Total Maximum Daily Load

Evaluation

for

Thirty-Two Stream Segments

in the

Oconee 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

January 2007

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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 three categories, supporting, partially supporting, or not supporting their designated uses, depending on water quality assessment results. 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* (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 restore and maintain water quality.

The State of Georgia has identified thirty-two (32) stream segments located in the Oconee 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 1998 and 1999, the Department of Natural Resources (DNR) Wildlife Resources Division (WRD) conducted studies of fish populations. WRD used the Index of Biotic Integrity (IBI) and modified Index of Well-Being (IWB) to identify affected fish populations. The IBI and IWB values were used to classify the populations as Excellent, Good, Fair, Poor, or Very Poor. Stream segments with fish populations rated as Poor or Very Poor were listed as Biota Impacted, and were included in the partially supporting or not supporting list. Fourteen stream segments were rated as Poor or Very Poor, placed on the 303(d) list as partially supporting or not supporting their designated use, and scheduled for TMDL evaluation. One additional stream, Carr Creek, was placed on the 303(d) list based on GA EPD investigations. The TMDLs for these fifteen stream segments were completed in January 2002. Since that time, four of the stream segments evaluated in the 2002 TMDL document have been removed from the 303(d) list (Black Creek, Carter's Mill Creek, Porter Creek, and Sandy Hill Creek).

In each year between 1999 and 2003, the WRD conducted additional studies of fish populations in the Oconee River Basin. Based on these studies, twenty-one additional stream segments were rated as Poor or Very Poor and placed on the 303(d) list as partially supporting or not supporting their designated water use. Overall, between 1998 and 2003, thirty-six stream segments were rated as Excellent, Good, or Fair and assessed as supporting their designated water use.

The general cause of low IBI scores is the lack of fish 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 total 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 partially supporting and not supporting 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 load in those watersheds listed on the partially supporting or not supporting list is 0.25 tons/acre/yr, ranging from 0.02 to 2.26 tons/acre/yr. The average sediment load of the unimpaired watersheds is 0.18 tons/acre/yr, ranging from 0.01 to 0.75 tons/acre/yr. These values represent sediment load contributions from all land uses within unimpaired watersheds. Note that the average annual sediment loads for both watershed groups are generally within the same range.

Table 1 shows that approximately 28.7 percent of the average sediment load in the Oconee River Basin results from row crops, having an average sediment load of 1.24 tons/acre/yr. Approximately 19.7 percent of the total sediment load is from roads. Mining activities contribute approximately 18.4 percent of the total sediment load, with an average load of 7.4 tons/acre/yr. Pasture and hay contribute approximately 10.7 percent of the total sediment load, grasses and wetlands make up about 9.8 percent of the total load, and urban land contributes approximately 4.0 percent of the total sediment load. 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 Oconee River Basin

Land Use	Average Percent Land Use	Average Percent Sediment Load	Average Sediment Load (tons/acre/yr)
Open Water	0.6%	0.0%	0.00
Urban	8.1%	4.0%	0.13
Bare Rock, Sand and Clay	0.4%	0.0%	0.00
Quarries, Strip Mines, Gravel Pits	1.0%	18.4%	7.40
Forest	58.7%	2.7%	0.05
Pasture / Hay	26.47%	10.7%	0.07
Row Crops	3.8%	28.7%	1.24
Grasses, Wetland	15.0%	9.8%	0.21
Roads		19.7%	

These data indicate that row crops are the major source of sediment to our rivers and streams. 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 the 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 sediment loads that can enter the impaired Oconee River Basin streams without causing sediment impairment to the streams. This is based on the hypothesis that if an impaired watershed has a total annual sediment loading rate similar to a biologically unimpaired watershed, then the receiving stream will remain stable and not be biologically impaired due to sediment. The average total annual sediment load in the Oconee River Basin watersheds not on the 303(d) list is 0.18 tons/acre/yr. The total annual sediment loads for each of the impaired watersheds that have been listed based on WRD fish population studies are summarized in Table 2, along with any required sediment load reductions. The impaired stream segments in the Piedmont ecoregion are presented first, followed by the impaired stream segments in the Southeastern Plains ecoregion.

