<0.2	11	<0.5	1.1					
09-19-83	1455	24.8	8.4	93	9.9	31.3	7.6	32.4	4.5	<0.2	<10	<0.5	0.6			0	0	5200
10-05-83	1445	20.4	7.3	92	9.6	28.1	10.4	27.9	6.0	<0.2	<10	<0.5	0.7					
11-15-83	1400	9.0	6.5	124	11.4	35.5	8.1	37.3	9.5	<0.2	12	<0.5	0.6			124	34	6600
12-08-83	1445	6.8	6.7	46	11.6	10.2	5.9	17.4	3.0	<0.2	<10	<0.5	3.6					
01-31-84	1420	3.5	6.8	45	12.9	9.0	5.7	16.2	2.5	<0.2	<10	<0.5	2.0			98	0	
03-27-84	1420	10.3	7.5	45	11.5	8.6	6.0	16.3	2.5	<0.2	<10	<0.5	1.6			9	3	
04-30-84	1505	15.5	6.7	47	9.6	10.4	8.4	16.4	3.0	<0.2	<10	<0.5	17.0					
05-30-84	1350	16.4	7.7	60	9.7	18.6	7.2	22.3	2.5	<0.2	<10	<0.5	3.3			70	20	8000
07-18-84	1450	21.2	6.9	49	8.4	20.2	8.1	25.2	3.0	0.45	<10	<0.5	37.0			2010		34800
09-19-84	840	16.8	7.6	108	7.1	40.8	17.4	41.8	4.0	<0.2	<10	<0.5	0.5					
10-17-84	1435	18.4	7.3	125	9.3	36.2	11.9	40.5	7.0	<0.2	<10	<0.5	0.7					
11-15-84	1400	7.1	6.7	52	11.3	13.2	8.5	17.9	3.0	<0.2	<10	<0.5	1.4			42	4	
12-19-84	1425	11.6	6.7	51	10.2	12.5	5.1	18.1	3.0	<0.2	<10	<0.5	0.9					
02-20-85	1515	5.2	7.0	56	12.7	8.8	6.1	18.3	5.0	<0.2	<10	<0.5	1.8			23	2	87
04-02-85	1210	11.2	7.3	56	10.8	11.7	5.4	18.1	3.5	<0.2	<10	<0.5	2.7					
05-30-85	1450	22.6	7.4	66	8.2	16.3	5.1	22.6	4.5	<0.2	<10	<0.5				0	0	260
08-27-85	1400	19.4	7.2	62	9.1	14.0	7.8	20.8	3.5	<0.2	<10	<0.5	15.0			1000	440	1200
09-30-85	1345	18.0	6.5	92	9.6	26.1	6.4	31.2	4.5	<0.2	<10	<0.5	0.6					
10-24-85	1410	18.2		90	8.8	23.7	9.2	29.5	7.0	<0.2	<10	<0.5	1.0					

MEAN

14.8 7.2 66 10.0 18.7 8.0 23.6 4.2

6.1

298

50

7054

STATION NAME Obed River, Site DR 2 (Potters Ford)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
	hours	C		uhmhos /cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	#/ 100ml	#/ 100ml	#/ 100ml

05-10-83																380	60	1200
07-18-83	1110															0	10	
09-19-83	1125															100	20	4200
11-15-83	1045															96	42	17200
01-31-84	1050															51	4	
03-27-84	1050															44	43	
05-30-84	1055															890	310	21200
07-18-84	1110															930		47400
09-19-84	1050															140		5200
11-15-84	1100															56	8	
02-20-85	1145															90	22	210
05-30-85	1100															40	0	300
08-27-85	1115															1320	610	1400

MEAN

0.0 0.0 0 0.0 0.0 0.0 0.0 0.0

318 103 10923

STATION NAME Obed River, Site DR 3 (Adams Bridge)

DATE	TIME	TEMP	pH	COND uhm/cm	DO mg/l	ALK mg/l	ACID mg/l	HARD mg/l	Cl- mg/l	Fe mg/l	SO4 mg/l	Mn mg/l	TURB NTU	STAGE ft	VEL cfs	T COL #/100ml	F COL #/100ml	F STRP #/100ml
hours		C																

