Total Maximum Daily Load

Evaluation

for

Eight Stream Segments

in the

Tennessee River Basin

for

Sediment

(Biota Impacted)

Submitted to:
The U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

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EXECUTIVE SUMMARY

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories with respect to designated uses: 1) supporting, 2) partially supporting, or 3) not supporting. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* every two years (GA EPD, 2000-2001).

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and to restore and maintain water quality.

The State of Georgia has identified eight (8) stream segments located in the Tennessee River Basin as water quality limited (i.e., 303(d) listed as Biota Impacted) due to sedimentation. The water use classification of all of the impacted streams is Fishing. The general water quality criteria not being met states:

> All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

The Biota Impacted designation indicates that studies have shown a modification of the biological community, more specifically, fish. In 1993, the Tennessee Valley Authority (TVA) Hiawassee River Action Team (RAT) conducted macroinvertebrate population studies in forty-three monitoring sites in the Blue Ridge Ecoregion. The TVA Hiawassee RAT used the Modified Rapid Bioassessment (MRB) protocol to evaluate the ecological health of these streams. In 1995, the TVA conducted fish population studies in twenty-three streams in the Ridge and Valley Ecoregion. TVA used the Index of Biotic Integrity (IBI) to identify affected fish populations. The MRB and IBI values were used to classify the biological populations as Excellent, Good, Fair, Poor, or Very Poor. Stream segments with biological populations rated as Poor or Very Poor were included in the partially supporting list. As a result, eight stream segments in the Tennessee River Basin were added to the State's 303(d) list and scheduled for a TMDL evaluation. Fifty-eight stream segments, assessed and rated as Excellent, Good, and/or Fair, were considered as supporting uses.

The general cause of low IBI and MRB scores is the lack of habitat due to stream sedimentation. To determine the relationship between the in-stream water quality and the source loadings, each watershed was modeled. The analysis performed to develop sediment TMDLs for the 303(d) listed watersheds utilized the Universal Soil Loss Equation (USLE). The USLE predicts the average annual soil loss caused by erosion. The USLE method considered the characteristics of the watershed including land use, soil type, ground slope, and road surface. National Pollutant Discharge Elimination System (NPDES) permitted discharges were also considered. Modeling assumptions were considered conservative and provide the necessary implicit margin of safety for the TMDL.

The USLE was applied to both the 303(d) listed watersheds and those not biologically impacted to determine both the existing sediment loading rates and the sediment load reductions needed to support beneficial use (i.e., unimpacted conditions). The average sediment loads in the 303(d) listed watersheds in the Ridge and Valley and Blue Ridge Ecoregions are 0.30 tons/acre-yr (ranging from 0.21 to 0.36 tons/acre-yr) and 0.20 tons/acre-yr (ranging from 0.09 to 0.28 tons/acre-yr), respectively. The average sediment loads of the watersheds in the Ridge and Valley and Blue Ridge Ecoregions not on the 303(d) list are 0.30 tons/acre-yr (ranging from 0.14 to 0.58 tons/acre-yr) and 0.12 tons/acre-yr (ranging from 0.03 to 0.25 tons/acre-yr), respectively. These values represent sediment load contributions from all land uses within unimpaired watersheds.

Table 1 shows that approximately 67.55 percent of the average sediment load in the Tennessee River Basin watersheds modeled results from row crops with an average sediment load of 6.625 tons/acre-yr. Approximately 4.86 percent of the total sediment load is from pastureland with an average load of 0.09 tons/acre-yr. In the modeled Tennessee River Basin watersheds, mining activities contribute approximately 0.84 percent of the total sediment load with an average load of 15.44 tons/acre-yr. Roads contribute approximately 32.44 percent of the total sediment load, forests make up about 5.43 percent of the total load with an average load of 0.02 tons/acre/year, and urban land contributes approximately 2.07 percent of the total sediment load with an average load of 0.49 tons/acre-yr. Estimates of the sediment contribution from construction are not available, but could represent a relatively high sediment load per acre.

Table 1. Summary of Current Conditions in the Tennessee River Basin

Land Use	Average Percent Land Use	Average Percent Sediment Load	Average Sediment Load (tons/acre-yr)
Open Water	0.10%	0.00%	0.00
Urban	0.97%	2.07%	0.49
Bare Rock, Sand and Clay	0.00%	0.00%	1.34
Quarries, Strip Mines, Gravel Pits	0.01%	0.84%	15.44
Transitional Land	0.78%	0.21%	0.06
Forest	82.54%	5.43%	0.02
Pasture/Hay	12.95%	4.86%	0.09
Row Crops	2.33%	67.55%	6.62
Grasses, Wetland	0.32%	3.03%	2.19
Roads	-	32.44%	-

These data indicate that row crops are the major source of sediment to the rivers and streams in the Tennessee River Basin. However, over the last century there has been a dramatic decrease in the amount of land farmed in Georgia. Since 1950, there has been a 57 percent reduction in farmland. With this reduction in farmland, there has also been a decrease in the amount of soil erosion. This suggests that the sedimentation observed in the impaired stream segments may be legacy sediment resulting from past land use practices. It is believed that if sediment loads are maintained at acceptable levels, streams will repair themselves over time.

This TMDL determines the allowable sediment loads to the impaired Tennessee River Basin streams and is based on the hypothesis that an impaired watershed having an average annual sediment loading rate similar to the biological least impacted watersheds will remain stable and not be biologically impaired due to sediment. The average annual sediment loads of the least impacted watersheds in the Ridge and Valley (IBI Scores ≥ 50, see Table 6a) and Blue Ridge Ecoregions (MRB Scores ≥ 54, see Table 7a) within the Tennessee River Basin are 0.36 tons/acre-yr (ranging from 0.30 to 0.42 tons/acre-yr) and 0.096 tons/acre-yr (ranging from 0.04 to 0.13 tons/acre-yr), respectively. If the sediment load is less than the least impacted watershed, then the total allowable load becomes the current load and no reductions are required. The average annual sediment loads for each of the impaired watersheds are summarized in the table below, along with any required sediment load reductions.

Average Annual Sediment Loads and the Required Sediment Load Reductions

Name	Current Load (tons/yr)	WLA (tons/yr)	LA (tons/yr)	Total Load (tons/yr)	% Reduction
Bearmeat Creek	549		146	146	73
Butternut Creek	2,793	18	644	662	76
Chattanooga Creek	3,522		3,522	3,522	0
Dry Creek	631		631	631	0
Lower Youngcane Creek	503		207	207	59
Peavine Creek	5,605	2	5,603	5,605	0
Rock Creek	2,527		2,527	2,527	0
Weaver Creek	999		296	296	70

Management practices that may be used to help reduce and/or maintain the average annual sediment loads include:

- Compliance with the requirements of the NPDES permit program
- Implementation of Georgia Forestry Commission (GFC) Best Management Practices for forestry
- Adoption of Natural Resources Conservation Service (NRCS) Conservation Practices
- Adherence to the Mined Land Use Plan prepared as part of the Surface Mining Permit Application
- Adoption of proper unpaved road maintenance practices
- Implementation of Erosion and Sedimentation Control Plans for land disturbing activities
- Mitigation and prevention of stream bank erosion due to increased streamflow velocities caused by urban runoff

The amount of sediment delivered to a stream is difficult to determine. However, by requiring and monitoring the implementation of these practices, their effects will improve stream habitats and water quality, and represent a beneficial measure of TMDL implementation.

1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories with respect to designated uses: 1) supporting, 2) partially supporting, or 3) not supporting. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that addresses the assessment process, and are published in *Water Quality in Georgia* every two years (GA EPD, 2000-2001).

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and to restore and maintain water quality.

In 1993, the Tennessee Valley Authority (TVA) Hiawassee River Action Team (RAT) conducted studies of macroinvertebrate populations at a number of monitoring sites in the Tennessee River Basin. The TVA Hiawassee RAT used the Modified Rapid Bioassessment (MRB) protocol to evaluate the ecological health of streams in the Hiawassee River watershed. The MRB values were used to classify the populations as Excellent, Good, Fair, Poor, or Very Poor. Four stream segments in the Hiawassee River watershed (HUC 06020002 and HUC 06020003) were rated as Poor or Very Poor. Thirty-nine stream segments were rated as Excellent, Good, or Fair and assessed as supporting their designated water use.

In 1995, the TVA conducted studies of fish populations at a number of monitoring sites in the Chickamauga/Nickajack Basins in the Tennessee River Basin (HUC 060200001). TVA used the Index of Biotic Integrity (IBI) to identify affected fish populations. The IBI values were used to classify the populations as Excellent, Good, Fair, Poor, or Very Poor. Four stream segments in the Chickamauga/Nickajack (HUC 06020001) were rated as Poor or Very Poor. Twenty stream segments were rated as Excellent, Good, or Fair and assessed as supporting their designated water use.

Stream segments with macroinvertebrate or fish populations rated as Poor or Very Poor were listed as Biota Impacted. The Biota Impacted designation indicates that studies have shown a significant modification of the biological community. Eight (8) stream segments have been placed on the 303(d) list as partially supporting their designated water use, and scheduled for TMDL evaluation (see Table 2).

1.2 Watershed Description

The eight impaired stream segments are located in the Tennessee River Basin in north Georgia (see Figure 1). These watersheds incorporate the following counties: Catoosa, Dade, Fannin, Towns, Union, Walker, and Whitfield The fifty-nine unimpaired watersheds are located in Catoosa, Dade, Fannin, Towns, Union, Walker, and Whitfield counties in Georgia, Dekalb County in Alabama, Bradley, Hamilton and Polk counties in Tennessee, and Cherokee and Clay Counties in North Carolina.

Table 2. 303(d) Listed Stream Segments located in the Tennessee River Basin

STREAM	STATUS	LOCATION	MILES
Bearmeat Creek	Partially Supporting	Tributary to Hiawassee River (Towns Co)	2
Butternut Creek	Partially Supporting	Blairsville (Union Co)	2
Chattanooga Creek	Partially Supporting	High Point to Flintstone (Walker Co)	7
Dry Creek	Partially Supporting	Upstream East Chickamauga Creek (Catoosa Co)	5
Lower Youngcane Creek	Partially Supporting	Union County	2
Peavine Creek	Partially Supporting	Upstream South Chickamauga Creek (Catoosa Co)	8
Rock Creek	Partially Supporting	Tributary to Chattanooga Creek (Dade/Walker Co)	14
Weaver Creek	Partially Supporting	Fannin County	2

Source: GA EPD, 2000-2001. *Water Quality in Georgia, 2000-2001,* Georgia Department of Natural Resource, Environmental Protection Division.

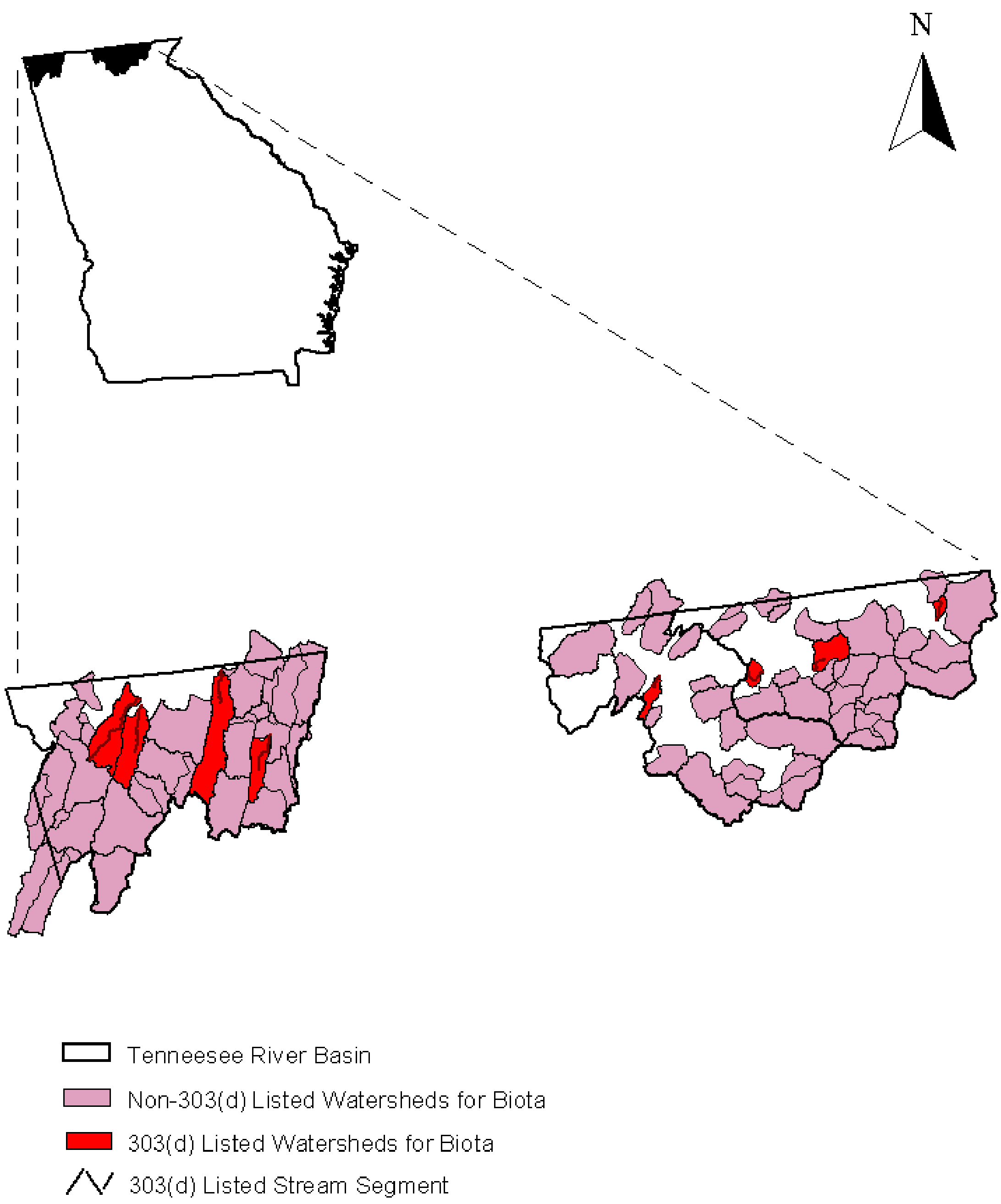
The land use characteristics of the Tennessee River Basin watersheds were determined using data from Georgia's National Land Cover Dataset (NLCD). This coverage is based on Landsat Thematic Mapper digital images developed in 1995. The classification is based on a modified Anderson level one and two system. Table 3 lists the land coverage distribution of the sixty-seven watersheds monitored in 1993 and 1995. The watersheds are grouped by those that are not on the 303(d) list and those that are on the 303(d) list, as well as by ecoregion (Ridge and Valley and Blue Ridge). Table 4 lists the land coverage percentages for all the Tennessee River Basin watersheds monitored. The data show that the watersheds are predominately forested with approximately 87.3 percent (ranging from 27.3 to 100 percent) in forest use. Agriculture is the next predominate land use with approximately 8.6 percent pasture land (ranging from 0.0 to 27.6 percent) and approximately 2.5 percent cropland (ranging from 0.0 to 67.7 percent).

The soil characteristics of the Tennessee River Basin watersheds were determined using data from the State Soil Geographic (STATSGO) coverage. This coverage provides major soil type classifications. Table 5 lists the soil type distribution of the monitored watersheds.

1.3 Water Quality Standard

The water use classification for the impaired watersheds in the Tennessee River Basin is Fishing. The criterion violated is listed as Biota Impacted, which indicates studies have shown an impact on the fish community. The potential cause(s) listed include urban runoff, nonpoint sources, unknown sources, and industrial facilities. The purpose of the narrative standard is to prevent objectionable conditions that interfere with legitimate water uses, as stated in *Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(5)(c):

> All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.