Table 2. Total Annual Sediment Loads and the Required Sediment Reduction

Name	Current Load (tons/yr)	WLA (tons/yr)	WLAsw (tons/yr)	LA (tons/yr)	Allowable Total Load (tons/yr)	% Reduction
Briar Creek	192.2			192.2	192.2	0.0
Carr Creek	1,583.4	108.5	11.2	4.8	124.5	92.1
Crooked Creek (Putnam Co.)	194.6			194.6	194.6	0.0
Freeman Creek	206.9			206.9	206.9	0.0
Hardeman Creek	941.2			254.5	254.5	73.0
Little Creek	64.5			64.5	64.5	0.0
Little Fishing Creek	6,167.7			939.7	939.7	84.8
Marburg Creek	1,764.0			427.0	427.0	75.8
Noketchee Creek	134.8		63.2	71.6	134.8	0.0
Rooty Creek	670.1	12.6		644.9	657.5	1.9
Sandy Run Creek	155.4			155.4	155.4	0.0
Tobler Creek	94.9			94.9	94.9	0.0
Zoie Brown Creek	202.4			202.4	202.4	0.0
Alligator Creek	97.8			97.8	97.8	0.0
Cedar Creek	1,002.1			1,002.1	1,002.1	0.0
Crooked Creek (Jones Co.)	456.7			220.1	220.1	51.8
Crooked Creek (Laurens Co.)	220.1			456.7	456.7	0.0
Cypress Creek	1,920.1			1,920.1	1,920.1	0.0
Keg Creek	12,499.6	2,177.2		6,641.4	8,818.6	39.6
Lamars Creek	1,815.5	42.5		1,773.0	1,815.5	2.3
Limestone Creek (Montgomery)	548.8	12.3		464.1	476.4	13.2
Limestone Creek (Washington)	3,752.8	132.2		551.4	683.6	81.8
Little Commissioner Creek	6,037.2	1,348.9		2,741.4	4,090.3	43.7
Lotts Creek	184.4			184.4	184.4	0.0
Ochwalkee Creek (Laurens Co.)	514.5			514.5	514.5	0.0
Ochwalkee Creek (Laurens / Wheeler Co.)	4,901.7			4,901.7	4,901.7	0.0
Peterson Creek	226.1	15.1		192.8	207.9	8.0
Red Bluff Creek	3,290.3			3,290.3	3,290.3	0.0
Reedy Creek	1,504.5			1,504.5	1,504.5	0.0
Rocky Creek	12,220.7			5,844.7	5,844.7	52.2
Sandy Creek	369.5			369.5	369.5	0.0
Tiger Creek	48.9			48.9	48.9	0.0

Management practices that may be used to help maintain the annual average sediment loads at current levels include:

- Compliance with the requirements of the NPDES permit program;
- 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; and
- Evaluation of the effects of increased flow due to urban runoff on stream bank erosion.

Though the measurement of sediment delivered to a stream is difficult to determine, by monitoring the implementation of these practices, their anticipated effects will contribute to improving stream habitats and water quality, and thus be an indirect measurement of the TMDLs.

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 three categories, supporting, partially supporting, or not supporting their designated uses, depending on water quality assessment results. 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* (GA EPD, 2000-2001).

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In 1998 and 1999, the Department of Natural Resources (DNR) Wildlife Resources Division (WRD) conducted studies of fish populations at a number of monitoring sites in the Oconee River Basin. WRD used the Index of Biotic Integrity (IBI) and modified Index of Well-Being (IWB) to identify affected fish populations. The IBI and IWB values were used to classify the populations as Excellent, Good, Fair, Poor, or Very Poor. Stream segments with 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. Fourteen stream segments were rated as Poor or Very Poor, placed on the 303(d) list as partially supporting or not supporting their designated use, and scheduled for TMDL evaluation. One additional stream, Carr Creek, was placed on the 303(d) list based on GA EPD investigations. The TMDLs for these fifteen stream segments were completed in January 2002. Since that time, four of the stream segments evaluated in the 2002 TMDL document have been removed from the 303(d) list (Black Creek, Carter's Mill Creek, Porter Creek, and Sandy Hill Creek).