11-10-82	1310	7.6	6.4	85	11.8	22.0	13.2	29.1		<0.2					2.0			
12-08-82	1200	9.5	6.4	60	10.9	12.7	7.4	22.2		<0.2	<10				3.3			
01-05-83	1150	5.2	6.3	56	12.2	11.9	8.4	19.7		<0.2	<10				3.9			
02-02-83	1310	9.5	7.5	17	10.9	17.8	8.0	28.1		<0.2	<10				52.0			
03-17-83	1200	11.2	7.2	55	11.1	13.2	5.7	21.1		<0.2	<10	<0.5			3.0			
04-14-83	1140	13.5	6.9	54	10.3	10.4	5.3	19.0	5.0	<0.2	<10	<0.5			4.0			
05-10-83	1120	12.6	7.0	49	10.3	11.0	4.9	17.5	4.0	<0.2	<10	<0.5			6.1	410	330	2420
06-27-83	1325	22.5	7.2	90	7.0	22.5	10.7	28.9	6.0	<0.2	<10	<0.5			2.2			
07-18-83	1130	23.5		95	6.7	25.4	10.3	30.3	7.0	<0.2	<10	<0.5			3.8	0	45	
08-16-83	1350	22.2	7.2	135	7.5	40.0	18.0	38.2	9.0	<0.2	12	<0.5			2.5			
09-19-83	1145	19.6	7.3	187	7.6	50.1	11.6	45.4	17.0	<0.2	15	<0.5			0.8	60	20	13400
10-05-83	1130	16.9	7.2	195	7.2	50.0	15.6	45.3	14.0	<0.2	16	<0.5			0.8	48	537	86800
11-15-83	1105	7.3	7.0		10.9	24.8	10.6	30.8	8.0	<0.2	10	<0.5			4.0			
12-08-83	1125	6.1	6.3	53	12.0	10.6	7.9	20.5	3.5	<0.2	<10	<0.5			1.3	93	6	
01-31-83	1120	2.6	6.6	59	12.9	9.1	5.8	19.7	4.0	<0.2	<10	<0.5				125	48	
03-27-84	1105	9.3	7.3	60	11.6	9.8	6.3	20.2	4.5	<0.2	13	<0.5						
04-30-84	1225	14.7	6.6	51	9.8	11.4	9.2	18.0	3.0	<0.2	<10	<0.5			12.0			
05-30-84	1115	13.8	7.4	68	9.6	17.9	8.9	23.2	3.5	<0.2	<10	<0.5			6.4	1780	290	17800
07-18-84	1130	19.6	7.2	100	8.4	31.9	11.9	37.5	5.0	0.65	<10	<0.5			27.0	1950	TNTC	TNTC
09-12-84	1040	18.9	7.4	98	7.9	43.9	13.2	43.3	8.5	<0.2	<10	<0.5			0.7			
09-12-84	1040																80	3600
10-17-84	1140	17.6	7.1	158	7.2	47.3	15.9	49.1	10.5	<0.2	<10	<0.5			0.9			
11-15-84	1125	7.4	7.0	64	11.9	15.9	8.0	21.7	4.0	<0.2	<10	<0.5			1.6	63	11	
12-19-84	1140	11.2	7.0	65	11.2	14.5	6.4	22.1	4.5	<0.2	<10	<0.5			1.3			
02-20-85	1240	4.1	7.3	77	12.9	12.2	4.7	23.9	7.0	<0.2	<10	<0.5			2.7	109	70	298
04-01-85	1300	12.0	7.3	82	11.0	16.9	7.1	25.1	7.0	<0.2	<10	<0.5			6.3			
05-30-85	1205	19.4	7.2	88	8.1	21.4	8.3	27.0	7.0	<0.2	<10	<0.5			2.4	40	35	540
08-27-85	1130	18.1	7.2	80	8.5	19.9	7.0	28.6	4.5	<0.2	<10	<0.5			11.0		2060	2000
09-30-85	1120	13.7	6.8	175	9.0	42.8	13.3	47.1	13.0	<0.2	<10	<0.5			1.5			
10-24-85	1135	17.1		105	7.6	25.7	11.5	30.6	9.0	<0.2	<10	<0.5			1.4			