TMDL Evaluation - Biota
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Figure 1. Non-303(d) Listed and 303(d) Listed Watersheds Monitored in the Tennessee River Basin for Biota

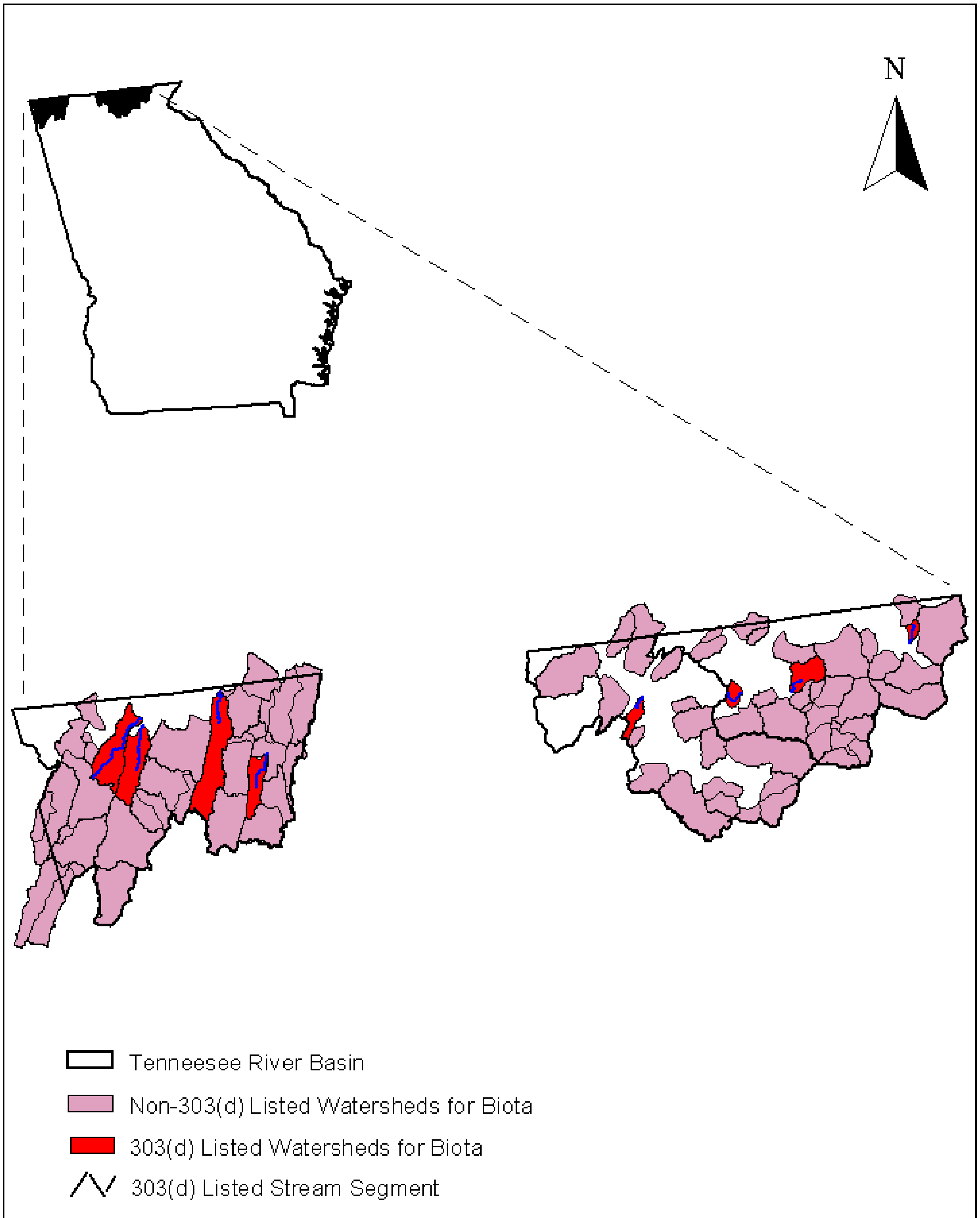

Figure 1. Non-303(d) Listed and 303(d) Listed Watersheds Monitored in the Tennessee River Basin for Biota

Table 3a. Land Coverage Distribution (Unimpaired – Ridge and Valley Ecoregion)

Name	Area (acres)															
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Crawfish Creek trib to Lookout	5.1	3.3	0.0	19.6	0.0	0.0	33.6	3,218.2	479.9	962.0	209.7	116.8	0.0	0.0	0.0	5,048.2
Crawfish Creek trib W Chicka.Ck	1.8	2.9	1.8	3.3	0.0	0.0	0.0	1,452.0	668.7	1,158.4	761.9	137.2	0.0	0.0	0.0	4,188.3
Dry Creek trib to Lookout Mt Ck	10.7	8.9	0.0	236.4	0.0	6.7	196.8	5,970.6	1,797.6	3,070.9	1,196.0	607.8	137.9	0.0	0.0	13,240.3
East Chickamauga Creek upper	29.1	7.8	0.2	11.1	0.0	0.0	404.5	3,834.0	1,798.0	2,657.5	2,527.0	108.1	0.0	44.3	0.0	11,421.6
East Chickamauga Creek lower	62.9	451.9	37.6	224.6	0.0	3.1	942.5	12,642.5	7,045.9	10,157.3	8,293.7	1,171.5	186.6	44.3	0.0	41,264.3
Hurricane Creek	6.4	805.3	80.5	41.1	0.0	0.0	12.7	2,919.7	895.1	2,504.1	2,405.1	297.1	159.5	0.0	0.0	10,126.6
Little Chickamauga Creek	30.5	12.9	0.2	32.0	0.0	0.0	165.0	8,219.4	3,715.6	7,252.7	8,008.6	1,514.2	0.0	29.4	1.3	28,981.9
Lookout Mountain Creek upper	11.6	4.4	0.0	11.3	0.0	0.0	155.4	6,012.9	1,172.2	2,437.8	1,035.2	475.5	0.0	0.0	0.0	11,316.4
Lookout Mountain Creek middle	68.3	21.8	0.7	328.0	0.0	6.7	938.7	21,699.9	5,518.1	9,858.9	3,382.7	1,361.5	151.2	0.0	0.0	43,336.3
Lookout Mountain Creek lower	140.1	462.1	44.5	701.6	0.0	6.7	1,227.8	46,913.9	11,894.8	22,854.0	6,865.1	3,411.9	275.8	48.0	0.0	94,846.3
Pope Creek	5.8	8.5	0.0	38.3	0.0	0.0	0.4	1,975.7	503.7	1,090.6	431.4	231.1	21.1	0.0	0.0	4,306.5
South Chickamauga Creek	149.4	1,772.4	222.4	760.6	0.0	2.7	1,609.0	39,280.0	17,040.2	31,120.2	28,200.2	4,895.4	523.3	73.6	1.3	125,650.6
Squirreltown Creek	2.4	25.1	0.4	33.8	0.0	0.0	0.0	2,889.3	912.7	2,149.8	610.9	443.7	29.1	0.0	0.0	7,097.3
Tanyard Creek	10.7	260.9	27.1	150.1	0.0	0.0	256.9	1,338.1	839.3	1,484.0	849.1	181.9	147.4	0.0	0.0	5,545.4
Tiger Creek upper	27.4	22.7	0.4	10.0	0.0	0.0	239.3	3,898.4	2,198.5	3,093.4	3,778.1	609.3	0.7	0.0	0.0	13,878.3
Tiger Creek lower	31.8	30.5	0.4	56.3	0.0	0.0	340.0	9,011.3	3,770.6	6,362.9	5,984.7	1,035.7	4.9	0.0	0.0	26,629.1
West Chickamauga Creek upper	39.8	6.2	0.0	39.8	0.0	0.0	179.0	18,225.1	4,852.0	9,282.0	7,271.2	961.4	23.8	10.0	0.0	40,890.3
West Chickamauga Creek mid	87.6	42.9	6.7	66.9	0.0	0.0	366.9	25,586.3	9,196.8	16,803.3	15,067.2	1,923.6	44.9	114.3	6.4	69,314.1
West Chickamauga Creek lower	159.0	1,041.7	85.0	260.6	0.0	41.4	396.1	29,676.0	12,398.1	23,897.5	21,056.7	3,098.7	673.8	131.9	6.4	92,922.9

Table 3b. Land Coverage Distribution (Unimpaired – Blue Ridge Ecoregion)

	Area (acres)															
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Arkaqua Creek	4.0	4.9	0.0	2.2	0.0	0.0	0.0	5,071.1	380.9	1,070.3	785.5	94.7	0.0	0.0	0.0	7,413.7
Big Creek	0.2	0.4	0.0	0.2	0.0	0.0	0.0	5,078.0	971.4	1,366.6	99.9	0.4	0.0	0.0	0.0	7,517.1
Brasstown Creek	3.1	19.6	3.8	26.5	0.0	0.0	34.0	11,419.1	1,402.8	2,855.9	780.8	215.9	3.1	0.0	0.0	16,764.6
Butler Creek	0.0	0.4	0.0	0.0	0.0	0.0	0.0	835.7	157.2	261.5	63.2	1.3	0.0	0.0	0.0	1,319.4
Canada Creek	22.9	1.1	0.0	1.6	0.0	0.0	0.0	6,003.3	253.7	963.4	217.7	6.0	63.4	0.0	0.9	7,534.0
Charlie Creek	1.8	0.4	0.0	0.2	0.0	0.0	0.0	1,303.4	157.2	425.0	79.6	0.4	0.0	0.0	0.0	1,968.1
Conley Creek	0.7	1.6	0.0	0.0	0.0	0.0	0.0	1,141.7	188.4	431.0	168.1	5.6	0.2	0.0	0.0	1,937.2
Cooper Creek	10.7	0.9	0.0	0.4	0.0	0.0	56.3	14,108.5	4,351.2	4,714.6	147.7	5.3	0.0	0.0	0.0	23,395.6
Coosa Creek	3.6	35.1	0.0	17.8	0.0	0.0	15.3	7,821.6	1,501.1	2,841.7	1,327.9	68.7	19.1	0.0	0.0	13,651.9
Dooley Creek	0.2	0.9	0.0	0.4	0.0	0.0	0.0	3,166.6	305.3	743.7	112.3	16.9	0.0	0.0	0.0	4,346.3
Fightingtown Creek	5.3	108.5	1.1	24.7	0.2	0.0	113.6	8,263.9	3,673.6	5,933.7	886.7	44.0	45.4	0.0	0.0	19,100.8
Fodder Creek	1.8	10.7	0.0	0.7	0.0	0.0	0.0	4,214.9	274.0	1,110.8	171.9	0.4	0.0	0.0	0.0	5,785.2
Helton Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,604.4	475.9	612.0	0.0	0.0	0.0	0.0	0.0	4,692.4
Hemptown Creek	4.7	0.7	0.0	0.2	0.0	0.0	23.1	2,823.2	600.7	1,214.9	122.1	12.5	0.0	0.0	0.0	4,802.0
Hightower Creek	7.3	84.1	0.7	0.0	0.0	0.0	0.0	16,811.8	877.1	2,288.8	576.6	39.1	19.8	0.0	0.0	20,705.3
Hiawassee River	0.9	1.8	0.0	2.7	0.0	0.0	5.3	19,600.5	2,461.8	4,352.6	575.3	8.9	0.0	0.0	0.0	27,009.8
Hog Creek	0.0	0.2	0.0	0.4	0.0	0.0	0.0	2,469.2	297.8	772.1	116.8	0.0	0.0	0.0	0.0	3,656.5
Hothouse Creek	0.2	19.6	0.0	11.6	0.0	0.0	48.7	8,630.2	1,262.5	2,978.7	649.4	71.4	21.6	0.0	0.0	13,693.7
Ivylog Creek	0.2	1.6	0.0	0.7	0.0	0.0	24.9	5,101.6	411.0	895.6	378.1	34.2	0.0	0.0	0.0	6,847.7
Kiutuestia Creek	0.0	0.4	0.0	24.5	0.0	0.0	18.0	1,498.4	263.1	490.1	352.3	12.5	0.0	0.0	0.0	2,659.3
Moccasin Creek	0.4	1.8	0.0	2.0	0.0	0.0	0.0	2,561.0	529.1	920.2	370.3	27.4	0.0	0.0	0.0	4,412.2
Noontootla Creek	3.1	0.7	0.0	0.9	0.0	0.0	63.6	13,205.3	2,959.3	4,378.4	157.5	1.1	0.0	0.0	0.0	20,769.8
Nottely River upper	0.2	0.0	0.0	0.2	0.0	0.0	0.0	2,591.5	291.3	468.8	1.6	1.1	0.0	0.0	0.0	3,354.7
Nottely River middle	1.6	0.2	0.0	0.4	0.0	0.0	8.9	8,302.8	1,206.2	1,916.3	68.5	31.1	0.0	0.0	0.0	11,536.1
Nottely River lower	31.4	41.1	0.0	12.0	0.0	68.1	8.9	35,593.5	5,072.4	9,171.5	2,592.6	443.2	1.8	0.0	0.0	53,036.4
Rock Creek upper	4.0	0.7	0.0	0.0	0.0	0.0	1.1	3,296.0	633.1	1,096.8	0.0	0.0	0.0	0.0	0.0	5,031.7
Rock Creek lower	4.0	1.8	0.0	1.1	0.0	0.0	61.6	5,876.1	1,807.1	2,483.6	0.0	0.2	0.0	0.0	0.0	10,235.6
Skeenah Creek	0.2	0.9	0.0	0.0	0.0	0.0	0.0	5,155.6	440.8	1,074.6	276.6	4.9	0.0	0.0	0.0	6,953.6
Star Creek	1.6	0.4	0.0	0.0	0.0	0.0	78.5	1,751.1	159.9	443.4	63.8	1.8	0.0	0.0	0.0	2,500.5
Stink Creek	0.2	2.4	0.0	0.4	0.0	0.0	0.0	3,689.8	372.9	807.7	206.6	28.7	0.0	0.0	0.0	5,108.9
Suches Creek	0.0	0.0	0.0	0.2	0.0	0.0	20.9	3,899.1	183.7	528.4	104.1	2.7	0.0	0.0	0.0	4,739.1
Sugar Creek	7.6	7.6	0.0	10.2	0.0	0.0	25.6	5,623.1	862.6	2,014.6	701.9	25.6	2.4	0.0	0.0	9,281.1
Toccoa River	0.0	0.2	0.0	0.0	0.0	0.0	0.0	2,445.1	68.9	298.9	2.0	0.0	0.0	0.0	0.0	2,815.2
Town Creek	0.7	2.0	0.0	1.1	0.0	0.0	0.0	7,028.5	1,465.5	2,259.5	435.2	95.2	0.0	0.0	0.0	11,287.7
Upper Bell Creek	1.6	0.2	0.0	0.0	0.0	0.9	0.0	3,576.9	169.9	410.7	340.7	0.4	0.0	0.0	0.0	1,708.2
Wilscot Creek	0.4	1.6	0.0	0.2	0.0	0.0	12.7	6,710.5	363.6	892.2	703.2	6.2	0.0	0.0	0.0	8,690.7
Wolf Creek (Nottely)	14.5	0.7	0.0	1.3	0.0	0.0	0.0	3,952.7	687.2	1,019.0	74.5	6.4	0.0	0.0	0.0	5756.3
Wolf Creek (Toccoa)	0.0	13.3	0.0	16.5	0.0	0.0	143.2	3,200.4	745.9	1,271.8	206.6	30.0	20.7	0.0	0.0	5,648.4
Youngcane Creek	0.7	0.7	0.0	0.9	0.0	0.0	0.0	6,078.9	772.6	1,850.7	1,200.0	97.2	0.0	0.0	0.0	10,001.6

Table 3c. Land Coverage Distribution (Impaired – Ridge and Valley Ecoregion)

	Area (acres)															
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Chattanooga Creek	26.9	156.6	14.9	29.1	0.0	0.0	10.9	5,443.8	1,357.7	3,532.4	1,661.7	248.6	100.3	0.0	0.0	12,582.9
Dry Creek	0.7	1.6	0.0	4.4	0.0	0.0	272.0	2,879.0	1,476.4	1,990.8	547.3	48.3	0.0	0.0	0.0	7,220.5
Peavine Creek	27.1	448.1	51.4	205.7	0.0	0.0	119.2	5,099.6	3,302.7	5,519.2	5,701.6	937.6	173.2	0.0	0.0	21,585.3
Rock Creek	14.2	82.3	5.8	55.2	0.0	0.0	0.0	8,821.9	1,674.1	4,506.7	346.3	189.3	30.2	0.0	0.0	15,725.9

Table 3d. Land Coverage Distribution (Impaired – Blue Ridge Ecoregion)

	Area (acres)															
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Bearmeat Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,297.6	87.4	198.6	87.6	12.9	0.0	0.0	0.0	1,684.1
Butternut Creek	1.8	99.0	31.4	192.1	0.0	0.2	0.0	5,277.0	316.5	822.8	687.2	137.0	53.2	0.0	0.4	7,618.5
Lower Youngcane Creek	1.1	0.0	0.0	26.5	0.0	0.0	0.0	1,240.0	159.7	427.9	476.4	55.2	0.0	0.0	0.0	2,386.7
Weaver Creek	1.6	66.5	24.5	105.0	0.0	0.0	0.0	1,783.8	326.7	773.5	211.3	73.6	36.2	0.0	1.6	3,404.1

Table 4a. Land Coverage Percentages (Unimpaired –Ridge and Valley Ecoregion)

Name	Percent Total Land Coverage														
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Crawfish Creek trib to Lookout Mt	0.1%	0.1%	0.0%	0.4%	0.0%	0.0%	0.7%	63.7%	9.5%	19.1%	4.2%	2.3%	0.0%	0.0%	0.0%
Crawfish Creek trib W Chicka. Ck	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	34.7%	16.0%	27.7%	18.2%	3.3%	0.0%	0.0%	0.0%
Dry Creek trib to Lookout Mt Ck	0.1%	0.1%	0.0%	1.8%	0.0%	0.1%	1.5%	45.1%	13.6%	23.2%	9.0%	4.6%	1.0%	0.0%	0.0%
East Chickamauga Creek upper	0.3%	0.1%	0.0%	0.1%	0.0%	0.0%	3.5%	33.6%	15.7%	23.3%	22.1%	0.9%	0.0%	0.4%	0.0%
East Chickamauga Creek lower	0.2%	1.1%	0.1%	0.5%	0.0%	0.0%	2.3%	30.6%	17.1%	24.6%	20.1%	2.8%	0.5%	0.1%	0.0%
Hurricane Creek	0.1%	8.0%	0.8%	0.4%	0.0%	0.0%	0.1%	28.8%	8.8%	24.7%	23.8%	2.9%	1.6%	0.0%	0.0%
Little Chickamauga Creek	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.6%	28.4%	12.8%	25.0%	27.6%	5.2%	0.0%	0.1%	0.0%
Lookout Mountain Creek upper	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	1.4%	53.1%	10.4%	21.5%	9.1%	4.2%	0.0%	0.0%	0.0%
Lookout Mountain Creek middle	0.2%	0.1%	0.0%	0.8%	0.0%	0.0%	2.2%	50.1%	12.7%	22.7%	7.8%	3.1%	0.3%	0.0%	0.0%
Lookout Mountain Creek lower	0.1%	0.5%	0.0%	0.7%	0.0%	0.0%	1.3%	49.5%	12.5%	24.1%	7.2%	3.6%	0.3%	0.1%	0.0%
Pope Creek	0.1%	0.2%	0.0%	0.9%	0.0%	0.0%	0.0%	45.9%	11.7%	25.3%	10.0%	5.4%	0.5%	0.0%	0.0%
South Chickamauga Creek	0.1%	1.4%	0.2%	0.6%	0.0%	0.0%	1.3%	31.3%	13.6%	24.8%	22.4%	3.9%	0.4%	0.1%	0.0%
Squirreltown Creek	0.0%	0.4%	0.0%	0.5%	0.0%	0.0%	0.0%	40.7%	12.9%	30.3%	8.6%	6.3%	0.4%	0.0%	0.0%
Tanyard Creek	0.2%	4.7%	0.5%	2.7%	0.0%	0.0%	4.6%	24.1%	15.1%	26.8%	15.3%	3.3%	2.7%	0.0%	0.0%
Tiger Creek upper	0.2%	0.2%	0.0%	0.1%	0.0%	0.0%	1.7%	28.1%	15.8%	22.3%	27.2%	4.4%	0.0%	0.0%	0.0%
Tiger Creek lower	0.1%	0.1%	0.0%	0.2%	0.0%	0.0%	1.3%	33.8%	14.2%	23.9%	22.5%	3.9%	0.0%	0.0%	0.0%
West Chickamauga Creek upper	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.4%	44.6%	11.9%	22.7%	17.8%	2.4%	0.1%	0.0%	0.0%
West Chickamauga Creek middle	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.5%	36.9%	13.3%	24.2%	21.7%	2.8%	0.1%	0.2%	0.0%
West Chickamauga Creek lower	0.2%	1.1%	0.1%	0.3%	0.0%	0.0%	0.4%	31.9%	13.3%	25.7%	22.7%	3.3%	0.7%	0.1%	0.0%