In each year between 1999 and 2003, the WRD conducted additional studies of fish populations in the Oconee River Basin. Based on these studies, twenty-one additional stream segments were rated as Poor or Very Poor and placed on the 303(d) list as partially supporting or not supporting their designated water use. Overall, between 1998 and 2003, thirty-six stream segments were rated as Excellent, Good, or Fair and assessed as supporting their designated water use. The thirty-two impaired stream segments are shown in Table 3. The eleven impaired stream segments remaining from the 2002 TMDL document are presented first, followed by the twenty-one impaired stream segments that have been listed based on additional WRD fish population studies.

1.2 Watershed Description

The thirty-two impaired watersheds located in the Oconee River Basin are located in the following counties: Baldwin, Barrow, Bleckley, Clarke, Dodge, Greene, Hancock, Jackson, Jones, Laurens, Madison, Montgomery, Morgan, Oconee, Putnam, Treutlen, Twiggs,

Table 3. 303(d) Listed Stream Segments Located in the Oconee River Basin

Stream	Status	Location	Miles	Ecoregion
Alligator Creek	Partially Supporting	Headwaters to Ugly Creek (Twiggs Co.)	6	Southeastern Plains
Carr Creek	Partially Supporting	Headwaters to North Oconee River, Athens (Clarke Co.)	2	Piedmont
Crooked Creek	Partially Supporting	Putnam County	9	Piedmont
Limestone Creek	Partially Supporting	Kaolin Road to Keg Creek (Washington Co.)	8	Southeastern Plains
Little Commissioner Creek	Partially Supporting	Ga. Hwy. 18 to Commissioner Creek (Wilkinson Co.)	9	Southeastern Plains
Little Fishing Creek	Partially Supporting	Baldwin County	5	Piedmont
Rooty Creek	Not Supporting	Rd. S926, Eatonton to Little Creek (Putnam Co.)	9	Piedmont
Sandy Creek	Partially Supporting	Headwaters to Harrison's Lake / Little Sandy Creek (Jones / Twiggs Co.)	6	Southeastern Plains
Sandy Run Creek	Partially Supporting	Hancock County	5	Piedmont
Tobler Creek	Partially Supporting	Baldwin County	8	Piedmont
Zoie Brown Creek	Partially Supporting	Tributary to Buffalo Creek (Hancock Co.)	3	Piedmont
Briar Creek	Partially Supporting	Headwaters to Hard Labor Creek (Morgan Co.)	4	Piedmont
Cedar Creek	Partially Supporting	Headwaters to Maiden Creek (Wilkinson Co.)	11	Southeastern Plains
Crooked Creek	Partially Supporting	Headwaters to Commissioner Creek (Jones Co.)	5	Southeastern Plains
Crooked Creek	Partially Supporting	Headwaters to Turkey Creek (Laurens Co.)	3	Southeastern Plains
Cypress Creek	Partially Supporting	Little Cypress Creek to Oconee River (Montgomery Co.)	4	Southeastern Plains
Freeman Creek	Partially Supporting	Headwaters to Apalachee River (Oconee Co.)	4	Piedmont
Hardeman Creek	Partially Supporting	Headwaters to Sandy Creek (Jackson Co.)	5	Piedmont
Keg Creek	Partially Supporting	Little Keg Creek to Buffalo Creek (Washington Co.)	8	Southeastern Plains
Lamars Creek	Partially Supporting	Headwaters to Buffalo Creek (Washington Co.)	8	Southeastern Plains
Limestone Creek	Partially Supporting	Mount Vernon to Oconee River (Montgomery Co.)	2	Southeastern Plains
Little Creek	Partially Supporting	Headwaters to Richland Creek (Greene Co.)	3	Piedmont
Lotts Creek	Partially Supporting	Headwaters to Oconee River (Wheeler Co.)	5	Southeastern Plains
Marburg Creek	Partially Supporting	Marburg Lake to Masseys Lake (Barrow Co.)	1	Piedmont
Noketchee Creek	Partially Supporting	Headwaters to Sandy Creek (Madison / Clarke Co.)	5	Piedmont