MEAN

13.3 7.0 85 9.8 22.9 9.5 28.7 7.0

6.3

397 288 14095

STATION NAME White Creek, Site WH 1 (mouth near Barnett Bridge)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
				u/mos												#/	#/	#/
	hours	C		/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	100ml	100ml	100ml

11-10-82	1445	6.4	6.8	62	10.8	16.4	12.9	20.4		<0.2			1.0					
12-08-82	1325	9.1	5.9	37	11.1	6.8	5.6	11.2		<0.2	<10		2.5					
01-05-83	1330	4.5	6.4	29	12.7	4.8	6.9	11.5		<0.2	<10		2.0					
02-02-83	1430	9.1	6.8	38	11.1	5.2	5.0	13.6		<0.2	<10		40.0					
03-17-83	1350	10.7	6.9	36	11.2	8.2	5.1	10.9		<0.2	<10	<0.5	2.0					
04-14-83	1315	12.8	6.7	32	10.4	5.6	6.3	9.4	4.4	<0.2	<10	<0.5	2.3					
05-10-83	1310	12.9	6.9	29	10.2	7.1	5.3	9.8	4.0	<0.2	<10	<0.5	5.0			65	15	685
06-27-83	1440	24.0	7.0	52	7.2	12.8	7.4	15.5	5.0	<0.2	<10	<0.5	1.4					
07-18-83	1300	24.6		68	6.2	21.7	9.9	17.4	6.5	<0.2	<10	<0.5	4.0			0	15	
08-16-83	1540	22.5	7.0	76	7.0	29.6	13.0	23.2	3.5	<0.2	<10	<0.5	14.0					
09-19-83	1305	20.4	6.6	87	6.0	31.7	12.3	21.5	4.0	<0.2	15	<0.5	1.0			20	20	28200
10-05-83	1250	18.8	7.2	77	7.1	28.8	13.2	20.6	4.5	<0.2	<10	<0.5	1.1					
11-15-83	1210	6.8	6.4	107	11.2	39.1	10.2	21.4	6.5	<0.2	<10	<0.5	2.8			148	26	15600
12-08-83	1245	6.4	6.7	39	11.8	6.3	6.2	12.6	4.5	<0.2	<10	<0.5	2.6					
01-31-84	1245	2.8	6.4	36	13.2	4.6	4.2	10.8	3.5	<0.2	<10	<0.5	5.7			1	1	
03-27-84	1225	8.9	7.0	37	11.1	5.5	6.8	10.8	3.0	<0.2	<10	<0.5	1.4			18	8	
04-30-84	1310	14.4	6.5	40	10.1	6.3	6.2	12.2	4.5	<0.2	<10	<0.5	6.2					
05-30-84	1220	14.1	7.2	54	10.2	10.2	8.6	14.4	6.5	<0.2	<10	<0.5	2.6			170	10	2400
07-18-84	1310	19.5	6.3	57	8.5	12.2	7.4	15.2	7.5	0.30	<10	<0.5	12.0			610	90	19000
09-12-84	1120	18.9	7.1	75	7.8	22.3	9.5	18.8	6.0	<0.2	<10	<0.5	1.0					
09-19-84	1015															180		4800
10-17-84	1240	17.8	7.1	95	7.5	34.0	12.9	20.4	5.5	<0.2	<10	<0.5	12.0					
11-15-84	1225	6.4	6.8	43	11.7	7.7	6.0	11.4	5.0	<0.2	<10	<0.5	1.5			10	1	
12-19-84	1230	10.7	7.2	43	10.8	7.5	4.4	11.0	4.0	<0.2	<10	<0.5	1.1					
02-20-85	1335	4.2	6.9	37	12.7	5.1	3.8	11.3	3.5	<0.2	<10	<0.5	1.8			4	1	38
04-02-85	1115	9.0	7.0	37	11.3	6.4	4.1	10.8	3.5	<0.2	<10	<0.5	2.5					
05-30-85	1255	19.2	7.0	53	8.3	13.2	6.2	14.9	5.0	<0.2	<10	<0.5	1.9			0	15	200
08-27-85	1225	17.6	6.8	41	8.9	7.0	5.1	12.5	4.0	<0.2	<10	<0.5	4.7			330	110	200
09-30-85	1210	13.2	6.9	53	9.7	11.3	8.2	15.2	4.5	<0.2	<10	<0.5	3.3					
10-24-85	1240	16.9		48	9.0	10.6	8.7	14.2	4.0	<0.2	<10	<0.5	1.6					