Table 4b. Land Coverage Percentages (Unimpaired – Blue Ridge Ecoregion)

Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
	Percent Total Land Coverage														
Arkaqua Creek	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	68.4%	5.1%	14.4%	10.6%	1.3%	0.0%	0.0%	0.0%
Big Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	67.6%	12.9%	18.2%	1.3%	0.0%	0.0%	0.0%	0.0%
Brasstown Creek	0.0%	0.1%	0.0%	0.2%	0.0%	0.0%	0.2%	68.1%	8.4%	17.0%	4.7%	1.3%	0.0%	0.0%	0.0%
Butler Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	63.3%	11.9%	19.8%	4.8%	0.1%	0.0%	0.0%	0.0%
Canada Creek	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	79.7%	3.4%	12.8%	2.9%	0.1%	0.8%	0.0%	0.0%
Charlie Creek	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	66.2%	8.0%	21.6%	4.0%	0.0%	0.0%	0.0%	0.0%
Conley Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	58.9%	9.7%	22.2%	8.7%	0.3%	0.0%	0.0%	0.0%
Cooper Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	60.3%	18.6%	20.2%	0.6%	0.0%	0.0%	0.0%	0.0%
Coosa Creek	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	0.1%	57.3%	11.0%	20.8%	9.7%	0.5%	0.1%	0.0%	0.0%
Dooley Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	72.9%	7.0%	17.1%	2.6%	0.4%	0.0%	0.0%	0.0%
Fightingtown Creek	0.0%	0.6%	0.0%	0.1%	0.0%	0.0%	0.6%	43.3%	19.2%	31.1%	4.6%	0.2%	0.2%	0.0%	0.0%
Fodder Creek	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	72.9%	4.7%	19.2%	3.0%	0.0%	0.0%	0.0%	0.0%
Helton Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	76.8%	10.1%	13.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Hemptown Creek	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	58.8%	12.5%	25.3%	2.5%	0.3%	0.0%	0.0%	0.0%
Hightower Creek	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	81.2%	4.2%	11.1%	2.8%	0.2%	0.1%	0.0%	0.0%
Hiawassee River	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	72.6%	9.1%	16.1%	2.1%	0.0%	0.0%	0.0%	0.0%
Hog Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	67.5%	8.1%	21.1%	3.2%	0.0%	0.0%	0.0%	0.0%
Hothouse Creek	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.4%	63.0%	9.2%	21.8%	4.7%	0.5%	0.2%	0.0%	0.0%
Ivylog Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	74.5%	6.0%	13.1%	5.5%	0.5%	0.0%	0.0%	0.0%
Kiutuestia Creek	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.7%	56.3%	9.9%	18.4%	13.2%	0.5%	0.0%	0.0%	0.0%
Moccasin Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	58.0%	12.0%	20.9%	8.4%	0.6%	0.0%	0.0%	0.0%
Noontootla Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	63.6%	14.2%	21.1%	0.8%	0.0%	0.0%	0.0%	0.0%
Nottely River upper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	77.2%	8.7%	14.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Nottely River middle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	72.0%	10.5%	16.6%	0.6%	0.3%	0.0%	0.0%	0.0%
Nottely River lower	0.1%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	67.1%	9.6%	17.3%	4.9%	0.8%	0.0%	0.0%	0.0%
Rock Creek upper	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	65.5%	12.6%	21.8%	0.0%	0.0%	0.0%	0.0%	0.0%
Rock Creek lower	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	57.4%	17.7%	24.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Skeenah Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	74.1%	6.3%	15.5%	4.0%	0.1%	0.0%	0.0%	0.0%
Star Creek	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	3.1%	70.0%	6.4%	17.7%	2.6%	0.1%	0.0%	0.0%	0.0%
Stink Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	72.2%	7.3%	15.8%	4.0%	0.6%	0.0%	0.0%	0.0%
Suches Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	82.3%	3.9%	11.1%	2.2%	0.1%	0.0%	0.0%	0.0%
Sugar Creek	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.3%	60.6%	9.3%	21.7%	7.6%	0.3%	0.0%	0.0%	0.0%
Toccoa River	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	86.9%	2.4%	10.6%	0.1%	0.0%	0.0%	0.0%	0.0%
Town Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	62.3%	13.0%	20.0%	3.9%	0.8%	0.0%	0.0%	0.0%
Upper Bell Creek	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	18.0%	4.0%	5.3%	4.8%	67.7%	0.0%	0.0%	0.0%
Wilscot Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	77.2%	4.2%	10.3%	8.1%	0.1%	0.0%	0.0%	0.0%
Wolf Creek (Nottely)	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	68.7%	11.9%	17.7%	1.3%	0.1%	0.0%	0.0%	0.0%
Wolf Creek (Toccoa)	0.0%	0.2%	0.0%	0.3%	0.0%	0.0%	2.5%	56.7%	13.2%	22.5%	3.7%	0.5%	0.4%	0.0%	0.0%
Youngcane Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	60.8%	7.7%	18.5%	12.0%	1.0%	0.0%	0.0%	0.0%

Table 4c. Land Coverage Percentages (Impaired – Ridge and Valley Ecoregion)

	Percent Total Land Coverage														
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Chattanooga Creek	0.2%	1.2%	0.1%	0.2%	0.0%	0.0%	0.1%	43.3%	10.8%	28.1%	13.2%	2.0%	0.8%	0.0%	0.0%
Dry Creek	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	3.8%	39.9%	20.4%	27.6%	7.6%	0.7%	0.0%	0.0%	0.0%
Peavine Creek	0.1%	2.1%	0.2%	1.0%	0.0%	0.0%	0.6%	23.6%	15.3%	25.6%	26.4%	4.3%	0.8%	0.0%	0.0%
Rock Creek	0.1%	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%	56.1%	10.6%	28.7%	2.2%	1.2%	0.2%	0.0%	0.0%

Table 4d. Land Coverage Percentages (Impaired – Blue Ridge Ecoregion)

	Percent Total Land Coverage														
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Bearmeat Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	77.1%	5.2%	11.8%	5.2%	0.8%	0.0%	0.0%	0.0%
Butternut Creek	0.0%	1.3%	0.4%	2.5%	0.0%	0.0%	0.0%	69.3%	4.2%	10.8%	9.0%	1.8%	0.7%	0.0%	0.0%
Lower Youngcane Creek	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	52.0%	6.7%	17.9%	20.0%	2.3%	0.0%	0.0%	0.0%
Weaver Creek	0.0%	2.0%	0.7%	3.1%	0.0%	0.0%	0.0%	52.4%	9.6%	22.7%	6.2%	2.2%	1.1%	0.0%	0.0%

Table 5a. Soil Type Distribution (Unimpaired – Ridge and Valley Ecoregion)

	Soil Types (acres)																							
NAME	AL040	AL039	AL027	AL026	TN239	TN219	TN217	TN110	TN098	GA126	GA110	GA106	GA105	GA028	GA023	GA013	GA011	GA010	GA009	GA008	GA007	GA003	GA002	GA001
K-Factor	**0.34**	**0.37**	**0.24**	**0.23**	**0.23**	**0.34**	**0.38**	**0.34**	**0.35**	**0.25**	**0.34**	**0.37**	**0.34**	**0.25**	**0.25**	**0.36**	**0.32**	**0.34**	**0.33**	**0.38**	**0.35**	**0.24**	**0.24**	**0.23**
Crawfish Creek trib to Lookout Mt Ck	1,464	375	855		855								1,858									805	82	
Crawfish Creek trib to W. Chickamauga Ck																				1,741	2,633	31		
Dry Creek trib to Lookout Mt Ck	8,406	264	95	3,747								495	549									39		
East Chickamauga Creek upper																	2,670	1,685	298		5,512	1,530		
East Chickamauga Creek lower																	10,784	16,722	298		9,640	3,914		
Hurricane Creek					695	1,036	1,745	3,470			858						344	469		901		809		
Little Chickamauga Creek																				16,180	10,700	2,173		
Lookout Mountain Creek upper	4,824	2,575	195	2,041	195							60	832									1,263	1	
Lookout Mountain Creek middle	13,232	2,837	291	6,075	291							4,496	2,761									6,113	5,690	1,630
Lookout Mountain Creek lower	16,193	2,837	828	8,612	828							4,496	11,649	1,700	3,954					3,708	861	19,473	16,616	3,590
Pope Creek					1,033				259								1,718				375	1,150		
South Chickamauga Creek					696	1,038	1,756	3,544			2,807							883	598		26,100	11,591	4,270	
Squirreltown Creek																	2,605			359	57	3,900	232	
Tanyard Creek																	2	4,124			1,938			
Tiger Creek lower						2,776		1,334			1,041						2,787	13,811			5,385			
Tiger Creek upper						1,514		1,309			1,044		930					4,227			5,382			
West Chickamauga Creek upper																				4,412	17,789	15,434	2,038	1,010
West Chickamauga Creek middle																				18,159	32,087	16,123	2,038	1,010
West Chickamauga Creek lower																3,589				31,492	38,265	16,123	2,038	1,010

Table 5b. Soil Type Distribution (Unimpaired – Blue Ridge Ecoregion)

	Soil Types (acres)															
NAME	**TN154**	**NC121**	**NC120**	**NC103**	**NC102**	**NC093**	**NC006**	**GA125**	**GA115**	**GA099**	**GA098**	**GA020**	**GA019**	**GA018**	**GA016**	**GA015**
K-Factor	**0.24**	**0.25**	**0.23**	**0.27**	**0.26**	**0.24**	**0.24**	**0.25**	**0.25**	**0.26**	**0.24**	**0.24**	**0.25**	**0.29**	**0.23**	**0.25**
Arkaqua Creek													4,715		2,521	298
Big Creek								1,643					5,856			167
Brasstown Creek											156		9,115		5,822	1,599
Butler Creek		148						1,513								
Canada Creek													7,649			
Charlie Creek								678					1,303			
Conley Creek								179	1,763						1,763	
Cooper Creek																
Coosa Creek													5,899		3,347	4,421
Dooley Creek								4,558							78	
Fightingtown Creek	28							326			177		2,449		5,332	10,718
Fodder Creek													4,407		1,362	
Helton Creek													4,747			
Hemptown Creek								4,874								
Hightower Creek									10,784			141	5,795		3,819	
Hiawassee River													23,373		198	3,262
Hog Creek													3,066		579	
Hothouse Creek		84		458	3,583		2,004	6,395			1,244					
Ivylog Creek										185			3,097		1,579	2,194
Kiutuestia Creek															2,198	668
Moccasin Creek		1,388			589			1,831							632	
Noontootla Creek								2,579					18,157			65
Nottely River upper													3,376			
Nottely River middle													23,244			
Nottely River lower													35,150		15,239	2,466
Rock Creek upper													5,021			
Rock Creek lower													10,205			
Skeenah Creek													4,400			
Star Creek								2,581							98	
Stink Creek													3,300		1,484	447
Suches Creek													5,079			
Sugar Creek								3,731							2,959	2,770
Toccoa River													2,838			
Town Creek													8,866		2,311	
Upper Bell Creek			2			1,521			459			2,526			293	
Wilscot Creek								6,059					2,862			
Wolf Creek (Nottely)													5,086		646	
Wolf Creek (Toccoa)	684				858		2,273	1,232			920					
Youngcane Creek								1,834					3,565		4,079	745

Table 5c. Soil Type Distribution (Impaired – Ridge and Valley Ecoregion)

	Soil Types (acres)																							
NAME	**AL040**	**AL039**	**AL027**	**AL026**	**TN239**	**TN219**	**TN217**	**TN110**	**TN098**	**GA126**	**GA110**	**GA106**	**GA105**	**GA028**	**GA023**	**GA013**	**GA011**	**GA010**	**GA009**	**GA008**	**GA007**	**GA003**	**GA002**	**GA001**
K-Factor	**0.34**	**0.37**	**0.24**	**0.23**	**0.23**	**0.34**	**0.38**	**0.34**	**0.35**	**0.25**	**0.34**	**0.37**	**0.34**	**0.25**	**0.25**	**0.36**	**0.32**	**0.34**	**0.33**	**0.38**	**0.35**	**0.24**	**0.24**	**0.23**
Chattanooga Creek																2,193					5,671	4,581	235	
Dry Creek																	5,277	117				1,983		
Peavine Creek											91					1,007				12,872	7,688			
Rock Creek										3,181						2						1,382	11,141	

Table 5d. Soil Type Distribution (Impaired – Blue Ridge Ecoregion)

	Soil Types (acres)															
NAME	**TN154**	**NC121**	**NC120**	**NC103**	**NC102**	**NC093**	**NC006**	**GA125**	**GA115**	**GA099**	**GA098**	**GA020**	**GA019**	**GA018**	**GA016**	**GA015**
K-Factor	**0.24**	**0.25**	**0.23**	**0.27**	**0.26**	**0.24**	**0.24**	**0.25**	**0.25**	**0.26**	**0.24**	**0.24**	**0.25**	**0.29**	**0.23**	**0.25**
Bearmeat Creek									4,838			1,427			1,370	
Butternut Creek													16,476		15,956	2,474
Lower Youngcane Ck								1,990							10,959	
Weaver Creek								7,444					3,632	3,861		1,328

2.0 WATER QUALITY ASSESSMENT

Biological monitoring is a method used to evaluate the health of a biological system in order to assess degradation from various sources. It is based on direct observations of aquatic communities. The results of these studies were the basis for the listing of Biota Impacted stream segments on Georgia's 1996 303(d) list.

2.1 Fish Sampling

In 1995, the Tennessee Valley Authority (TVA) conducted studies of fish communities in the Chickamauga/Nickajack Basin in the Tennessee River Basin (HUC 060200001). Twenty-three sites were sampled. These sites had to be accessible, wadeable, and representative of the stream under investigation. Electrofishing and seining techniques were used for the sampling of fish populations.

The work performed by the TVA looked at patterns of fish communities within the Ridge and Valley Ecoregion. An ecoregion is a region of relative homogeneity in ecological systems or in relationships between organisms and their environment. Seven major ecoregions have been identified in Georgia based upon the soil types, potential natural vegetation, land surface form, and predominant land uses. These include the Blue Ridge Mountains, Ridge and Valley, Southwestern Appalachians, Piedmont, Middle Atlantic Coastal Plain, Southeastern Plains, and Southern Coastal Plain.

TVA used the Index of Biotic Integrity (IBI) to identify affected fish populations. The IBI assesses the biotic integrity of aquatic communities based on the functional and compositional attributes of the fish community. The IBI consists of twelve measurements or metrics, which assess three facets of the fish population: species richness and composition, trophic composition and dynamics, and fish abundance and condition.

The IBI values were used to classify the populations as Excellent, Good, Fair, Poor, or Very Poor. Four stream segments in the Chickamauga/Nickajack (HUC 06020001) were rated as Poor or Very Poor, and these segments were listed as Biota Impacted. Nineteen stream segments were rated as Excellent, Good, or Fair and assessed as supporting their designated water use.

Table 6 summarizes TVA's study scores. The IBI scores are listed and the watersheds are grouped by those that were not 303(d) listed streams and those that were. In addition, the table includes the drainage areas upstream of the monitoring points, and the counties in which the watersheds are located. The least impacted sites, given the prevalent land use, have IBI scores of approximately 50.

Table 6a. 1995 TVA's Fish Community Study Scores (Unimpaired – Ridge and Valley Ecoregion)

Name	Drainage Area upstream from the monitoring point (sq mi)	Location	County	IBI Score	IBI Category
Crawfish Creek trib to Lookout Mt	7.9	At Us Hwy 11	Dade, Dekalb AL	52	Good
Crawfish Creek trib W Chicka. Ck	6.5	Glass Mill Road crossing	Catoosa, Walker	48	Good
Dry Creek	20.7	East Near Cloverdale Road	Dade, Dekalb AL	52	Good
East Chickamauga Creek upper	17.8	Dunnegan Road crossing	Catoosa, Whitfield, Walker	40	Fair
East Chickamauga Creek lower	64.5	Near Mouth	Whitfield, Walker	48	Good
Hurricane Creek	15.8	Hollow Road crossing	Catoosa, Hamilton TN	48	Good
Little Chickamauga Creek	45.3	Hackett Mill Road near mouth	Catoosa, Walker	40	Fair
Lookout Mountain Creek upper	17.7	At Cloverdale Road	Dade, Dekalb AL	46	Fair/Good
Lookout Mountain Creek middle	67.7	Newson Gap Rd near Rising Fawn	Dade, Walker, Dekalb AL	46	Fair/Good
Lookout Mountain Creek lower	148.2	At Creek Road	Dade, Walker, Dekalb AL	36	Poor/Fair
Pope Creek	6.7	Creek Road crossing near mouth	Dade, Hamilton TN	48	Good
South Chickamauga Creek	83.3	Graysville at Swanson Mill	Catoosa, Whitfield, Walker, Bradley TN, Hamilton TN	44	Fair
Squirreltown Creek	11.1	New England Road crossing	Dade	46	Fair/Good
Tanyard Creek	8.7	At Tunnel Hill golf course	Catoosa, Whitfield	44	Fair
Tiger Creek lower	41.6	Hwy 2 behind Tiger Creek Elementary	Catoosa, Whitfield, Bradley TN, Hamilton TN	46	Fair/Good
Tiger Creek upper	21.7	Near Salem Chapel Road	Catoosa, Whitfield, Bradley TN, Hamilton TN	42	Fair
West Chickamauga Creek upper	63.9	Hwy 136	Dade, Walker	42	Fair
West Chickamauga Creek middle	108.3	Glass Mill Road crossing	Catoosa, Dade, Walker	34	Poor/Fair
West Chickamauga Creek lower	145.2	Hwy 2 crossing	Catoosa, Dade, Walker	48	Good

Table 6b. 1995 TVA's Fish Community Study Scores (Impaired – Ridge and Valley Ecoregion)

Name	Drainage Area upstream from the monitoring point (sq mi)	Location	County	IBI Score	IBI Category
Chattanooga Creek	19.7	Near Valley View , GA	Walker	34	Poor
Dry Creek	11.3	East Chickamauga	Catoosa, Whitfield	34	Poor
Peavine Creek	33.7	Wooten Road	Catoosa, Walker	34	Poor
Rock Creek	24.6	Rock Creek Road	Dade, Walker	30	Poor

2.2 Macroinvertebrate Sampling

In 1993, the Tennessee Valley Authority (TVA) Hiawassee River Action Team (RAT) conducted studies of macroinvertebrate populations at forty-three of monitoring sites in the Blue Ridge Ecoregion of the Tennessee River Basin. The TVA Hiawassee RAT used the Modified Rapid Bioassessment (MRB) protocol to evaluate the ecological health of the streams in the Hiawassee River watershed (HUC 06020002 and HUC06020003).