Stream	Status	Location	Miles	Ecoregion
Ochwalkee Creek	Partially Support	Mayberry Road to u / s Little New York Road (Laurens Co.)	5	Southeastern Plain
Ochwalkee Creek	Not Support	U / S Little New York Rd. to Oconee River (Laurens / Wheeler Co.)	18	Southeastern Plain
Peterson Creek	Partially Support	Headwaters to Oconee River (Wheeler Co.)	8	Southeastern Plain
Red Bluff Creek	Partially Support	Little Red Bluff Creek to Oconee River (Treutlen Co.)	3	Southeastern Plain
Reedy Creek	Partially Support	Headwaters to Turkey Creek (Laurens Co.)	7	Southeastern Plain
Rocky Creek	Partially Support	Bay Branch to Buckhorn Branch (Laurens Co.)	6	Southeastern Plain
Tiger Creek	Partially Support	Headwaters to Buffalo Creek (Hancock / Washington Co.)	5	Southeastern Plain

Washington, Wheeler, and Wilkinson (see Figure 1). The thirty unimpaired watersheds are located in the following counties: Baldwin, Barrow, Clarke, Greene, Gwinnett, Hall, Hancock, Jasper, Johnson, Jones, Laurens, Morgan, Newton, Oconee, Putnam, Treutlen, Twiggs, Walton, Washington, and Wilkinson.

The land use characteristics of the Oconee River Basin watersheds were determined using data from Georgia's National Land Cover Data (NLCD). This coverage is based on Landsat Thematic Mapper digital images developed in 2001. The classification is based on a modified Anderson level one and two system. Table 4 lists the land use distribution of the sixty-two watersheds WRD monitored between 1998 and 2003. The watersheds are grouped by those that are unimpaired (Piedmont ecoregion, then Southeastern Plains ecoregion), followed by those that are impaired (Piedmont ecoregion, then Southeastern Plains ecoregion). Table 5 lists the land use percentages for all the Oconee River Basin watersheds monitored in a similar fashion. The data show that the watersheds are predominately forested with approximately 58.0 percent (ranging from 14.0 to 88.3 percent) in forest use. Agriculture is the next predominate land use at approximately 16.2%, consisting of approximately 3.8 percent row crops (ranging from 0.0 to 26.6 percent) and approximately 12.3 percent pastureland (ranging from 0.3 to 44.6 percent).

The soil characteristics of the Oconee River Basin watersheds were determined using data from the State Soil Geographic (STATSGO) coverage. This coverage provides major soil type classifications. Table 6 lists the soil type distribution of the monitored watersheds.

1.3 Water Quality Standard

The water use classification for the impaired watersheds in the Oconee River Basin is Fishing. The criterion violated is listed as Biota Impacted, which indicates that studies have shown a significant impact on fish. The potential cause(s) listed include urban runoff, nonpoint sources, industrial facilities, and residual from industrial sources. The narrative standard exists to prevent objectionable conditions which 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.