MEAN

13.2 6.8 52 9.8 13.4 7.6 14.6 4.7

4.9

120

26

7903

Threatened and Endangered Species
Big South Fork N.R.R.A.

Cr Name	Species Name	Federal Status	Tennessee Status	Kentucky Status	In. Heritage Program Status
=====	=====	=====	=====	=====	=====
Mussel	<i>Alasmidonta atropurpurea</i>	E	E		
Cumberland Sandwort	<i>Arenaria cumberlandensis</i>	1	E		E
Alabama grape fern	<i>Botrychium alabamense</i>		SC		SC
Sapsuck	<i>Buckleya distichophylla</i>	2	T		T
Big South Fork Crayfish	<i>Cambarus bouchardi</i>	2			
Round Leaved Bitter Cress	<i>Cardamine rotundifolia</i>		T		T
Pigweed	<i>Chenopodium stanleyanum</i>		T		T
Cumberland Rosemary	<i>Conradina verticillata</i>	1	E	E	E
Kentucky Lady Slipper	<i>Cypripedium kentuckiense</i>	2			
Mussel	<i>Epioblasma walkeri</i>	E			
Lucy Braun's White Snakeroot	<i>Eupatorium luciae-brauniae</i>	1	T		T
Peregrine falcon	<i>Falco peregrinus</i>	E			
Witch Alder	<i>Fothergilla major</i>		T		T
Steezeweed	<i>Helenium brevifolium</i>		E		E
Virginia Hearleaf	<i>Hexastylis virginica</i>		SC		SC
Virginia Hearleaf	<i>Hexastylis virginicae</i>		SC		SC
Water Pennywort	<i>Hydrocotyle americana</i>		P		T
Goldenseal	<i>Hydrastis canadensis</i>	3C	T		T
Barbara's Buttons	<i>Marshallia grandiflora</i>	2	E		E
Ginseng	<i>Panax quinquefolium</i>	3C	T		T
Muskrat	<i>Pegias fabula</i>	1			
Leaded Woodpecker	<i>Picoides borealis</i>	E			
Tennessee Pondweed	<i>Potamogeton tennesseensis</i>		T		T
Tennessee Azalea	<i>Rhododendron bakeri</i>	3C	T	T	T
Chaffseed	<i>Schmalbea americana</i>	2	EP	E	E
Stonecrop	<i>Sedum nevii</i>	2	E		E
Round-leaved Fame Flower	<i>Talinum teretifolium</i>		TP		TP
American Yew	<i>Taxus canadensis</i>		T		T
Leathery leaved Meadowrue	<i>Thalictrum coriaceum</i>		T		T
Rattlesnake Fern	<i>Trichomanes boschianum</i>		T		T

IE:

Federal Status 1

Taxa for which the U.S. Fish and Wildlife Service presently has sufficient information on hand to support the biological appropriateness of their being listed as Endangered or Threatened species.

Federal Status 2

Taxa for which information now in possession of the Service indicates probable appropriateness of listing as Endangered or Threatened, but for which sufficient information is not presently available to biologically support a proposed rule.