Macroinvertebrate data results were evaluated using twelve metrics as a measure of diversity, community composition (e.g., prevalence of tolerant or intolerant organisms), and environmental stress from a variety of possible sources. The MRB values were used to classify the populations as Excellent, Good, Fair, Poor, or Very Poor.

Table 7 summarizes TVA Hiawassee RAT's macroinvertebrate study scores and includes the drainage areas upstream of the monitoring points, the counties in which the watersheds are located, and the number of obviously different taxa of Ephemeroptera, Plecoptera and Tricoptera evaluated at streamside without magnification (EPT). The watersheds are grouped by those that were not 303(d) listed and those that were. Thirty-nine stream segments were rated as Excellent, Good, or Fair and assessed as supporting their designated water use. Four stream segments were rated as Poor or Very Poor, and were listed as Biota Impacted. The least impacted sites, given the prevalent land use, have MRB scores greater than 50.

Table 7a. 1993 Hiawassee RAT's Macroinvertebrate Community Study Scores (Unimpaired – Blue Ridge Ecoregion)

Name	Drainage Area upstream from the monitoring point (sq mile)	County	MRB Score	Rating	EPT
Arkaqua Creek	11.6	Union	38	Poor/Fair	23
Big Creek	11.7	Union, Cherokee NC	50	Good	25
Butler Creek	26.2	Fannin, Union, Cherokee NC	40	Fair	25
Canada Creek	2.1	Union	48	Good	23
Charlie Creek	11.8	Fannin, Gilmer	38	Poor/Fair	20
Conley Creek	3.1	Union	42	Fair	24
Cooper Creek	3.0	Fannin, Union	54	Good/Excellent	26
Coosa Creek	36.6	Union	qual	Poor/Fair	NC
Dooley Creek	21.3	Fannin, Union	40	Fair	17
Fightingtown Creek	6.8	Fannin	58	Excellent	24
Fodder Creek	29.8	Towns, Union	44	Fair	26
Helton Creek	9.0	Union	56	Good/Excellent	31
Hemptown Creek	7.3	Fannin	54	Good/Excellent	24
Hiawassee River	7.5	Rabun, Towns, Union	50	Good	30
Hightower Creek	32.4	Rabun, Towns	52	Good	27
Hog Creek	42.2	Towns	40	Fair	25
Hothouse Creek	5.7	Fannin, Cherokee NC	54	Good/Excellent	21
Ivylog Creek	21.4	Union	42	Fair	27
Kiutuestia Creek	10.7	Union	36	Poor/Fair	23
Moccasin Creek	4.2	Union, Cherokee NC	38	Poor/Fair	24
Noontootlah Creek	6.9	Fannin, Gilmer, Union	52	Good	29
Nottely River Upper	32.5	Union	44	Fair/Good	28
Nottely River Middle	5.2	Union	56	Good/Excellent	26
Nottley River Lower	18.0	Union	42	Fair	22
Rapier Mill Creek	82.9	Union	44	Fair	26
Rock Creek upper	7.9	Fannin, Union	52	Good	27
Rock Creek lower	16.0	Fannin, Union	44	Fair	17
Skeenah Creek	10.9	Fannin, Union	52	Good	26
Star Creek	3.9	Union	46	Fair/Good	19
Stink Creek	8.0	Union	44	Fair/Good	23
Suches Creek	7.4	Union	56	Good/Excellent	22
Sugar Creek	14.5	Fannin, Gilmer	52	Good	22
Toccoa River	4.4	Union	56	Good/Excellent	23
Town Creek	17.6	Union	40	Fair	28
Upper Bell Creek	2.7	Towns, Clay NC	38	Poor/Fair	17
Wilscot Creek	13.6	Fannin	54	Good/Excellent	21
Wolf Creek (Nottely River)	9.0	Union	36	Poor/Fair	23
Wolf Creek (Toccoa River)	8.8	Fannin, Polk TN, Cherokee NC	46	Good	23
Youngcane Creek	15.6	Fannin, Union	44	Fair	26

Table 7b. 1993 Hiawassee RAT's Macroinvetrebrate Community Study Scores (Impaired – Blue Ridge Ecoregion)

Name	Drainage Area upstream from the monitoring point (sq mile)	County	MRB Score	Rating	EPT
Bearmeat Creek	2.6	Towns	32	Poor	16
Butternut Creek	11.9	Towns, Union	30	Poor	14
Lower Youngcane Creek	3.7	Fannin, Union	32	Poor	20
Weaver Creek	5.3	Fannin	30	Poor	9

3.0 SOURCE ASSESSMENT

A healthy aquatic ecosystem requires a healthy habitat. The major disturbance to stream habitats is erosion and sedimentation. As sediment is carried into the stream, it changes the stream bottom and smothers sensitive organisms. Turbidity associated with sediment loads may also impair recreational and drinking water uses (GA EPD, 1998).

A source assessment characterizes the known and suspected sources of sediment in the watershed for use in a water quality model and the development of the TMDL. The general sources of sediment are point and nonpoint sources. National Pollutant Discharge Elimination System (NPDES) permittees discharging treated wastewater are the primary point sources of sediment as total suspended solids (TSS) and/or turbidity.

Nonpoint sources of sediment are diffuse sources that cannot be identified as entering the water body at a single location. These sources generally involve land use activities that contribute sediment to streams during a rainfall runoff event. Nonpoint sources of sediment included in the source assessment analysis are:

- Silviculture,
- Agriculture,
- Grazing areas,
- Mining sites,
- Roads, and
- Urban Development

For nonpoint sources involving silviculture, the Georgia Forestry Commission (GFC) was consulted for information and parameters regarding silviculture activities. The Natural Resources Conservation Service (NRCS) was consulted for information and parameters regarding agricultural activities. Data regarding mining sites was from the Watershed Characterization System developed by Tetra Tech for United States Environmental Protection Agency (EPA) Region IV. The Georgia Department of Transportation (DOT) provided the road coverage and other information, including road surface type.

3.1 Point Source Assessment

For purposes of this TMDL, facilities permitted under the National Pollutant Discharge Elimination System (NPDES) will be considered point sources. Discharges from municipal and industrial facilities may contribute biological reactive solids to receiving waters as TSS and/or turbidity. There are three permitted NPDES discharges identified in the Tennessee River Basin watersheds upstream from the listed segments. Table 8 provides the permitted flow and TSS concentrations for the NPDES permits located in the impaired Tennessee River Basin watersheds, as well as the calculated TSS load.

Heavy metals, total residual chlorine, and ammonia are sometimes present in wastewater effluent. Fish and macroinvertebrate communities in the receiving streams may be affected by these parameters. The facilities listed in Table 8 are currently not required to monitor for these constituents.

Table 8. NPDES Permit Limits For Facilities in the Impaired Watersheds of the Tennessee River Basin

Facility	NPDES Permit No.	Facility Type	Receiving Water	Flow (MGD)		TSS (mg/L)		TSS LOAD	
				Monthly Average	Weekly Average	Monthly Average	Weekly Average	Daily Avg (lbs/day)	Annual (ton/yr)
Blairsville WPCP	GA0033375	Municipal	Butternut Creek	0.4	0.5	30	45	100.08	18.3
Knight's Inn WPCP	GA0022411	Private	Peavine Creek	0.016	0.020	30	45	4.00	0.7
Sherwood Forest Mobile Home Park	GA0029734	Private	Peavine Creek	0.03	0.0375	30	45	7.51	1.4

Soil erosion from construction sites is a major source of sediment in Georgia's streams. Georgia requires construction sites over five acres to have a General Storm Water NPDES permit. A Notice of Intent (NOI) must be submitted to the State for each construction site over five acres in order for its storm water to be covered under this permit. The permits authorize the discharge of storm water associated with construction activity to the waters of the State in accordance with the limitations, monitoring requirements, and other conditions set forth in the permit. All sites are required to have an Erosion and Sedimentation Control Plan; to implement, inspect and maintain BMPs; and to monitor storm water for turbidity. In 2003, this permit will also cover all construction sites disturbing between one and five acres.

3.2 Nonpoint Source Assessment

Eroded soils from forests, cropland, mining sites, and other land are transported to Georgia streams through runoff. Excessive sediment that reaches streams can cause several changes. It can make streams shallower and wider, affecting the stream's temperature, dissolved oxygen, flow rate and velocity. It can affect the ability of the streams to assimilate pollutants. It can change the diversity of fish populations and other biological communities in the streams. It can also cause increased flooding. In addition, harmful pollutants attached to the sediment can be transported to rivers and streams.

3.2.1 Silviculture

Georgia has 23.6 million acres of commercial forests. This represents approximately 64 percent of all of Georgia's land use. Approximately 68 percent of the commercial forests are privately owned, 25 percent are owned by industry, and 7 percent are publicly held (GA EPD, 1999).

The majority of soil erosion from forested land occurs during timber harvesting and the period immediately following, as well as during reforestation. Once the forest is re-established, very little soil erosion occurs. Timber harvesting includes the layout of access roads, log decks, and skid trails; the construction and stabilization of these areas; and the cutting of trees. Both hardwoods and pines are harvested throughout Georgia. A minimum harvest is usually ten acres and the percent of forest that is harvested each year varies from county to county. Table 9 lists the percent timberland and percent harvested per year by county.

Table 9. Percent Timberland and Percent Harvested per Year by County

County	Total Area (1000 acres)	Timberland (1000 acres)	Percent Timberland	Growing Stock Volume (million ft^3)[a]	Annual Volume Removal (million ft^3)	Annual Percent Removal
Catoosa	103.8	46.5	44.80%	88.6	0.7	0.79%
Dade	111.3	72.7	65.32%	159.4	-	-
Fannin	246.9	165	66.83%	346.7	6.1	1.76%
Gilmer	273.1	225.3	82.50%	480.7	4.3	0.89%
Lumpkin	182.1	139.5	76.61%	305.9	4.2	1.37%
Rabun	237.5	190.4	80.17%	470.8	1.1	0.23%
Towns	106.6	64.8	60.79%	131.8	3.4	2.58%
Union	206.5	135.6	65.67%	250.5	8.5	3.39%
Walker	285.6	190.5	66.70%	293.4	7.1	2.42%
Whitfield	185.6	102.8	55.39%	173.4	5.5	3.17%

[a] Estimate - does not include trees less than 5" DBH.
Source: Thomas, Michael T., 1997. *Forest Statistics for Georgia*

3.2.2 Agriculture

Agriculture can be a significant contributor of nonpoint pollutants to rivers and streams. Sediment and nutrients are the major pollutants of concern and cropland is one of the major sources of soil loss due to sheet and rill erosion. Over the last century there has been a dramatic decrease in the amount of land farmed in Georgia. In 1950, there were 208,000 farms encompassing 26 million acres in Georgia (U.S. Department of Agriculture, National Agricultural Statistics Service website). In 2000, there were approximately 11.1 million acres of farmland in Georgia, with the number of farms estimated to be 50,000 and the average farm size being approximately 222 acres. This represents a 57 percent reduction in farmland.

With this reduction in farmland, there has also been a decrease in the amount of soil erosion. The National Resources Inventory found the total wind and water erosion on cropland and Conservation Reserve Program land in Georgia declined 38 percent, from 3.1 billion tons in 1982 to 1.9 billion tons in 1997. This suggest that the source of sediment in many of the impaired streams in the Tennessee River Basin may be the result of past land use practices. Thus, it is believed that if sediment loads are maintained at acceptable levels, streams will repair themselves over time.

3.2.3 Grazing Areas

Farm animals grazing on pasture land can leave areas of ground with little or no vegetative cover. During a rainfall runoff event, the soil in the pastures is eroded and transported to nearby streams, typically by gully erosion. The amount of soil loss from gully erosion is generally less than that caused by sheet and rill erosion. Work in small grazed catchments in New Mexico found that gully erosion contributed only 1.4 percent of the total sediment load as compared to sheet and rill erosion. Other research had found that gully erosion typically contributes less than 30 percent of the total sediment load; however, contributions have ranged from 0 to 89 percent (USEPA, 2001b).

Beef cattle spend all their time grazing in pastures, while dairy cattle and hogs are periodically confined. Hog farms confine the animals or allow them to graze in small pastures or pens. On dairy farms, the cows are confined for a limited period each day, during which time they are fed and milked. In addition, beef cattle and other unconfined animals often have direct access to streams that pass through pastures. As these animals walk down to the stream, they often damage stream banks. Stream bank vegetation is destroyed and the banks often collapse, resulting in increased sedimentation to the waterway.

3.2.4 Mining Sites

Minerals, rocks, and ores are found in natural deposits on or in the earth. Kaolin, clays, granite, marble, sand, gravel, and other mineral products are the materials primarily mined in Georgia. Surface mining involves the activities and processes used to remove minerals, ores, or other solid material. Tunnels, shafts and dimension stone quarries are not considered to be surface mines. Surface mining encompasses a variety of activities from sand dredging to open pit clay mining to hard rock aggregate quarrying.

Removal of vegetation, displacement of soils and other significant land disturbing activities are typically associated with surface mining. These operations can result in accelerated erosion and sedimentation of surface waters. Table 10 lists the active, inactive, and exploratory mines located in the watersheds monitored in the Tennessee River Basin.

Table 10. Mines Located in the Tennessee River Basin Watersheds

Name	Company	Type	County	Current Status	Material Mined
Coffee Prospect		Unknown	Union	Exp Prospect	Iron
J.T. Algoods Property		Underground	Walker	Past Producer	Iron
Rossville Quarry	Stone Man Inc.	Surface	Walker	Producer	Stone - Limestone Cb
Stoner-Caldwell Property		Surface	Walker	Past Producer	Iron
Track Rock Corundum Mine	New York Corundum and Mining Co.	Underground	Union	Past Producer	Abrasive Corundum
W. H. Dodd Property		Unknown	Fannin	Unknown	Iron
Wellborn Mountain Quarry	Colwell Construction Company Inc.	Surface	Union	Producer	Stone - Granite Cb

Source: USEPA, 2001a. *Watershed Characterization System (WCS)* Data, Georgia, US. Tetra Tech, Environmental Protection Agency, Region IV, Atlanta, Georgia , Jan 31, 2001.

3.2.5 Roads

Erosion from unpaved roadways can be a significant source of sediment to our rivers and streams. It occurs when soil particles are loosened and carried away from the roadway, ditch, or road bank by water, wind, or traffic. The physical aspects of road construction (including erosive road-fill soil types, shape and size of coarse surface aggregate, poor subsurface and/or surface drainage, poor road bed construction, roadway shape, and inadequate runoff discharge outlets or “turn-outs” from the roadway) may aggravate roadway erosion. In addition, external factors such as roadway shading and light exposure, traffic patterns, and road maintenance may also affect roadway erosion.

Exposed soils, high runoff velocities and volumes, and poor road compaction all increase the potential for erosion. Loose soil particles are often carried from the road bed into the adjacent drainage ditches. Some of these particles settle out, but usually they do not, causing diminished ditch carrying capacity, which leads to roadway flooding and, subsequently, increased roadway erosion (Choctawhatchee, et. al, 2000).

3.2.6 Urban Development

Soil erosion from land disturbing activities is a major source of sediment in Georgia’s streams. Land-disturbing activities are defined as any activity that may result in soil erosion and the movement of sediments into state waters or on lands of the state. Examples of land disturbing activities include clearing, grading, excavating, or filling of land. The following activities are unconditionally exempt from the provisions of the Erosion and Sedimentation Act; surface mining, granite quarrying, minor land-disturbing activities such as home gardens and landscaping, agricultural and silvicultural operations, and any project carried out under the technical supervision of the NRCS.

Conversion of forest to urban land use is often associated with water quality degradation. From 1982 through 1989, the area classified as commercial forest within the Tennessee River Basin decreased by approximately 1053 acres or 0.0045 percent (GA EPD, 1998). It should be noted that forest undergoing conversion to another land use is not considered silviculture, but rather a land disturbing activity.

Storm water runoff from developed urban areas can also have an impact on the transport of sediment to and within streams. Urbanization increases imperviousness, resulting in an increase in the volume of runoff entering the streams. In addition, the streamflow rates may increase significantly from pre-construction rates, causing stream bank erosion and stream bottom down-cutting.

4.0 MODELING APPROACH

Establishing the relationship between the in-stream water quality and the source loadings is an important component of TMDL development. It provides for both the identification of sources and their relative contribution, as well as the examination of potential water quality changes resulting from varying management options to meet the water quality standard. This relationship can be developed using a variety of techniques, ranging from simple methods based on scientific principles to more complex numerical computer modeling techniques.

In this section, the numerical modeling techniques used to simulate sediment fate and transport in the watershed are discussed. The limited amount of sediment loading data and in-stream sediment information prevents GA EPD from using a dynamic watershed runoff model, which requires a great deal of data for model development and calibration. Instead, GA EPD determined the annual sediment loads delivered to the stream from the surrounding watershed. This TMDL does not address in-stream sedimentation processes, such as bank erosion and stream bottom down-cutting, since computer models that simulate these processes are not available at this time.

4.1 Model Selection

The Agricultural Research Station (ARS) developed the Universal Soil Loss Equation (USLE) over 30 years ago. It is the most widely accepted and most used soil loss equation. It was designed as a method to predict average annual soil loss caused by sheet and rill erosion. The USLE can estimate long-term soil loss and can assist in choosing proper cropping, management and conservation practices. However, it cannot be used to determine erosion for a specific year or specific storm. Because of the wide acceptance by the forestry, agricultural, and academic communities, the USLE was selected as the tool for estimating long-term annual soil erosion, assessing the impacts of various land uses, and evaluating the benefits of various Best Management Practices (BMPs).