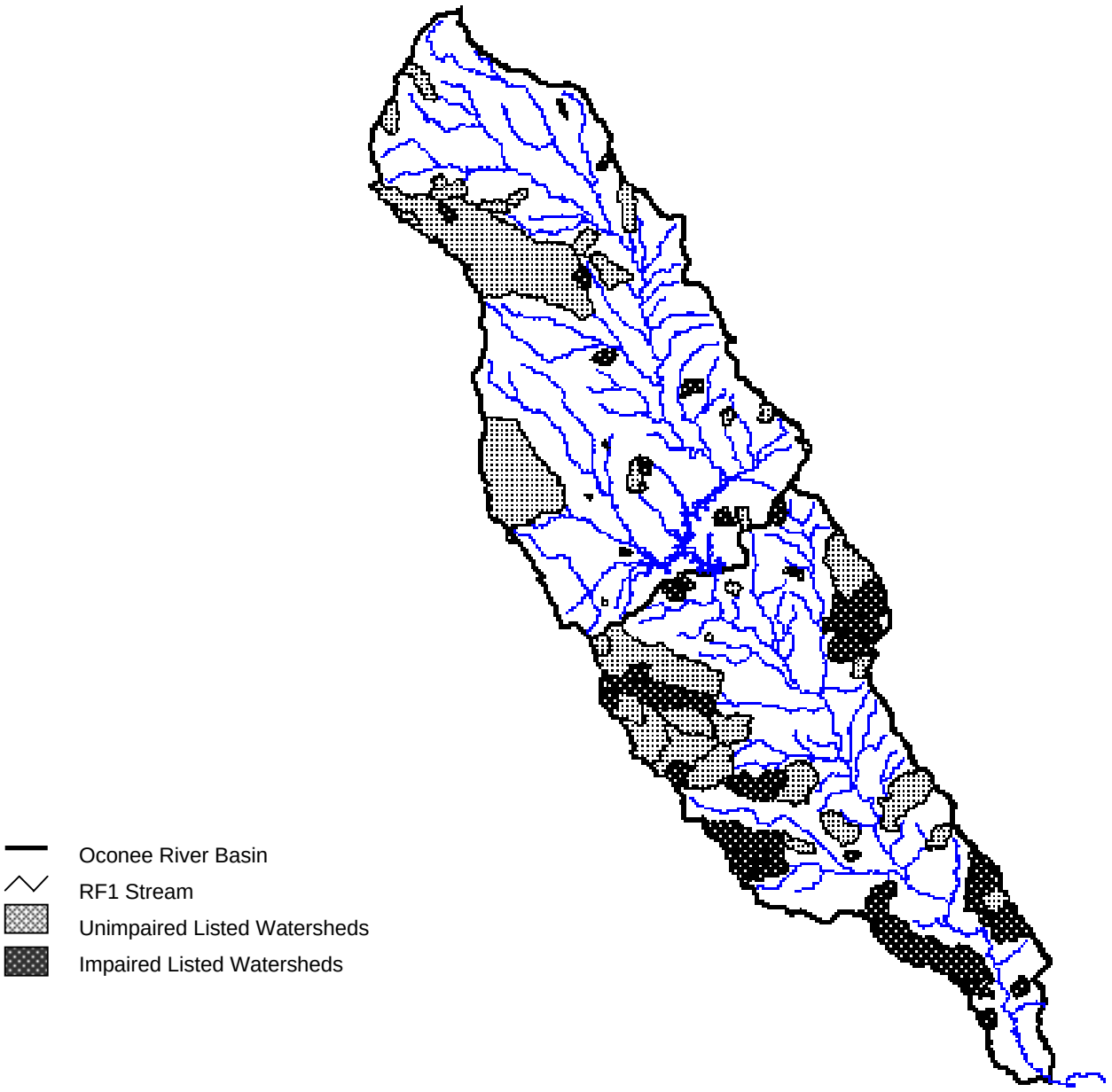

Figure 1. Impaired and Unimpaired Watersheds Monitored in the Oconee River Basin

Table 4a. Land Use Distribution (Unimpaired Piedmont)

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	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Allen Creek	14.2	411.2	415.9	313.6	60.3	110.7	3854.9	131.2	7.6	16.5	776.6		589.3	50.0		6751.9
Apalachee River	1401.3	9730.3	6630.2	1405.0	1826.2	856.0	43207.3	24626.0	2960.9	506.8	43615.2	454.1	14500.5	7449.1	6.2	159175.2
Barber Creek	51.6	186.8	246.2	237.5	33.4		856.6	343.8	24.9	13.8	1311.2	22.2	395.8	107.9		3831.7
Beaverdam Trib.	1.1	21.3					375.8	115.9	36.5	4.0	1.8		37.8	4.0		598.2
Big Bear Creek	7.3	162.3	178.8	18.7	8.5		739.2	212.6	24.9	5.3	1125.5	6.2	236.8	87.0		2813.2
Black Springs Branch	7.1	112.1	21.3		17.1		1016.5	475.0	146.6	8.0	91.6		308.0	4.7		2208.1
Calls Creek	52.3	893.6	494.8	132.3	22.5	10.5	1364.3	434.5	64.3	10.5	1359.5	3.6	443.4	71.4		5357.3
Cedar Creek - Barrow	51.4	647.4	1284.1	243.1	25.8	121.0	1509.1	623.1	45.6	19.8	1448.0	1.1	354.3	116.5		6490.1
Cedar Creek - Jasper	6.0	50.9	12.5	0.2	24.5		379.6	195.9	63.4	0.4	54.5	4.9	57.4	44.3		894.4
Copeland Creek	15.1	51.4	9.1		11.8		731.7	1389.7	171.5	18.9	252.9	8.0	106.7	71.4		2838.1
Drowning Creek	6.0	159.7	329.6	40.5	13.3		670.7	201.0	10.9	6.0	769.7		154.3	46.7		2408.5
Kimbro Creek		65.8	4.9			208.8	310.9	761.5	42.5	29.4	93.2	13.3	586.7	51.6		2168.5
Milsap Creek	91.0	365.8	131.2	26.5	18.9		1104.8	714.1	153.4	12.7	944.0	4.0	293.8	114.8		3974.9
Mulberry Creek	4.2	594.2	524.8	33.8	65.8		2921.3	314.5	45.4	32.5	940.9		285.8	4.9		5768.1
Murder Creek	934.7	4343.4	349.8	76.5	630.5	673.8	27336.0	16658.8	3117.0	250.9	14352.9	170.1	10254.9	3900.2	2.2	83051.7
Rocky Creek	1.8	81.6	92.5	5.6	3.8		659.8	179.5	12.7	3.1	747.9	1.6	96.5	37.4		1923.6
Rooty Creek	79.6	343.4	108.5	42.5	75.8		1467.8	196.8	119.6	6.9	1703.9	20.9	603.8	106.5		4876.1
Rose Creek	47.4	242.0	46.9	10.2	74.3	4.2	4076.8	974.7	222.8	15.3	3376.9	20.0	783.7	209.3	1.8	10106.4
Shoal Creek	76.5	1316.5	380.1	55.6	67.6	62.9	2882.4	781.2	121.4	9.8	1927.9	58.9	598.0	290.0		8628.8