Federal Status E

Endangered

State Status

SC

State Status

Special Concern

TP

Protection Needed

STATION NAME Rock Creek, Site RC 1 (mouth near Nemo Bridge)

DATE	TIME	TEMP	pH	COND	DO	ALK	ACID	HARD	Cl-	Fe	SO4	Mn	TURB	STAGE	VEL	T COL	F COL	F STRP
	hours	C		uhmos	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NTU	ft	cfs	#/100ml	#/100ml	#/100ml

11-10-82	1020	5.9	3.8	200	11.6	0.0	28.2	86.0		0.65								0.8
12-08-82	905	9.8	4.0	80	11.7	2.0	13.3	25.4		0.30	36							2.4
01-05-83	915	4.5	3.7	100	12.1	0.0	16.7	33.0		0.45	49							1.7
02-02-83	950	9.7	4.7	44	10.9	2.5	7.8	13.6		<0.2	19							25.0
03-17-83	935	10.6	4.3	112	10.8	0.0	16.6	33.9		0.35	48	1.2						1.1
04-14-83	940	13.0	4.6	86	10.5	1.5	13.9	27.4	2.5	0.35	41	<0.5						2.3
05-10-83	840	9.7	4.6	62	10.8	2.2	10.1	17.7	2.5	0.30	24	<0.5						1.8
06-27-83	1000	19.6	3.6	340	8.6	0.0	34.4	110.6	2.5	0.40	>80	1.4						8.5
07-18-83	920	20.7		380	8.1	0.0	39.3	145.0	1.5	<0.2	>80	6.9						2.4
08-16-83	1015	20.0	3.6	450	8.0	0.0	41.4	157.2	1.0	<0.2	>80	6.4						1.4
09-19-83	905	17.4	3.7	180	8.2	0.0	40.4	175.8	1.0	<0.2	>80	7.9						0.6
10-05-83	930	16.7	3.8	290	8.8	0.0	26.0	11.6	1.0	0.25	>80	3.4						105.0
11-15-83	905	8.0	4.4	295	11.3	0.0	30.5	105.0	1.5	0.65	76	4.1						12.0
12-08-83	910	5.5	4.5	105	12.5	0.5	15.9	39.3	1.5	0.30	36	1.4						0.7
01-31-84	915	2.0	4.5	104	13.1	1.0	14.0	35.0	1.0	0.25	38	2.0						1.0
03-27-84	915	8.4	4.6	90	11.1	0.0	11.7	27.5	1.0	0.25	34	0.5						0.7
04-30-84	1010	13.7	4.3	59	10.6	1.0	8.8	17.9	1.0	<0.2	23	<0.5						1.4
05-30-84	925	11.0	4.2	200	10.6	0.0	22.1	60.1	1.0	0.30	64	2.5						0.4
07-18-84	930	17.8	5.1	68	9.3	1.0	20.6	19.4	1.0	0.85	25	1.0						12.0
09-12-84	900	16.9	3.9	200	9.4	0.0	20.3	63.1	1.0	0.55	65	2.0						4.2
10-17-84	950	16.3	4.1	302	8.9	0.0	30.4	100.0	2.0	0.45	65	4.0						
11-15-84	930	6.9	4.5	97	12.1	2.3	12.2	29.5	4.0	0.25	36	0.5						0.5
12-19-84	940	11.3	4.4	118	10.5	0.0	13.2	34.8	1.0	0.20	41	0.7						0.8
02-20-85	1000	3.9	4.8	75	12.2	1.0	10.3	24.1	1.0	0.20	20	<0.5						0.9
04-01-85	1100	9.4	4.7	80	11.2	1.5	9.2	24.6	1.0	0.30	28	0.5						1.0
05-30-85	935	16.1	4.1	225	9.0	0.0	19.7	72.0	1.0	<0.2	73	<0.5						0.7
08-27-85	955	17.5	4.3	165	9.2	0.0	19.1	48.8	1.5	0.25	57	0.7						2.5
09-30-85	1005	12.8	4.1	360	10.2	0.0	36.7	122.3	1.0	0.45	>80	3.5						0.6
10-24-85	955	16.4		312	8.8	0.0	33.0	107.4	1.5	0.35	>80	2.8						0.6

MEAN

12.1 4.3 179 10.3 0.6 21.2 61.0 1.5

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