4.2 Universal Soil Loss Equation

For each of the watersheds monitored in the Tennessee River Basin, the existing average annual sediment load was estimated using the USLE. The USLE predicts the average annual soil loss caused by sheet and rill erosion. Soil loss from sheet and rill erosion is mainly due to detachment of soil particles during rainfall events. It is the major source of soil loss from crop production, animal grazing areas, logging areas, mine sites, unpaved roads, and construction sites. The equation used for estimating average annual soil erosion is:

$$A = RKLSCP$$

Where:

A = average annual soil loss (tons/acre)
R = rainfall erosivity index
K = soil erodibility factor
LS = topographic factor
  L = slope length
  S = slope
C = cropping factor
P = conservation practice factor

4.2.1 Rainfall Erosivity Index

The R factor, or rainfall erosivity index, describes the kinetic energy generated by the frequency and intensity of the rainfall. It is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, multiplied by its maximum 30-minute intensity. This factor varies geographically, and Table 11 gives the R factors for the counties in which watersheds were modeled within the Tennessee River Basin.

Table 11. R factors by County

County	R factor
Catoosa	275
Dade	275
Fannin	275
Gilmer	275
Lumpkin	275
Rabun	300
Towns	300
Union	300
Walker	275
Whitfield	275

Source: USEPA, 2001a. *Watershed Characterization System (WCS)* Data, Georgia, US. Tetra Tech, Environmental Protection Agency, Region IV, Atlanta, Georgia, Jan 31, 2001.

4.2.2 Soil Erodibility Factor

The K factor, or soil erodibility factor, represents the susceptibility of soil to be eroded. This factor quantifies the cohesive or bonding character of the soil, as well as the ability of the soil to resist detachment and transport during a rainfall event. It is a function of the soil type, a parameter provided by the STATSGO data. Table 5 provides a breakdown of the soil type within each modeled watershed and the corresponding K factor. STATSGO soil data has a resolution of 1:250,000 and is available for all of Georgia. A higher-resolution (1:25,000) soil data, SSURGO, is available for fourteen Georgia counties. For consistency, however, it was decided that STATSGO data would be used for the first phase of sediment TMDLs because of its availability for all of Georgia. During the second phase of sediment TMDLS, if SSURGO data is available for all counties in Georgia, then it may be used.

4.2.3 Topographic Factor

The LS factor, or topographic factor, represents the effect of slope length and slope steepness on erosion. Steeper slopes produce higher overland flow velocities. Longer slopes accumulate more runoff from larger areas and also result in higher overflow velocities. The slope length and slope steepness are based on the grid size and ground slope provided by the USGS 30 by 30 meter Digital Elevation Model (DEM) grids, which were downloaded from the State GIS clearinghouse.

4.2.4 Cropping factor

The C factor, or cropping factor, represents the effect plants, soil cover, soil biomass, and soil disturbing activities have on erosion. It is the most complicated of all the USLE factors. It incorporates the effects of tillage, crop type, cropping history, and crop yield. Cropping factors for forested, agricultural, and urban lands were provided by the GFC, NRCS, and EPA, respectively.

Forested land includes both mature trees and those being harvested. The forest C factor for each watershed was calculated based on the percent of forest harvested in each county (see Table 9). If a watershed is in multiple counties, the percent forest harvested is determined by area-weighting the forested area within each county.

C factors for cropland and pastureland for each county were developed by NRCS under the National Resource Inventory Program and are listed in Table 12. These values were developed based on the 1995 MRLC data. Low-level aerial photography was performed and the photographs were interpreted to identify land features. If data were not available for a given county, the C factor was calculated by averaging the C factors from all the surrounding counties. The crop and pasture land C factors for watersheds in multiple counties were determined by area-weighting the agricultural land use within each county.

Table 12. Cropland and Pasture C factors by County

County	C factor	
	Cropland	Pasture
Catoosa	0.220	0.003
Dade	0.303	0.006
Fannin	0.172	0.004
Gilmer	0.202	0.003
Lumpkin	0.090	0.018
Rabun	0.510	0.006
Towns	0.358	0.011
Union	0.352	0.004
Walker	0.420	0.003
Whitfield	0.460	0.003

Source: USDA-NCRS, 1997. *National Resources Inventory*; USDA-NCRS Athens, Georgia

C factors for the road networks were determined based on the road surface type and are given in Table 13. Road information, including road surface type, was provided by the Georgia DOT. Data gaps were filled based on adjacent road surfaces and road types (i.e., state, county, private).

Table 13. Road C factors

Road Surface	Type	C factor
Rigid and High Flexible Road	1	0.13
Bituminous Surfaced Road	2	0.25
Gravel or Stone Road	3	0.65
Soil-Surfaced Road	4	0.75
Primitive or Unimproved Road	5	0.75

C factors for other land uses, including urban, mining, transitional, grass, and wetlands, are listed in Table 14. These values were provided by EPA and are used in all watersheds.

Table 14. Various Land Use C factors

Land Use	C factor
Water	0
Low Intensity Residential	0.02
High Intensity Residential	0.005
High Intensity Commercial, Industrial, Transportation	0.003
Bare rock, sand, clay	0
Quarries, strip mines, gravel pits	0.75
Transitional	0.002
Other Grasses	0.003
Woody Wetlands	0.011
Emergent Herbaceous Wetlands	0.003

4.2.5 Conservation Practice Factor

The P factor, or conservation practice factor, represents the effects of conservation practices on erosion. The conservation practices include Best Management Practices (BMPs) such as contour farming, strip cropping and terraces. In all cases, it was assumed that no BMPs were used and the P factor for all land uses was 1.0.

4.3 WCS Sediment Tool

EPA and Tetra Tech developed the Arcview-based Watershed Characterization System (WCS) to provide tools for characterizing various watersheds. WCS was used to display and analyze geographic information system (GIS) data including land use, soil type, ground slope, road networks, point source discharges, and watershed characteristics.

An extension of WCS is the Sediment Tool, which incorporates the USLE. The Sediment Tool can be used to perform the following tasks:

- Estimate the extent and distribution of potential soil erosion within a watershed.
- Estimate the potential sediment delivery to the receiving water body.
- Evaluate the effects of land use, BMPs, and road networks on erosion and sediment delivery.

The watersheds of interest were delineated based on the stream coverage (RF3) and elevation data. If there was no RF3 segment within the delineated watershed, the WCS Sediment Tool could not be used.

A stream grid for each delineated watershed was created based on elevation data. The stream grid corresponded to a stream network with twenty-five 30 by 30 meter headwater cells (5.5 acres). The stream grid network incorporates flow and has the capability of accumulating flow.

For each 30 by 30 meter grid cell within the watershed, the WCS Sediment Tool calculates the potential erosion using the USLE and each cell's specific characteristics. The model then calculates the potential sediment delivery to the stream grid network. Sediment delivery can be calculated using one of the four available sediment delivery equations:

- Distance-based equation

  $$M_d = M * (1-0.97 * D/L)$$

  where M_d = mass moved (tons/acre-yr)
  M = sediment mass eroded (ton)
  D = least cost distance from a cell to the nearest stream grid (ft)
  L = maximum distance the sediment may travel (ft)

- Distance Slope-based equation

  $$DR = \exp(-0.4233 * L * S_f)$$

  where DR = sediment delivery ration
  $S_f = \exp(-16.1 * (r / L + 0.057)) - 0.6$
  L = distance to the stream (m)
  r = relief to the stream (m)

- Area-based equation

  $$DR = 0.417762 * A^{(-0.134958)} - 1.27097, \qquad DR \leq 1.0$$

  Where DR = sediment delivery ratio
  A = area (sq miles)
- WEPP-based regression equation

$$Z = 0.9004 - 0.1341 * X - 0.0465 * X^2 + 0.00749 * X^3 - 0.0399 * Y + 0.0144 * Y^2 + 0.00308 * Y^3$$

where Z = percent of source sediment passing to the next grid cell
X = cumulative distance downslope
Y = percent slope in the grid cell

Based on work previously performed by EPA on the Chattooga River Watershed, it was determined that the distance slope-based equation provided the best prediction of the sediment delivery (USEPA, 2001b).

The WCS Sediment Tool estimates the total annual soil erosion and sediment delivered to the stream from each grid cell according to its land cover and roads.

5.0 TOTAL MAXIMUM DAILY LOADS

A Total Maximum Daily Load (TMDL) is the amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard; in this case, the narrative water quality standard for aquatic life. A TMDL is the sum of the individual waste load allocations (WLAs) from point sources and load allocations (LAs) from nonpoint sources and natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For sediment, the TMDLS are expressed as tons per year (tons/yr).

Conceptually, a TMDL can be expressed as follows:

$$\text{TMDL} = \Sigma\text{WLAs} + \Sigma\text{LAs} + \text{MOS}$$

This TMDL determines the allowable sediment loads to the impaired Tennessee River Basin streams and is based on the hypothesis that an impaired watershed having an average annual sediment loading rate similar to the biological least impacted watersheds will remain stable and not be biologically impaired due to sediment. The average annual sediment loads of the least impacted watersheds in the Ridge and Valley (IBI Scores ≥ 50, see Table 6a) and Blue Ridge Ecoregions (MRB Scores ≥ 54, see Table 7a) within the Tennessee River Basin are 0.36 tons/acre-yr (ranging from 0.30 to 0.42 tons/acre-yr) and 0.096 tons/acre-yr (ranging from 0.04 to 0.13 tons/acre-yr), respectively. The following sections describe the various sediment TMDL components.

5.1 Waste Load Allocations

The waste load allocation (WLA) is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. Waste load allocations are provided to the point sources from municipal and industrial wastewater treatment systems. There are two NPDES permitted facilities in the Tennessee River Basin watersheds. The daily maximum and annual allocated TSS loads for these NPDES facilities are given in Table 15.

Table 15. Waste Load Allocations

FACILITY	NPDES PERMIT NO	RECEIVING WATER	COUNTY	TSS LOAD	
				Daily Max (lbs/day)	Annual (ton/yr)
Blairsville WPCP	GA0033375	Butternut Creek	Union	100.08	18.36
Knight's Inn WPCP	GA0022411	Peavine Creek	Catoosa	4.00	0.7
Sherwood Forest Mobile Home Park	GA0029734	Peavine Creek	Catoosa	7.51	1.4

Average annual load, assuming daily discharge at average monthly flow.

The WLA loads were calculated based on the design flow and average monthly permitted TSS concentration for the municipal facilities. If a facility expands its capacity and the permitted flow increases, the wasteload allocation for the facility would increase in proportion to the flow.

The sediment load allocation from future construction sites within the watershed will have to meet the requirements outlined in the Georgia General Storm Water NPDES Permit for

Construction Activities. This permit authorizes the discharge of storm water associated with construction activity to the waters of the State in accordance with the limitations, monitoring requirements, and other conditions set forth in Parts I through VII of the Georgia Storm Water Permit. The conditions of the permit were established to assure that the storm water runoff from these sites does not cause or contribute sediment to the stream. Georgia's General Storm Water Permit can be considered a water quality-based permit in that the numeric limits in the permit, if met, will not cause a water quality problem.

5.2 Load Allocations

The USLE was used to determine the relative sediment contributions from each significant land use. The USLE was applied to those watersheds that are biologically impaired and those that are not, in order to estimate the current sediment loading rates to the streams. The current sediment load allocation for each stream by land use, including roads, is reported in Table 16. The watersheds are grouped according to 303(d) listing. For comparison purposes, the total sediment load in tons per acre per year is also given. Table 17 gives each source's percent contribution to the total sediment load.

Understanding the potential sediment sources and the changes in land use that have occurred over the last century provides insight into the streams' current water quality issues. The average annual sediment load per unit area for the unimpaired and impaired watersheds are generally within the same range. Over the last century there has been a dramatic decrease in the amount of land farmed in Georgia. Since 1950, there has been a 57 percent reduction in farmland. With this reduction in farmland, there has also been a decrease in the amount of soil erosion. This suggests that the sedimentation observed in the listed stream segments may be legacy sediment resulting from past land use practices. It is believed that if sediment loads are maintained at acceptable levels, streams will repair themselves over time.

5.3 Seasonal Variation

Sediment is expected to fluctuate according to the amount and distribution of rainfall. Since rainfall is greatest in the spring and winter seasons, it is expected that sediment loadings would be highest during these seasons. However, these seasonal fluctuations and other short-term variability in loadings due to episodic events is usually evened out by the response of the biological community to habitat alteration, which is a long-term process. Therefore, the average annual sediment load was considered to be an adequate indicator of potential stream impairment due to sediment.

5.4 Margin of Safety

The MOS is a required component of TMDL development. There are two basic methods for incorporating the MOS: 1) Implicitly incorporate the MOS using conservative model assumptions to develop allocations; or 2) Explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For this TMDL, the MOS was implicitly incorporated in the use of conservative modeling assumptions, including the selection of average USLE factors and the use of no conservation practices (P factor = 1.0) for all land uses. In addition, average reference watershed sediment loading rates were used for the numeric targets.

Table 16a. Sediment Load Allocations (Unimpaired – Ridge and Valley Ecoregion)

Name	Sediment Load (tons/yr)																
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road	Total	Load (tons/acre-yr)
Crawfish Creek trib to Lookout Mt	0.0	2.3	0.0	3.5	0.0	0.0	1.0	31.6	3.4	7.4	46.6	1,178.5	0.0	0.0	0.0	239.6	1,513.8	0.30
Crawfish Creek trib W Chicka. Ck	0.0	1.6	0.1	0.2	0.0	0.0	0.0	18.2	3.9	10.7	58.2	1,402.7	0.0	0.0	0.0	71.3	1,567.2	0.37
Dry Creek trib to Lookout Mt Ck	0.0	27.4	0.0	16.8	0.0	59.0	9.1	45.9	13.9	19.0	150.9	4,323.1	14.4	0.0	0.0	908.0	5,587.4	0.42
East Chickamauga Creek upper	0.0	8.3	0.0	0.8	0.0	0.0	30.7	59.4	14.5	34.2	169.4	1,069.5	0.0	18.0	0.0	237.9	1,642.8	0.14
East Chickamauga Creek lower	0.0	223.2	6.0	26.0	0.4	0.0	61.3	81.3	29.3	55.5	555.2	8,446.7	11.8	18.0	0.0	1,275.9	10,790.6	0.26
Hurricane Creek	0.0	843.7	8.8	8.2	0.0	0.0	0.3	32.4	6.2	16.9	180.1	1,450.2	14.7	0.0	0.0	40.4	2,601.8	0.26
Little Chickamauga Creek	0.0	5.3	0.0	1.9	0.0	0.0	8.0	31.1	10.8	25.7	525.7	8,841.6	0.0	6.0	0.0	736.9	10,193.1	0.35
Lookout Mountain Creek upper	0.0	2.1	0.0	0.9	0.0	0.0	20.0	56.9	6.4	15.1	83.1	1,934.8	0.0	0.0	0.0	706.6	2,825.9	0.25
Lookout Mountain Creek middle	0.0	34.0	0.1	28.2	0.0	57.0	58.0	193.0	31.9	58.5	401.3	8,508.9	15.9	0.0	0.0	1,848.7	11,235.4	0.26
Lookout Mountain Creek lower	0.0	224.0	3.0	63.9	0.0	55.9	65.0	436.3	76.2	146.4	825.1	20,322.6	24.5	22.0	0.0	3,394.7	25,659.7	0.3
Pope Creek	0.0	12.7	0.0	3.3	0.0	0.0	0.0	23.5	4.3	8.9	76.4	2,089.1	2.1	0.0	0.0	145.8	2,366.1	0.55
South Chickamauga Creek	0.0	1,481.5	25.3	76.3	0.0	0.4	101.2	261.7	68.6	156.6	1,887.2	28,078.5	41.3	24.0	0.0	3,497.5	35,700.2	0.28
Squirreltown Creek	0.0	14.0	0.0	4.6	0.0	0.0	0.0	34.7	4.7	15.4	85.8	3,699.8	1.8	0.0	0.0	264.3	4,125.2	0.58
Tanyard Creek	0.0	128.8	3.9	17.7	0.0	0.0	14.7	6.5	3.3	6.1	82.6	1,869.8	10.9	0.0	0.0	331.0	2,475.2	0.45
Tiger Creek upper	0.0	9.9	0.0	0.7	0.0	0.0	13.7	19.4	8.6	10.9	0.0	233.2	2,724.8	0.1	0.0	391.9	3,413.1	0.25
Tiger Creek lower	0.0	15.7	0.0	2.3	0.0	0.0	18.1	53.5	14.3	27.9	0.0	380.3	4,475.5	0.1	0.0	553.3	5,541.0	0.21
West Chickamauga Creek upper	0.0	13.7	0.0	2.5	0.0	0.0	5.6	378.2	45.4	127.2	509.7	9,612.6	1.4	1.2	0.0	1,187.0	11,884.3	0.29
West Chickamauga Creek middle	0.0	45.3	0.9	5.0	0.0	0.0	11.8	259.5	45.5	108.8	935.6	15,235.1	3.5	25.8	0.2	1,608.8	18,285.7	0.26
West Chickamauga Creek lower	0.0	817.7	13.0	16.0	0.0	172.6	14.0	277.1	56.7	135.7	1,287.7	19,561.9	66.3	29.5	0.2	2,635.8	25,084.1	0.27

Table 16b. Sediment Load Allocations (Unimpaired – Blue Ridge Ecoregion)