Table 4b. Land Use Distribution (Unimpaired Southeastern Plain)

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	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Big Creek	56.9	1304.1	216.8	63.6		5.6	3025.6	7895.4	1827.4	248.4	2504.7	2271.7	2351.5	1530.2	162.8	23464.7
Big Sandy Creek	791.7	2356.0	406.3	159.5	109.2	2934.0	29203.9	18262.0	11363.8	1113.5	1984.6	1508.5	10714.2	8090.9	832.6	89830.3
Carter's Mill Creek	31.8	95.2	25.4				789.0	2161.2	477.7	179.2	509.0	252.9	537.7	294.2	25.8	5379.1
Commissioner Creek	559.7	2428.9	356.0	39.8	145.2	427.0	19961.5	12346.7	5660.9	468.8	6726.1	2072.2	5938.0	4306.5	215.7	61653.0
Hunger and Hardship Creek	24.0	1435.1	556.4	315.6		9.8	1736.2	1454.2	544.0	38.7	1108.4	1727.7	905.6	733.7	69.4	10658.6
Little Red Bluff Creek	13.8	585.5	225.3	31.6			1331.7	1502.4	470.3	44.3	550.4	594.4	1040.3	211.7	41.1	6642.9
Little Rocky Creek	3.6	360.9	119.9	48.7		5.3	872.4	804.2	256.9	9.3	444.6	1088.4	304.2	577.1	16.9	4912.3
Log Dam Creek	1.6	53.2	7.3		14.9		761.9	1236.5	113.4	6.0	116.5	15.1	248.9	35.8		2611.0
Porter Creek	55.6	175.5	6.4	6.9		329.4	9160.8	4012.8	2158.7	321.1	264.0	118.1	1648.3	916.7	85.0	19259.2
Pughes Creek	16.0	198.1	12.2			9.6	646.7	1940.5	403.6	27.1	699.4	615.8	521.7	421.0	47.6	5559.5
Sandy Hill Creek	5.3	44.9	7.1			10.9	1058.3	1451.5	459.0	22.7	646.0	280.7	228.6	182.4	4.4	4401.9
South Sandy Creek	26.5	461.5	22.7				5782.7	3067.6	1945.9	92.3	1200.9	1660.3	1078.4	934.5	34.7	16307.9

Table 4c. Land Use Distribution (Impaired Piedmont)