Name	Sediment Load (tons/yr)																
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road	Total	Load (tons/acre-yr)
Arkaqua Creek	0.0	3.0	0.0	0.2	0.0	0.0	0.0	127.1	5.2	15.1	107.0	1,289.3	0.0	0.0	0.0	283.8	1,830.8	0.25
Big Creek	0.0	0.2	0.0	0.0	0.0	0.0	0.0	91.7	22.7	24.9	43.5	0.0	0.0	0.0	0.0	495.7	678.6	0.09
Brasstown Creek	0.0	9.0	0.1	1.5	0.0	0.0	1.9	242.7	24.6	45.0	358.0	2,182.9	0.2	0.0	0.0	916.4	3,782.2	0.23
Butler Creek	0.0	0.5	0.0	0.0	0.0	0.0	0.0	8.6	1.1	2.6	11.8	9.3	0.0	0.0	0.0	10.4	44.3	0.03
Canada Creek	0.0	1.5	0.0	0.5	0.0	0.0	0.0	215.1	10.2	35.0	43.0	113.3	35.2	0.0	0.1	617.3	1,071.2	0.14
Charlie Creek	0.0	0.6	0.0	0.0	0.0	0.0	0.0	14.0	1.7	4.1	20.8	4.3	0.0	0.0	0.0	131.0	176.5	0.09
Conley Creek	0.0	0.2	0.0	0.0	0.0	0.0	0.0	16.6	2.9	5.5	22.5	60.7	0.0	0.0	0.0	84.4	192.8	0.10
Cooper Creek	0.0	2.3	0.0	0.4	0.0	0.0	21.1	514.2	155.9	148.8	25.1	80.1	0.0	0.0	0.0	1,330.1	2,278.0	0.10
Coosa Creek	0.0	20.6	0.0	1.7	0.0	0.0	1.6	246.5	44.1	70.7	185.5	807.6	1.4	0.0	0.0	691.0	2,070.7	0.15
Dooley Creek	0.0	0.5	0.0	0.0	0.0	0.0	0.0	16.5	2.5	4.0	16.8	103.5	0.0	0.0	0.0	118.5	262.3	0.06
Fightingtown Creek	0.0	59.4	0.2	1.4	0.0	0.0	6.6	82.0	27.4	41.3	156.4	153.6	2.8	0.0	0.0	757.3	1,288.3	0.07
Fodder Creek	0.0	15.7	0.0	0.0	0.0	0.0	0.0	120.2	8.1	35.9	77.1	0.0	0.0	0.0	0.0	204.4	461.5	0.08
Helton Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	223.2	30.5	42.2	0.0	0.0	0.0	0.0	0.0	314.4	610.3	0.13
Hemptown Creek	0.0	0.3	0.0	0.0	0.0	0.0	0.1	25.3	6.8	9.4	15.7	117.7	0.0	0.0	0.0	142.7	318.0	0.07
Hightower Creek	0.0	231.7	0.2	0.0	0.0	0.0	0.0	440.7	15.8	47.9	484.2	1,054.0	16.3	0.0	0.0	1,411.9	3,702.8	0.18
Hiawassee River	0.0	6.8	0.0	1.2	0.0	0.0	0.9	504.8	67.3	111.3	359.8	296.9	0.0	0.0	0.0	2,501.8	3,850.8	0.14
Hog Creek	0.0	0.6	0.0	0.2	0.0	0.0	0.0	74.9	8.6	22.6	94.6	0.0	0.0	0.0	0.0	60.1	261.7	0.07
Hothouse Creek	0.0	27.6	0.0	2.0	0.0	0.0	3.4	82.0	13.2	24.0	111.3	559.4	4.0	0.0	0.0	474.3	1,301.3	0.10
Ivylog Creek	0.0	0.7	0.0	0.1	0.0	0.0	2.2	141.1	7.4	15.0	72.4	795.1	0.0	0.0	0.0	210.1	1,244.0	0.18
Kiutuestia Creek	0.0	0.5	0.0	2.8	0.0	0.0	2.8	17.3	3.4	5.5	43.9	116.2	0.0	0.0	0.0	129.6	322.0	0.12
Moccasin Creek	0.0	2.3	0.0	0.1	0.0	0.0	0.0	21.3	3.1	5.4	61.8	191.1	0.0	0.0	0.0	123.1	408.3	0.09
Noontootla Creek	0.0	0.1	0.0	0.0	0.0	0.0	3.6	172.0	52.5	62.4	47.0	6.6	0.0	0.0	0.0	1,373.5	1,717.7	0.08
Nottely River upper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	146.2	15.8	24.2	0.9	21.2	0.0	0.0	0.0	148.2	356.4	0.11
Nottely River middle	0.0	0.3	0.0	0.0	0.0	0.0	1.2	445.5	58.0	89.9	10.9	634.5	0.0	0.0	0.0	679.2	1,919.5	0.17
Nottely River lower	0.0	41.7	0.0	1.0	0.0	1,666.2	1.2	1,409.1	188.4	295.9	477.2	6,867.2	0.2	0.0	0.0	2,394.1	13,342.1	0.25
Rock Creek upper	0.0	2.3	0.0	0.0	0.0	0.0	0.1	52.1	12.5	17.7	0.0	0.0	0.0	0.0	0.0	414.2	498.9	0.10
Rock Creek lower	0.0	7.9	0.0	0.5	0.0	0.0	17.2	100.8	34.1	40.2	0.0	0.0	0.0	0.0	0.0	700.3	901.0	0.09
Skeenah Creek	0.0	1.1	0.0	0.0	0.0	0.0	0.0	82.7	5.6	13.6	70.0	125.9	0.0	0.0	0.0	94.9	393.7	0.06
Star Creek	0.0	0.2	0.0	0.0	0.0	0.0	6.7	8.3	1.0	2.5	9.7	9.3	0.0	0.0	0.0	27.8	65.6	0.03
Stink Creek	0.0	1.3	0.0	0.0	0.0	0.0	0.0	181.7	12.5	27.6	38.5	477.7	0.0	0.0	0.0	139.3	878.4	0.17
Suches Creek	0.0	0.0	0.0	0.0	0.0	0.0	1.3	140.9	5.3	14.3	26.2	27.4	0.0	0.0	0.0	160.8	376.1	0.08
Sugar Creek	0.0	5.8	0.0	0.6	0.0	0.0	1.5	41.4	0.0	10.1	70.2	94.4	0.1	0.0	0.0	458.5	682.6	0.07
Toccoa River	0.0	0.8	0.0	0.0	0.0	0.0	0.0	108.4	2.9	13.7	0.7	0.0	0.0	0.0	0.0	110.7	237.1	0.08
Town Creek	0.0	2.7	0.0	0.0	0.0	0.0	0.0	308.0	67.7	91.1	82.6	1,156.0	0.0	0.0	0.0	263.3	1,971.5	0.17
Upper Bell Creek	0.0	0.2	0.0	0.0	0.0	94.5	0.0	56.5	1.6	4.0	122.7	0.0	0.0	0.0	0.0	59.6	339.2	0.20
Wilscot Creek	0.0	0.2	0.0	0.0	0.0	0.0	0.4	83.1	3.0	6.7	106.6	20.0	0.0	0.0	0.0	101.1	321.1	0.04
Wolf Creek (Nottely)	0.0	2.0	0.0	0.3	0.0	0.0	0.0	181.6	29.9	39.0	22.1	218.3	0.0	0.0	0.0	251.3	744.5	0.13
Wolf Creek (Toccoa)	0.0	6.9	0.0	2.1	0.0	0.0	1.6	25.1	3.9	7.2	26.1	166.5	1.9	0.0	0.0	62.6	304.0	0.05
Youngcane Creek	0.0	0.5	0.0	0.0	0.0	0.0	0.0	125.5	11.1	27.5	154.8	1,188.2	0.0	0.0	0.0	362.1	1,869.8	0.19

Table 16c. Sediment Load Allocations (Impaired – Ridge and Valley Ecoregion)

	Sediment Load (tons/yr)																	
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road	Total	Load (tons/acre-yr)
Chattanooga Creek	0.0	137.4	1.2	2.1	0.0	0.0	0.3	65.8	12.4	31.6	177.6	2,711.4	7.1	0.0	0.0	375.6	3,522.5	0.28
Dry Creek	0.0	1.9	0.0	0.3	0.0	0.0	17.6	19.8	6.7	13.5	24.6	360.9	0.0	0.0	0.0	186.3	631.4	0.09
Peavine Creek	0.0	179.0	4.3	8.6	0.0	0.0	1.7	23.2	9.5	19.1	285.2	4,461.6	4.9	0.0	0.0	606.2	5,603.2	0.26
Rock Creek	0.0	55.2	1.1	9.4	0.0	0.0	0.0	71.3	12.7	35.6	67.1	2,007.9	1.3	0.0	0.0	265.5	2,527.3	0.16

Table 16d. Sediment Load Allocations (Impaired – Blue Ridge Ecoregion)

	Sediment Load (tons/yr)																	
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road	Total	Load (tons/acre-yr)
Bearmeat Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.2	1.7	3.7	67.1	354.5	0.0	0.0	0.0	89.9	549.0	0.33
Butternut Creek	0.0	35.1	0.7	12.7	0.0	0.9	0.0	156.9	5.2	12.9	119.0	2,137.3	2.6	0.0	0.0	291.5	2,774.8	0.36
Lower Youngcane Ck	0.0	0.0	0.0	2.4	0.0	0.0	0.0	10.5	1.2	3.8	50.4	387.1	0.0	0.0	0.0	47.9	503.4	0.21
Weaver Creek	0.0	31.4	1.2	14.7	0.0	0.0	0.0	26.1	2.6	6.6	23.9	692.8	2.6	0.0	0.9	196.1	998.9	0.29

Table 17a. Sediment Load Percentages (Unimpaired – Ridge and Valley Ecoregion)

	Percent Total Sediment Load															
Name	**Open Water**	**Low Intensity Residential**	**High Intensity Residential**	**High Intensity Commercial/ Industrial Transportation**	**Bare Rock Sand and Clay**	**Quarries Strip Mines Gravel Pits**	**Transitional**	**Deciduous Forest**	**Evergreen Forest**	**Mixed Forest**	**Pasture/Hay**	**Row Crops**	**Other Grasses (Urban Recreational)**	**Woody Wetland**	**Emergent Herbaceous Wetlands**	**Road**
Crawfish Creek trib to Lookout Mt	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.1%	2.1%	0.2%	0.5%	3.1%	77.8%	0.0%	0.0%	0.0%	15.8%
Crawfish Creek trib W Chicka. Ck	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.2%	0.7%	3.7%	89.5%	0.0%	0.0%	0.0%	4.5%
Dry Creek trib to Lookout Mt Ck	0.0%	0.5%	0.0%	0.3%	0.0%	1.1%	0.2%	0.8%	0.2%	0.3%	2.7%	77.4%	0.3%	0.0%	0.0%	16.3%
East Chickamauga Creek upper	0.0%	0.5%	0.0%	0.1%	0.0%	0.0%	1.9%	3.6%	0.9%	2.1%	10.3%	65.1%	0.0%	1.1%	0.0%	14.5%
East Chickamauga Creek lower	0.0%	2.1%	0.1%	0.2%	0.0%	0.0%	0.6%	0.8%	0.3%	0.5%	5.1%	78.3%	0.1%	0.2%	0.0%	11.8%
Hurricane Creek	0.0%	32.4%	0.3%	0.3%	0.0%	0.0%	0.0%	1.2%	0.2%	0.6%	6.9%	55.7%	0.6%	0.0%	0.0%	1.6%
Little Chickamauga Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	0.1%	0.3%	5.2%	86.7%	0.0%	0.1%	0.0%	7.2%
Lookout Mountain Creek upper	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.7%	2.0%	0.2%	0.5%	2.9%	68.5%	0.0%	0.0%	0.0%	25.0%
Lookout Mountain Creek middle	0.0%	0.3%	0.0%	0.3%	0.0%	0.5%	0.5%	1.7%	0.3%	0.5%	3.6%	75.7%	0.1%	0.0%	0.0%	16.5%
Lookout Mountain Creek lower	0.0%	0.9%	0.0%	0.2%	0.0%	0.2%	0.3%	1.7%	0.3%	0.6%	3.2%	79.2%	0.1%	0.1%	0.0%	13.2%
Pope Creek	0.0%	0.5%	0.0%	0.1%	0.0%	0.0%	0.0%	1.0%	0.2%	0.4%	3.2%	88.3%	0.1%	0.0%	0.0%	6.2%
South Chickamauga Creek	0.0%	4.1%	0.1%	0.2%	0.0%	0.0%	0.3%	0.7%	0.2%	0.4%	5.3%	78.7%	0.1%	0.1%	0.0%	9.8%
Squirreltown Creek	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.8%	0.1%	0.4%	2.1%	89.7%	0.0%	0.0%	0.0%	6.4%
Tanyard Creek	0.0%	5.2%	0.2%	0.7%	0.0%	0.0%	0.6%	0.3%	0.1%	0.2%	3.3%	75.5%	0.4%	0.0%	0.0%	13.4%
Tiger Creek upper	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.4%	0.6%	0.3%	0.3%	0.0%	6.8%	79.8%	0.0%	0.0%	11.5%
Tiger Creek lower	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.3%	1.0%	0.3%	0.5%	0.0%	6.9%	80.8%	0.0%	0.0%	10.0%
West Chickamauga Creek upper	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	0.4%	1.1%	4.3%	80.9%	0.0%	0.0%	0.0%	10.0%
West Chickamauga Creek middle	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	1.4%	0.2%	0.6%	5.1%	83.3%	0.0%	0.1%	0.0%	8.8%
West Chickamauga Creek lower	0.0%	3.3%	0.1%	0.1%	0.0%	0.7%	0.1%	1.1%	0.2%	0.5%	5.1%	78.0%	0.3%	0.1%	0.0%	10.5%

Table 17b. Sediment Load Percentages (Unimpaired – Blue Ridge Ecoregion)

	Percent Total Sediment Load															
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road
Arkaqua Creek	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	6.9%	0.3%	0.8%	5.8%	70.4%	0.0%	0.0%	0.0%	15.5%
Big Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.5%	3.3%	3.7%	6.4%	0.0%	0.0%	0.0%	0.0%	73.0%
Brasstown Creek	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	6.4%	0.6%	1.2%	9.5%	57.7%	0.0%	0.0%	0.0%	24.2%
Butler Creek	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	19.4%	2.4%	5.8%	26.7%	21.0%	0.0%	0.0%	0.0%	23.5%
Canada Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	20.1%	1.0%	3.3%	4.0%	10.6%	3.3%	0.0%	0.0%	57.6%
Charlie Creek	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	7.9%	0.9%	2.3%	11.8%	2.5%	0.0%	0.0%	0.0%	74.3%
Conley Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	8.6%	1.5%	2.8%	11.7%	31.5%	0.0%	0.0%	0.0%	43.8%
Cooper Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.9%	22.6%	6.8%	6.5%	1.1%	3.5%	0.0%	0.0%	0.0%	58.4%
Coosa Creek	0.0%	1.0%	0.0%	0.1%	0.0%	0.0%	0.1%	11.9%	2.1%	3.4%	9.0%	39.0%	0.1%	0.0%	0.0%	33.4%
Dooley Creek	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%	1.0%	1.5%	6.4%	39.5%	0.0%	0.0%	0.0%	45.2%
Fightingtown Creek	0.0%	4.6%	0.0%	0.1%	0.0%	0.0%	0.5%	6.4%	2.1%	3.2%	12.1%	11.9%	0.2%	0.0%	0.0%	58.8%
Fodder Creek	0.0%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	26.0%	1.8%	7.8%	16.7%	0.0%	0.0%	0.0%	0.0%	44.3%
Helton Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	36.6%	5.0%	6.9%	0.0%	0.0%	0.0%	0.0%	0.0%	51.5%
Hemptown Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	8.0%	2.1%	2.9%	4.9%	37.0%	0.0%	0.0%	0.0%	44.9%
Hightower Creek	0.0%	6.3%	0.0%	0.0%	0.0%	0.0%	0.0%	11.9%	0.4%	1.3%	13.1%	28.5%	0.4%	0.0%	0.0%	38.1%
Hiawassee River	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	13.1%	1.7%	2.9%	9.3%	7.7%	0.0%	0.0%	0.0%	65.0%
Hog Creek	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	28.6%	3.3%	8.6%	36.1%	0.0%	0.0%	0.0%	0.0%	23.0%
Hothouse Creek	0.0%	2.1%	0.0%	0.2%	0.0%	0.0%	0.3%	6.3%	1.0%	1.8%	8.6%	43.0%	0.3%	0.0%	0.0%	36.4%
Ivylog Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.2%	11.3%	0.6%	1.2%	5.8%	63.9%	0.0%	0.0%	0.0%	16.9%
Kiutuestia Creek	0.0%	0.2%	0.0%	0.9%	0.0%	0.0%	0.9%	5.4%	1.1%	1.7%	13.6%	36.1%	0.0%	0.0%	0.0%	40.3%
Moccasin Creek	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	5.2%	0.8%	1.3%	15.1%	46.8%	0.0%	0.0%	0.0%	30.2%
Noontootla Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	10.0%	3.1%	3.6%	2.7%	0.4%	0.0%	0.0%	0.0%	80.0%
Nottely River upper	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	41.0%	4.4%	6.8%	0.2%	5.9%	0.0%	0.0%	0.0%	41.6%
Nottely River middle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	23.2%	3.0%	4.7%	0.6%	33.1%	0.0%	0.0%	0.0%	35.4%
Nottely River lower	0.0%	0.3%	0.0%	0.0%	0.0%	12.5%	0.0%	10.6%	1.4%	2.2%	3.6%	51.5%	0.0%	0.0%	0.0%	17.9%
Rock Creek upper	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	10.4%	2.5%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	83.0%
Rock Creek lower	0.0%	0.9%	0.0%	0.1%	0.0%	0.0%	1.9%	11.2%	3.8%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	77.7%
Skeenah Creek	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	21.0%	1.4%	3.5%	17.8%	32.0%	0.0%	0.0%	0.0%	24.1%
Star Creek	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	10.2%	12.7%	1.5%	3.9%	14.8%	14.2%	0.0%	0.0%	0.0%	42.4%
Stink Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	20.7%	1.4%	3.1%	4.4%	54.4%	0.0%	0.0%	0.0%	15.9%
Suches Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	37.5%	1.4%	3.8%	7.0%	7.3%	0.0%	0.0%	0.0%	42.8%
Sugar Creek	0.0%	0.8%	0.0%	0.1%	0.0%	0.0%	0.2%	6.1%	0.0%	1.5%	10.3%	13.8%	0.0%	0.0%	0.0%	67.2%
Toccoa River	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	45.7%	1.2%	5.8%	0.3%	0.0%	0.0%	0.0%	0.0%	46.7%
Town Creek	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	15.6%	3.4%	4.6%	4.2%	58.6%	0.0%	0.0%	0.0%	13.4%
Upper Bell Creek	0.0%	0.1%	0.0%	0.0%	0.0%	27.9%	0.0%	16.7%	0.5%	1.2%	36.2%	0.0%	0.0%	0.0%	0.0%	17.6%
Wilscot Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	25.9%	0.9%	2.1%	33.2%	6.2%	0.0%	0.0%	0.0%	31.5%
Wolf Creek (Nottely)	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	24.4%	4.0%	5.2%	3.0%	29.3%	0.0%	0.0%	0.0%	33.8%
Wolf Creek (Toccoa)	0.0%	2.3%	0.0%	0.7%	0.0%	0.0%	0.5%	8.3%	1.3%	2.4%	8.6%	54.8%	0.6%	0.0%	0.0%	20.6%
Youngcane Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.7%	0.6%	1.5%	8.3%	63.5%	0.0%	0.0%	0.0%	19.4%

Table 17c. Sediment Load Percentages (Impaired – Ridge and Valley Ecoregion)

	Percent Total Sediment Load																
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road
Chattanooga Creek	0.0%	3.9%	0.0%	0.1%	0.0%	0.0%	0.0%	1.9%	0.4%	0.9%	5.0%	77.0%	0.2%	0.0%	0.0%	10.7%
Dry Creek	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	2.8%	3.1%	1.1%	2.1%	3.9%	57.2%	0.0%	0.0%	0.0%	29.5%
Peavine Creek	0.0%	3.2%	0.1%	0.2%	0.0%	0.0%	0.0%	0.4%	0.2%	0.3%	5.1%	79.6%	0.1%	0.0%	0.0%	10.8%
Rock Creek	0.0%	2.2%	0.0%	0.4%	0.0%	0.0%	0.0%	2.8%	0.5%	1.4%	2.7%	79.4%	0.1%	0.0%	0.0%	10.5%

Table 17d. Sediment Load Percentages (Impaired – Blue Ridge Ecoregion)

	Percent Total Sediment Load															
Name	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/ Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Transitional	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Road
Bearmeat Creek	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.9%	0.3%	0.7%	12.2%	64.6%	0.0%	0.0%	0.0%	16.4%
Butternut Creek	0.0%	1.3%	0.0%	0.5%	0.0%	0.0%	0.0%	5.7%	0.2%	0.5%	4.3%	77.0%	0.1%	0.0%	0.0%	10.5%
Lower Youngcane Creek	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	2.1%	0.2%	0.8%	10.0%	76.9%	0.0%	0.0%	0.0%	9.5%
Weaver Creek	0.0%	3.1%	0.1%	1.5%	0.0%	0.0%	0.0%	2.6%	0.3%	0.7%	2.4%	69.4%	0.3%	0.0%	0.1%	19.6%

5.5 Total Sediment Load

The average annual sediment loads of the least impacted watersheds in the Ridge and Valley (IBI Scores ≥ 50, see Table 6a) and Blue Ridge Ecoregions (MRB Scores ≥ 54, see Table 7a) within the Tennessee River Basin are 0.36 tons/acre-yr (ranging from 0.30 to 0.42 tons/acre-yr) and 0.09 tons/acre-yr (ranging from 0.04 to 0.13 tons/acre-yr), respectively. The current sediment load was determined by adding the WLA given in Table 4 and the LA given in Table 16. The MOS, as described above, was implicitly included in the TMDL analysis. If the current sediment load is less than the load from the least impacted watershed, then the total allowable load becomes the current load and no reductions are required. If the current sediment load is more than the load from the least impacted watershed, then the total allowable load is calculated by multiplying the appropriate least impacted watershed annual load by the drainage areas listed in Table 3. The WLA is then subtracted from the TMDL to determine the LA. The average annual sediment loads for each of the listed watersheds are summarized in Table 18, which includes any required sediment load reductions. A Summary Memorandum for each watershed is provided in Appendix A.

The USLE method used indicates that the largest sediment loads come from areas with close proximity to the stream grid, especially dirt roads and croplands. The model does not account for any BMPs that are currently being used to control erosion from these areas, and thus may over estimate some sediment loads.

Table 18. Average Annual Sediment Loads and the Required Sediment Load Reductions

Name	Current Load (tons/yr)	WLA (tons/yr)	LA (tons/yr)	Total Load (tons/yr)	% Reduction
Bearmeat Creek	549		146	146	73
Butternut Creek	2,783	18	644	662	76
Chattanooga Creek	3,522		3,522	3,522	0
Dry Creek	631		631	631	0
Lower Youngcane Creek	503		207	207	59
Peavine Creek	5,605	2	5,603	5,605	0
Rock Creek	2,527		2,527	2,527	0
Weaver Creek	999		296	296	70

6.0 RECOMMENDATIONS

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. GA EPD has adopted a basin approach to water quality management; an approach that divides Georgia's major river basins into five groups. This approach provides for additional monitoring to be focused on one of the five basin groups each year. The Coosa, Tallapoosa, and Tennessee River Basins were the basins of focused monitoring in 2001 and will again receive focused monitoring in 2006. Additional monitoring of these streams will be initiated, as appropriate, during the next monitoring cycle to determine if there has been improvement in the biological communities.

6.2 Sediment Management Practices

Based on the findings of the source assessment, it was determined that most of the sediment found in the Tennessee River Basin streams is due to past land use practices and is referred to as "legacy" sediment. Therefore, it is recommended that there be no net increase in sediment delivered to the impaired stream segments, in order that these streams may recover over time.

The measurement of sediment delivered to a stream is difficult, if not impossible, to determine. Therefore, setting a numeric TMDL may be ineffective given the difficulty in measuring it. In addition, habitat and aquatic communities are usually slow to respond, which is why monitoring will continue according to the five-year monitoring cycle. Thus, this TMDL recommends compliance with NPDES permits and the implementation of BMPs. The effects of compliance with NPDES permits and the implementation of BMPs will contribute to the improvement of stream habitats and water quality, and will represent a beneficial measure of TMDL implementation.

Management practices recommended include:

- Compliance with NPDES permit limits and requirements
- Implementation of GFC Best Management Practices for forestry
- Adoption of NRCS Conservation Practices
- Adherence to the Mined Land Use Plan, prepared as part of the Surface Mining Permit Application
- Adoption of proper unpaved road maintenance practices
- Implementation of Erosion and Sedimentation Control Plans for land disturbing activities
- Mitigation and prevention of stream bank erosion due to increased streamflow and velocities caused by urban runoff

6.2.1 Point Source Approaches

Point sources are defined as discharges of treated wastewater or storm water into rivers and streams at discrete locations. Treated wastewater tends to be discharged at relatively stable rates; whereas, storm water is discharged at irregular, intermittent rates, depending on precipitation and runoff. The NPDES permit program provides a basis for municipal, industrial and storm water permits, monitoring and compliance with limitations, and appropriate enforcement actions for violations.

In accordance with GA EPD rules and regulations, all NPDES dischargers in the watershed are required to meet their current NPDES permit limits. It is recommended that there be no authorized increase in the concentration of sediment (TSS) above those in the current NPDES permits. In addition, it is necessary to maintain the current sediment loads in the impaired streams. The removal of mined material involves water pumped from the mine pit, and mineral processing involves the disposal of process waters. These waters are treated through either sedimentation ponds or detention basins prior to being discharged to the stream and are regulated by NPDES permits. For mining facilities located within the impaired watersheds, it is recommended that monitoring frequencies be increased in order to better characterize the total average annual sediment loads coming from these facilities.

GA EPD has developed a General Storm Water NPDES Permit for Construction Activities. The current permit is required for all construction sites disturbing five or more acres. In 2003, this permit will cover all construction sites disturbing one or more acres. All sites required to have this permit are authorized to discharge storm water associated with construction activity to the waters of the State in accordance with the limitations, monitoring requirements, and other conditions set forth in Parts I through VII of the Georgia Storm Water NPDES Permit for Construction Activities. The permit requires all sites to have an Erosion and Sedimentation Control Plan; to implement, inspect and maintain BMPs; and to monitor storm water for turbidity. Georgia's General Storm Water NPDES Permit for Construction Activities can be considered a water quality-based permit, in that the numeric limits in the permit, if met and enforced, will not cause a water quality problem.

It is recommended that construction sites within impaired watersheds that are located within 100 feet of the impaired stream or its tributaries use DIRT II techniques to model and manage storm water runoff from these sites. In addition, all construction sites will monitor their storm water runoff as required by the General Storm Water NPDES Permit for Construction Activities.

6.2.2 Nonpoint Source Land Use Approaches

The GA EPD is responsible for administering and enforcing laws to protect the waters of the State. GA EPD is the lead agency for implementing the State's Nonpoint Source Management Program. Regulatory responsibilities include establishing water quality standards and use classifications, assessing and reporting water quality conditions, issuing point source permits, issuing water withdrawal and ground water permits, and regulating land-disturbing activities that may affect water quality. Georgia is working with local governments, and agricultural and forestry agencies such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission to foster the implementation of best management practices that address nonpoint source pollution. In addition, public education efforts are being targeted at individual stakeholders to provide information regarding the use of best management practices to protect water quality. The following sections describe in more detail the specific measures to reduce nonpoint sources of sediment by land use type.

6.2.2.1 Forested Land

In 1978, GA EPD designated the Georgia Forestry Commission (GFC) to be the lead agency in managing and implementing the silvicultural portion of Georgia's Nonpoint Source Management Program. The GFC is responsible for coordinating water quality issues with regard to forested land in Georgia. The GFC is basically responsible for:

- Developing Best Management Practices (BMPs) for the forestry industry,
- Educating the forestry community on BMPs, and
- Conducting site inspections for measuring compliance with the established BMPs.

The GFC formed a Forestry Nonpoint Source Pollution Technical Task Force to assess the extent of water pollution caused by forestry practices, and to develop recommendations to reduce or eliminate erosion and sedimentation. After a three-year field study, the task force developed a set of BMPs that address all aspects of silviculture including forest road construction, timber harvesting, site preparation, and forest regeneration. The task force recommended the BMPs be implemented through a voluntary program, exempt from permitting under the Georgia Erosion and Sedimentation Control Act, emphasizing educational and training programs instead. In 1997, the original BMP document was revised to incorporate the 1989 Wetland BMP manual developed by the Georgia Forestry Association. The current BMP manual, *Georgia's Best Management Practices for Forestry,* was developed and became effective June 1, 1999 (GA EPD, 1999).

It is the responsibility of the GFC to educate and inform the forestry community (landowners, procurement and land management foresters, consulting foresters, loggers, site prep and tree planting contractors) on the importance of BMPs. The GFC statewide coordinator, along with twelve district coordinators, conducts these educational programs across the state. The district coordinators receive specialized training in erosion and sedimentation control, forest road layout and construction, stream habitat assessment, rapid bioassessment (macroinvertebrate) monitoring, wetland delineation, and fluvial geomorphology. The GFC has developed training videos, slide programs, tabletop exhibits, and BMP billboards that are displayed at wood yards across the state. For the benefit of private landowners selling timber, the GFC has developed a Sample Forest Products Sale Agreement, which includes fill-in-the-blank spaces for specific BMP incorporation. Since December 1995, the GFC has been cooperating with the University of Georgia School of Forest Resources, the Georgia Forestry Association, and the American Forest and Paper Association (AFPA) member companies in the ongoing education of loggers and timber buyers through the Sustainable Forestry Initiative (SFI) Master Timber Harvester program. This includes an intensive training session on the BMPs conducted by the GFC.

To determine if educational efforts have been successful and if the BMPs are effective at minimizing erosion and sedimentation, the GFC conducted BMP compliance surveys in 1991 and 1992. In 1998, another BMP survey was conducted using a newly developed and more rigorous protocol recommended by a Southern Group of State Foresters (SGSF) Task Force. The GFC sampled about 10 percent of the forestry operations that occur annually. The number of samples taken in each county was based on the volume of wood harvested as reported in the state's latest Product Drain Report. Sites were randomly selected to reflect various forest types (non-industrial private forest, forest industry, and publicly owned lands). The survey results show that of the number of acres evaluated, the number in BMP compliance was generally high. In 1991, approximately 86 percent of the acres evaluated were in compliance. In 1992, the figure increased to 92 percent compliance and in 1998, compliance rose to 98 percent.

The GFC also investigates and mediates complaints or concerns involving forestry operations on behalf of the GA EPD and the Army Corps of Engineers (COE) when stream water quality and wetlands are involved, respectively. Complaints from citizens are also received, particularly in counties growing in population where landowners are living close to commercial forestry operations. After notifying the forest owner, the GFC District Coordinator conducts a field inspection to determine if BMPs were followed, if the potential for water quality problems exists, and the identity of the responsible party. If the complaint is valid, GFC will work with the responsible party until the problem is corrected. However, the GFC has no regulatory authority. In situations where the GFC cannot get satisfactory compliance, the case is turned over to GA EPD or COE for enforcement actions under the Georgia Water Quality Control Act or Section 404 of the Federal Clean Water Act.

It is recommended that the GFC continue to encourage BMP implementation, educational training programs, and site compliance surveys. The numbers of individuals trained and the number of site compliance inspections conducted should be recorded each year. In addition, the number of complaints received, the actions taken, and the enforcement actions written should be recorded.

6.2.2.2 Agricultural Land

There are a number of agricultural organizations that work to support Georgia's more than 40,000 farmers. The following three organizations have primary responsibility for working with farmers to promote soil and water conservation:

- The University of Georgia (UGA) - Cooperative Extension Service
- Georgia Soil and Water Conservation Commission (GSWCC)
- Natural Resources Conservation Service (NRCS)

UGA has faculty, County Cooperative Extension Agents, and technical specialists who provide services in several key areas relating to agricultural impacts on water quality. These include classroom instruction, basic and applied research, consulting assistance, and information on nonpoint source water quality impacts.

The GSWCC was created in 1937 by a Georgia Legislative Act. In 1977, GA EPD designated the GSWCC as the lead agency for agricultural Nonpoint Source Management in the State. The GSWCC develops nonpoint source management programs and conducts educational activities to promote conservation and protection of land and water devoted to agricultural uses. In September 1994, the GSWCC developed a BMP manual, *Agricultural Best Management Practices for Protection of Water Quality in Georgia,* for the agricultural community (GSWCC, 1994).

The NRCS cooperates with Federal, State, and local governments to provide financial and technical assistance to farmers. NRCS develops standards and specifications for BMPs that are to be used to improve, protect, or maintain our State's natural resources. Practice standards establish the minimum level of acceptable quality for planning, designing, installing, operating, and maintaining BMPs. Practice specifications describe the technical details and workmanship required to install a BMP and the quality and extent of materials to be used in a BMP.

The NRCS provides Conservation Practice Standards and Job Sheets on their website (http://www.nrcs.usda.gov/technical/efotg/). Some of these BMPs may be used for farming operations to reduce soil erosion. It is recommended that the agricultural communities with crop land close to impaired streams, and pasture land where grazing animals have access to the stream, investigate the various BMPs available to them in order to reduce soil erosion and bank collapse.

The 1996 Farm Bill and PL83-566 Small Watershed Program provided new financial assistance programs to address high priority environmental protection goals. Some programs that specifically address erosion and sedimentation are:

- The Environmental Quality Incentives Program
- Conservation Reserve Program
- Small Watershed Program

The Environmental Quality Incentives Program (EQIP) is a USDA cost-share program available to farmers to address natural resource problems. EQIP offers financial, educational, and technical assistance funding for installing BMPs that reduce soil erosion, improve water quality, or enhance wildlife habitats.

The Conservation Reserve Program (CRP) was originally designed by NRCS to provide incentive and offer assistance to farmers to convert highly erodible and other environmentally sensitive land normally devoted to crop production into land with other long-term resource-conserving cover. The CRP has been expanded to place eligible acreage into filter strips, riparian buffers, grassed waterways, or contour grass strips. Each of these practices helps to reduce erosion and sedimentation and improve water quality.

The Small Watershed Program provides financial and technical assistance funding for the installation of BMPs in watersheds less than 250,000 acres. This program is used to augment ongoing conservation programs where serious natural resource degradation has, or is, occurring. Agricultural water management, which includes projects that reduce soil erosion and sedimentation and improve water quality, is one of the eligible purposes of this program.

NRCS is authorized by Public Law 83-566 to conduct river basin surveys and investigations. The NRCS River Basin Planning Program is designed to collect data on natural resource conditions within river basins of focus. NRCS is providing technical assistance to the GSWCC and the GA EPD with the Georgia River Basin Planning Program. Planning activities associated with this program will describe conditions of the agricultural natural resource base once every five years.

Every five years, the USDA Natural Resources Conservation Service conducts the National Resources Inventory (NRI). The NRI is a statistically based sample of land use and natural resource conditions and trends, covering non-federal land in the United States. The National Resources Inventory found the total wind and water erosion on cropland and Conservation Reserve Program land in Georgia declined 38 percent from 3.1 billion tons per year in 1982 to 1.9 billion tons in 1997 (USDA NRCS, 1998).

NRCS also provides a web-based database application, Performance and Results Measurement System (PRMS), so that conservation partners and the public can gain fast and easy access to the accomplishments and the progress made toward strategies and performance goals.

It is recommended that the GSWCC and the NRCS continue to encourage BMP implementation, education efforts, and river basin surveys with regard to River Basin Planning. The five-year NRI activities should be continued, and GA EPD supports the PRMS.

6.2.2.3 Mine Sites

Surface mining and mineral processing present two threats to surface waters. The first threat is the wastewater from mining and mineral processing operations. These discharges are considered point sources and therefore are regulated by NPDES permits, as discussed in Section 6.2.1 above. The second threat involves mine reclamation activities. Reclamation occurs throughout the mining operation. From the first cut to the last, overburden is moved twice. With each movement of the soil and rock debris, the overburden must be managed to prevent soil and mineral erosion. Until the mine is re-vegetated, and hence reclaimed, BMPs must be implemented to prevent nonpoint source pollution.

The Georgia Surface Mining Act of 1968 provides for the issuance of mining permits at the discretion of the Director of GA EPD. These permits are administered by the Land Protection Branch of EPD. The surface mining permit application must include a Mined Land Use Plan, reclamation strategies, and surety bond requirements to guarantee proper management and reclamation of surface mined areas. The Mined Land Use Plan specifies that all activities prior to, during, and following mining include disposal of refuse and erosion and sedimentation control. The reclamation strategy includes the use of operational BMPs and procedures. The BMPs used are drawn from the *Manual for Erosion and Sedimentation Control in Georgia*, *Georgia's Best Management Practices for Forestry*, and from other states. Thus, the issuance of a surface mining permit in effect addresses BMPs to control nonpoint source pollutants. The regional GA EPD offices monitor and inspect surface mining sites to assess their permit compliance.