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	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Briar Creek	26.7	171.5	34.2	14.5	171.0		1058.1	819.3	73.2	6.2	439.2	10.5	344.3	155.7		3324.2
Carr Creek	10.5	151.4	130.3	78.3		114.8	68.7	22.9			36.9	1.1	24.7	12.9		652.5
Crooked Creek	26.0	67.6	1.6		29.4		588.4	162.3	50.5	7.6	1067.0	26.0	324.2	40.5		2391.1
Freeman Creek	9.3	185.0	22.2	1.1	19.1		940.5	642.5	83.8	12.7	971.2	4.0	391.2	80.7		3363.4
Hardeman Creek	31.8	60.9	38.3	39.6		44.0	495.3	55.4	16.0	0.7	352.0	25.4	139.0	35.4		1333.7
Little Creek	17.1	37.4	7.8	2.0	18.9		608.7	1778.2	140.5	2.7	279.1	4.4	153.4	40.9		3091.2
Little Fishing Creek	4.4	129.2	2.7		14.2	302.0	1659.7	1431.9	205.3	40.0	310.9		798.6	24.7		4923.6
Marburg Creek	18.2	131.0	211.3	31.6	13.6	89.2	620.9	287.1	14.7	6.2	551.1		178.8	83.8		2237.4
Noketchee Creek	0.9	232.6	124.1	10.2	3.8	4.0	696.1	196.6	30.2	0.9	336.2		110.1	59.2		1804.9
Rooty Creek	82.5	356.7	111.2	42.5	79.6		1684.1	248.2	143.9	8.2	1837.4	20.9	693.8	112.8		5421.8
Sandy Run Creek	3.1	99.0			6.2		760.8	1524.0	179.0	50.3	18.9		391.2	146.1		3178.6
Tobler Creek	5.6	89.2	4.7		41.1		704.7	683.0	128.5	0.9	47.4		187.7	64.3		1957.0
Zoie Brown Creek	12.0	179.0	2.7				1157.1	1441.5	244.6	10.5	153.9		335.6	256.0	1.1	3793.9

Table 4d. Land Use Distribution (Impaired Southeastern Plains)

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	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Alligator Creek		97.0	6.2	9.8	10.2		3372.3	1169.8	474.8	61.8	63.6	13.6	341.8	273.3	8.2	5902.4
Cedar Creek	52.9	255.1	4.0	0.9		1.1	7317.4	4187.3	1690.6	174.6	558.2	582.9	1175.5	845.7	64.3	16910.5
Crooked Creek - Laurens	7.1	174.8	110.7	18.0			274.4	296.2	82.3	11.1	168.3	211.0	152.3	77.2	12.0	1595.6
Crooked Creek - Jones	14.2	154.6	17.1		1.1		1290.3	658.3	306.4	26.0	437.9	304.0	482.1	192.1	15.6	3899.8
Cypress Creek	22.9	531.3	64.3	1.1		1.1	2389.8	4396.6	1641.7	43.8	888.4	841.5	1793.3	715.6	95.8	13427.3
Keg Creek	669.6	1930.3	504.6	284.4	81.6	1063.7	16013.4	13808.2	6588.4	1003.4	3742.3	1840.9	7877.2	4789.8	353.6	60551.5
Lamars Creek	22.5	157.2	21.1	4.0	15.8	13.3	3701.6	4635.0	1303.6	128.8	676.3	687.8	1081.5	771.2	37.1	13256.9
Limestone Creek - Montgomery	2.2	338.7	107.4	27.4		1.8	440.1	988.3	225.9	16.0	289.3	251.1	331.6	221.7	29.8	3271.3
Limestone Creek - Washington	125.4	432.1	190.4	159.9		287.3	1108.8	860.6	427.0	52.7	273.3	143.2	499.0	109.0	25.4	4694.1
Little Commissioner Creek	144.1	1127.9	302.4	168.8	0.2	636.2	9115.0	6687.8	2770.3	234.4	1337.2	515.9	2729.4	2153.2	162.8	28085.7
Lotts Creek	18.0	87.4	5.3				395.8	1884.3	359.2	24.7	104.7	44.9	343.8	148.3	10.2	3426.8
Ochwalkee Creek - Laurens	6.0	214.8	6.2				767.5	3716.5	641.4	69.2	340.7	161.7	800.4	603.1	17.8	7345.2
Ockwalkee Creek - Wheeler	173.0	1409.9	40.7	0.0	0.0	25.8	3792.1	24232.0	4263.8	366.0	1859.6	1904.7	4683.0	3659.2	97.2	46507.1
Peterson Creek	20.5	299.8	46.3	10.2			591.1	1607.0	412.5	17.8	208.4	195.0	571.8	209.0	22.2	4211.6