It is recommended that special attention be given to those facilities located in impaired watersheds. The implementation and maintenance of BMPs used to control erosion should be reviewed during the site inspections.

The Georgia Mining Association (GMA) is an informal trade association of the mining industry. It serves more than 200 members, 47 mining companies and over 150 associate companies. The association monitors legislative developments and coordinates industry response. It educates miners about the laws and regulations that affect them and provides a forum for the exchange of ideas. Through its newsletters, seminars, workshops, and annual conventions, the Georgia Mining Association serves as a source for mining industry information. It has several committees, including the Environmental Committee, that meet three to four times a year. The mining industry is conducting informal discussions on the potential of developing industry-wide standards for BMPs to prevent and reduce nonpoint source pollution. If these standards are adopted, the mining industry would likely conduct demonstration projects to gauge the effectiveness of the BMPs.

6.2.2.4 Roads

Unpaved roads can be a major contributor of sediment to our waterways if not properly managed. The following guidance for the maintenance and service of unpaved roadways, drainage ditches, and culverts can be used to minimize roadway erosion. One publication that may include some additional guidance is *Recommended Practices Manual, A Guideline for Maintenance and Service of Unpaved Roads* (Choctawhatchee, et. al, 2000).

Disturbances to unpaved roadway surfaces and ditches, and poor road surface drainage, results in deterioration of the road surface. This leads to increased roadway erosion and thus stream sedimentation. Unpaved roads are typically maintained by the blading and/or scraping of the roads to remove loose material. Proper, timely, and selective surface maintenance can prevent and minimize erosion of unpaved roadways. This in turn lengthens the life of the road and reduces maintenance costs. Roadway blading that occurs during periods when there is enough moisture content allows for immediate re-compaction. In addition, roadwork performed near streams or stream-crossings during "dry" months of the year can reduce the amount of sediment that enters a stream.

Roadside ditches convey storm water runoff to an outlet. A good drainage ditch is shaped and lined with appropriate vegetative or structural material. A well-vegetated ditch slows, controls, and filters the storm water runoff, providing an opportunity for sediments to be removed from the runoff before it enters surface waters. Energy dissipating structures to reduce velocity and dissipate turbulence in ditches are often necessary. Efficient disposal of runoff from the road helps preserve the roadbed and banks. Properly installed "turn-outs", or intermittent discharge points, help to maintain a stable velocity and proper flow capacity within the ditch by timely outleting water from them. This, in turns, alleviates roadway flooding, erosion, and maintenance problems. Properly placed "turn-outs" distribute roadway runoff and sediment over a larger vegetative filtering area, helping to reduce road side ditch maintenance to remove accumulated sediment.

Culverts are conduits used to convey water from one side of a road to another. Installation, modification, and/or improvements of culverts when streamflows and expected rainfall is low can reduce the amount of sediment that enters a stream. If the entire installation process, from beginning to end, can be completed before the next rainfall event, stream sedimentation can be minimized. Diverting all existing or potential streamflows while the culvert is being installed can also help reduce or avoid sedimentation below the installation. The culvert design can have a significant impact on the biological community if the size and species of fish passing through it are not considered. Changes in water velocities and the creation of vertical barriers also affect the biological communities.

6.2.2.5 Urban Development

The Erosion and Sedimentation Act, established in 1975, provides the mechanism for controlling erosion and sedimentation from land-disturbing activities. This Act establishes a permitting process for land-disturbing activities. Many local governments and counties have adopted erosion and sedimentation ordinances and have been given authority to issue and enforce permits for land-disturbing activities. Approximately 32 counties and 240 municipalities in Georgia have been certified as the local issuing authority for land-disturbing permits. In areas where local governments have not been certified as an issuing authority, the GA EPD is responsible for permitting, inspecting, and enforcing the Erosion and Sedimentation Act.

To receive a land-disturbing permit, an applicant must submit an erosion and sedimentation control plan that incorporates specific conservation and engineering BMPs. The *Field Manual for Erosion and Sediment Control in Georgia,* developed by the GSWCC, may be used as a guide to develop erosion and sedimentation control plans (GSWCC, 1997).

Local governments, with oversight by the GA EPD, and the Soil and Water Conservation Districts, are primarily responsible for implementing the Erosion and Sedimentation Act. Reports of suspected violations are made to the agency that issued the permit. In cases with local issuing authority, if the violation continues, the compliant is referred to the appropriate Soil and Water Conservation District. If the situation remains unresolved, the compliant is then referred to GA EPD for enforcement action. Enforcement may include administrative orders, injunctions, and civil penalties. It is recommended that the local and state governments continue to work to implement the provisions of the revised June 2001 Erosion and Sedimentation Act across Georgia.

Storm water runoff from developed urban areas (post-construction) can also have an impact on the transport of sediment to and within streams. Urbanization increases imperviousness, resulting in an increase in the volume of runoff that enters the streams. In addition, the streamflow rates may increase significantly from pre-construction rates. These changes in the streamflow can result in stream bank erosion and stream bottom down-cutting. It is recommended that local governments review and consider implementation of practices presented in the *Land Development Provisions to Protect Georgia Water Quality* (GA EPD, 1997).

6.3 Reasonable Assurance

Permitted discharges will be regulated through the NPDES permitting process described in this report. Georgia is working with local governments, and agricultural and forestry agencies, such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission, to foster the implementation of best management practices to address nonpoint sources. In addition, public education efforts will be targeted at individual stakeholders to provide information regarding the use of best management practices to protect water quality.

6.4 Public Participation

A thirty-day public notice will be provided for this TMDL. During this time, the availability of the TMDL will be public noticed, a copy of the TMDL will be provided as requested, and the public will be invited to provide comments on the TMDL.

7.0 INITIAL TMDL IMPLEMENTATION PLAN

GA EPD has coordinated with EPA to prepare this Initial TMDL Implementation Plan for this TMDL. GA EPD has also established a plan and schedule for development of a more comprehensive implementation plan after this TMDL is established. GA EPD and EPA have executed a Memorandum of Understanding that documents the schedule for developing the more comprehensive plans. This Initial TMDL Implementation Plan includes a list of BMPs and provides for an initial implementation demonstration project to address one of the major sources of pollutants identified in this TMDL, while State and/or local agencies work with local stakeholders to develop a revised TMDL implementation plan. It also includes a process whereby GA EPD and/or Regional Development Centers (RDCs), or other GA EPD contractors (hereinafter, "GA EPD Contractors"), will develop expanded plans (hereinafter, "Revised TMDL Implementation Plans").

This Initial TMDL Implementation Plan, written by GA EPD and for which GA EPD and/or the GA EPD Contractor are responsible, contains the following elements.

1. EPA has identified a number of management strategies for the control of nonpoint sources of pollutants, representing some best management practices. The "Management Measure Selector Table" shown below identifies these management strategies by source category and pollutant. Nonpoint sources are the primary cause of excessive pollutant loading in most cases. Any wasteload allocations in this TMDL will be implemented in the form of water-quality based effluent limitations in NPDES permits issued under CWA Section 402. [See 40 C.F.R. § 122.44(d)(1)(vii)(B)]. NPDES permit discharges are a secondary source of excessive pollutant loading, where they are a factor, in most cases.

2. GA EPD and the GA EPD Contractor will select and implement one or more BMP demonstration projects for each River Basin. The purpose of the demonstration projects will be to evaluate by River Basin and pollutant parameter the site-specific effectiveness of one or more of the BMPs chosen. GA EPD intends that the BMP demonstration project be completed before the Revised TMDL Implementation Plan is issued. The BMP demonstration project will address the major pollutant categories of concern for the respective River Basin as identified in the TMDLs. The demonstration project need not be of a large scale, and may consist of one or more measures from the Table or equivalent BMP measures proposed by the GA EPD Contractor and approved by GA EPD. Other such measures may include those found in EPA's "*Best Management Practices Handbook*," the *"NRCS National Handbook of Conservation Practices*," or any similar reference, or measures that the volunteers, etc., devise that GA EPD approves. If for any reason the GA EPD Contractor does not complete the BMP demonstration project, GA EPD will take responsibility for doing so.

3. As part of the Initial TMDL Implementation Plan, the GA EPD brochure entitled "*Watershed Wisdom -- Georgia's TMDL Program*" will be distributed by GA EPD to the GA EPD Contractor for use with appropriate stakeholders for this TMDL. Also, a copy of the video of that same title will be provided to the GA EPD Contractor for its use in making presentations to appropriate stakeholders on TMDL Implementation Plan development.

4. If for any reason the GA EPD Contractor does not complete one or more elements of a Revised TMDL Implementation Plan, GA EPD will be responsible for getting that (those) element(s) completed, either directly or through another contractor.

5. The deadline for development of a Revised TMDL Implementation Plan is the end of December 2005.

6. The GA EPD Contractor helping to develop the Revised TMDL Implementation Plan, in coordination with GA EPD, will work on the following tasks involved in converting the Initial TMDL Implementation Plan to a Revised TMDL Implementation Plan:

   A. Generally characterize the watershed;
   B. Identify stakeholders;
   C. Verify the present problem to the extent feasible and appropriate (e.g., local monitoring);
   D. Identify probable sources of pollutant(s);
   E. For the purpose of assisting in the implementation of the load allocations of this TMDL, identify potential regulatory or voluntary actions to control pollutant(s) from the relevant nonpoint sources;
   F. Determine measurable milestones of progress;
   G. Develop monitoring plan, taking into account available resources, to measure effectiveness; and
   H. Complete and submit to GA EPD the Revised TMDL Implementation Plan.

7. The public will be provided an opportunity to participate in the development of the Revised TMDL Implementation Plan and to comment on it before it is finalized.

8. The Revised TMDL Implementation Plan will supersede this Initial TMDL Implementation Plan when GA EPD approves the Revised TMDL Implementation Plan.

Management Measure Selector Table

Land Use	Management Measures	*Fecal Coliform*	*Dissolved Oxygen*	*pH*	*Sediment*	*Temperature*	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	*PCBs, toxaphene*
Agriculture	1. Sediment & Erosion Control	_	_		_	_				
	2. Confined Animal Facilities	_	_							
	3. Nutrient Management	_	_							
	4. Pesticide Management		_							
	5. Livestock Grazing	_	_		_	_				
	6. Irrigation		_		_	_				
Forestry	1. Preharvest Planning				_	_				
	2. Streamside Management Areas	_	_		_	_				
	3. Road Construction & Reconstruction		_		_	_				
	4. Road Management		_		_	_				
	5. Timber Harvesting		_		_	_				
	6. Site Preparation & Forest Regeneration		_		_	_				
	7. Fire Management	_	_	_	_	_				
	8. Revegetation of Disturbed Areas	_	_	_	_	_				
	9. Forest Chemical Management		_			_				
	10. Wetlands Forest Management	_	_	_		_		_		

Land Use	Management Measures	*Fecal Coliform*	*Dissolved Oxygen*	*pH*	*Sediment*	*Temperature*	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	*PCBs, toxaphene*
Urban	1. New Development	—	—		—	—			—	
	2. Watershed Protection & Site Development	—	—		—	—		—	—	
	3. Construction Site Erosion and Sediment Control		—		—	—				
	4. Construction Site Chemical Control		—							
	5. Existing Developments	—	—		—	—			—	
	6. Residential and Commercial Pollution Prevention	—	—							
Onsite Wastewater	1. New Onsite Wastewater Disposal Systems	—	—							
	2. Operating Existing Onsite Wastewater Disposal Systems	—	—							
Roads, Highways and Bridges	1. Siting New Roads, Highways & Bridges	—	—		—	—			—	
	2. Construction Projects for Roads, Highways and Bridges		—		—	—				
	3. Construction Site Chemical Control for Roads, Highways and Bridges		—							
	4. Operation and Maintenance-Roads, Highways and Bridges	—	—			—			—	

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APPENDIX A

Average Annual Sediment Load Summary Memorandum

SUMMARY MEMORANDUM
Average Annual Sediment Load
Bearmeat Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Towns**
Major River Basin:	**Tennessee**
8-Digit Hydrologic Unit Code(s):	**06020002**
Waterbody Name:	**Bearmeat Creek**
Location:	**Tributary to Hiawassee River**
Stream Length:	**2 miles**
Watershed Area:	**2.6 square miles**
Tributary to:	**Hiawassee River**
Ecoregion:	**Blue Ridge**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (partially supporting designated use)**

Applicable Water Quality Standard:

All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:

Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):

Future Construction Sites	**Meet requirements of General Storm Water Permit**
Load Allocation (LA):	**146 tons/yr**
Margin of Safety (MOS):	**implicit**
Average Annual Sediment Load:	**146 tons/yr**

SUMMARY MEMORANDUM
Average Annual Sediment Load
Butternut Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Union**
Major River Basin:	**Tennessee**
8-Digit Hydrologic Unit Code(s):	**06020002**
Waterbody Name:	**Butternut Creek**
Location:	**Blairsville**
Stream Length:	**2 miles**
Watershed Area:	**11.9 square miles**
Tributary to:	**Nottely River**
Ecoregion:	**Blue Ridge**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (partially supporting designated use)**

Applicable Water Quality Standard:
All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:
Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):

Blairsville WPCP	**18 tons/yr**
Future Construction Sites Permit	**Meet requirements of General Storm Water**

Load Allocation (LA):	**644 tons/yr**
Margin of Safety (MOS):	**implicit**
Average Annual Sediment Load:	**662 tons/yr**

SUMMARY MEMORANDUM
Average Annual Sediment Load
Chattanooga Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Walker**
Major River Basin:	**Tennessee**
8-Digit Hydrologic Unit Code(s):	**06020001**
Waterbody Name:	**Chattanooga Creek**
Location:	**High Point to Flintstone**
Stream Length:	**7 miles**
Watershed Area:	**19.7 square miles**
Tributary to:	**Tennessee River**
Ecoregion:	**Ridge and Valley**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (partially supporting designated use)**

Applicable Water Quality Standard:

All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:

Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):

Future Construction Sites	**Meet requirements of General Storm Water Permit**

Load Allocation (LA):	**3,522 tons/yr**	
Land Use		**3,142 tons/yr**
Road		**376 tons yr**
Margin of Safety (MOS):	**implicit**	
Average Annual Sediment Load:	**3,522 tons/yr**	

SUMMARY MEMORANDUM
Average Annual Sediment Load
Dry Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Catoosa**
Major River Basin:	**Tennessee**
8-Digit Hydrologic Unit Code(s):	**06020001**
Waterbody Name:	**Dry Creek**
Location:	**Upstream East Chickamauga Creek**
Stream Length:	**5 miles**
Watershed Area:	**11.3 square miles**
Tributary to:	**East Chickamauga Creek**
Ecoregion:	**Ridge and Valley**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (partially supporting designated use)**

Applicable Water Quality Standard:
All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:
Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):
Future Construction Sites **Meet requirements of General Storm Water Permit**

Load Allocation (LA):	**631 tons/yr**	
Land Use		**445 tons/yr**
Road		**186 tons yr**
Margin of Safety (MOS):	**implicit**	
Average Annual Sediment Load:	**631 tons/yr**	

SUMMARY MEMORANDUM
Average Annual Sediment Load
Lower Youngcane Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Union

Major River Basin: Tennessee
8-Digit Hydrologic Unit Code(s): 06020002

Waterbody Name: Lower Youngcane Creek
Location: Union County
Stream Length: 2 miles
Watershed Area: 3.7 square miles
Tributary to: Youngcane Creek
Ecoregion: Blue Ridge

Constituent(s) of Concern: Sediment

Designated Use: Fishing (partially supporting designated use)

Applicable Water Quality Standard:
All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:
Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):
Future Construction Sites Meet requirements of General Storm Water Permit

Load Allocation (LA): 207 tons/yr

Margin of Safety (MOS): implicit

Average Annual Sediment Load: 207 tons/yr

SUMMARY MEMORANDUM
Average Annual Sediment Load
Peavine Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Catoosa

Major River Basin: Tennessee
8-Digit Hydrologic Unit Code(s): 06020001

Waterbody Name: Peavine Creek
Location: Upstream South Chickamauga Creek
Stream Length: 8 miles
Watershed Area: 33.7 square miles
Tributary to: South Chickamauga Creek
Ecoregion: Ridge and Valley

Constituent(s) of Concern: Sediment

Designated Use: Fishing (partially supporting designated use)

Applicable Water Quality Standard:
All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:
Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):
Knight's Inn WPCP 0.7 tons/yr
Sherwood Forest MHP 1.3 tons/yr
Future Construction Sites Meet requirements of General Storm Water Permit

Load Allocation (LA): 5,603 tons/yr
Land Use 4,997 tons/yr
Road 606 tons yr

Margin of Safety (MOS): implicit

Average Annual Sediment Load: 5605 tons/yr

SUMMARY MEMORANDUM
Average Annual Sediment Load
Rock Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Dade/Walker**
Major River Basin:	**Tennessee**
8-Digit Hydrologic Unit Code(s):	**06020001**
Waterbody Name:	**Rock Creek**
Location:	**Tributary to Chattanooga Creek**
Stream Length:	**14 miles**
Watershed Area:	**24.6 square miles**
Tributary to:	**Chattanooga Creek**
Ecoregion:	**Ridge and Valley**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (partially supporting designated use)**

Applicable Water Quality Standard:
All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:
Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):
Future Construction Sites Meet requirements of General Storm Water Permit

Load Allocation (LA):	**2,527 tons/yr**
Land Use	**2,262 tons/yr**
Road	**265 tons yr**
Margin of Safety (MOS):	**implicit**
Average Annual Sediment Load:	**2,527 tons/yr**

SUMMARY MEMORANDUM
Average Annual Sediment Load
Weaver Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Fannin**
Major River Basin:	**Tennessee**
8-Digit Hydrologic Unit Code(s):	**06020003**
Waterbody Name:	**Weaver Creek**
Location:	**Fannin County**
Stream Length:	**2 miles**
Watershed Area:	**5.3 square miles**
Tributary to:	**Toccoa River**
Ecoregion:	**Blue Ridge**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (partially supporting designated use)**

Applicable Water Quality Standard:

All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Analysis/Modeling:

Universal Soil Loss Equation was used to determine the average annual sediment load

3. Allocation Watershed/Stream Reach:

Wasteload Allocations (WLA):

Future Construction Sites	**Meet requirements of General Storm Water Permit**
Load Allocation (LA):	**296 tons/yr**
Margin of Safety (MOS):	**implicit**
Average Annual Sediment Load:	**296 tons/yr**