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	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands	Total
Red Bluff Creek	58.5	1587.2	350.3	41.1	0.0	9.1	4427.3	8642.2	2390.2	264.6	1740.0	1828.0	3188.1	1510.9	122.8	26160.3
Reedy Creek	12.2	494.6	72.1	10.7		3.3	1494.2	3660.3	1272.1	83.4	726.1	1001.0	1104.2	1053.2	21.1	11008.4
Rocky Creek	233.1	1851.1	576.6	22.5	0.0	72.5	6135.0	5768.1	1294.3	527.3	5153.6	9664.3	3930.7	4566.9	336.2	40132.2
Sandy Creek	4.7	125.0	13.8	22.0	13.1		1381.9	457.2	283.1	58.0	249.5	74.3	390.7	196.8	11.6	3281.8
Tiger Creek	69.2	5.1			13.8		529.1	425.6	114.3	22.7	115.2	9.1	350.0	55.2		1709.3

Table 5a. Land Use Percentages (Unimpaired Piedmont)

NAME	Percent Total Land Use														
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial Industrial Transportation	Bare Rock Sand and Clay	Quarries, Strip Mines Gravel Pits	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Allen Creek	0.21%	6.09%	6.16%	4.64%	0.89%	1.64%	57.09%	1.94%	0.11%	0.24%	11.50%	0.00%	8.73%	0.74%	0.00%
Apalachee River	0.88%	6.11%	4.17%	0.88%	1.15%	0.54%	27.14%	15.47%	1.86%	0.32%	27.40%	0.29%	9.11%	4.68%	0.00%
Barber Creek	1.35%	4.88%	6.42%	6.20%	0.87%	0.00%	22.36%	8.97%	0.65%	0.36%	34.22%	0.58%	10.33%	2.81%	0.00%
Beaverdam Trib.	0.19%	3.57%	0.00%	0.00%	0.00%	0.00%	62.83%	19.37%	6.10%	0.67%	0.30%	0.00%	6.32%	0.67%	0.00%
Big Bear Creek	0.26%	5.77%	6.36%	0.66%	0.30%	0.00%	26.28%	7.56%	0.89%	0.19%	40.01%	0.22%	8.42%	3.09%	0.00%
Black Springs Branch	0.32%	5.08%	0.97%	0.00%	0.78%	0.00%	46.04%	21.51%	6.64%	0.36%	4.15%	0.00%	13.95%	0.21%	0.00%
Calls Creek	0.98%	16.68%	9.24%	2.47%	0.42%	0.20%	25.47%	8.11%	1.20%	0.20%	25.38%	0.07%	8.28%	1.33%	0.00%
Cedar Creek - Barrow	0.79%	9.97%	19.78%	3.75%	0.40%	1.86%	23.25%	9.60%	0.70%	0.30%	22.31%	0.02%	5.46%	1.80%	0.00%
Cedar Creek - Jasper	0.67%	5.69%	1.39%	0.02%	2.73%	0.00%	42.44%	21.90%	7.09%	0.05%	6.09%	0.55%	6.41%	4.95%	0.00%
Copeland Creek	0.53%	1.81%	0.32%	0.00%	0.42%	0.00%	25.78%	48.97%	6.04%	0.67%	8.91%	0.28%	3.76%	2.52%	0.00%
Drowning Creek	0.25%	6.63%	13.68%	1.68%	0.55%	0.00%	27.85%	8.35%	0.45%	0.25%	31.96%	0.00%	6.41%	1.94%	0.00%
Kimbro Creek	0.00%	3.04%	0.23%	0.00%	0.00%	9.63%	14.34%	35.11%	1.96%	1.35%	4.30%	0.62%	27.05%	2.38%	0.00%
Milsap Creek	2.29%	9.20%	3.30%	0.67%	0.48%	0.00%	27.79%	17.96%	3.86%	0.32%	23.75%	0.10%	7.39%	2.89%	0.00%
Mulberry Creek	0.07%	10.30%	9.10%	0.59%	1.14%	0.00%	50.65%	5.45%	0.79%	0.56%	16.31%	0.00%	4.95%	0.08%	0.00%
Murder Creek	1.13%	5.23%	0.42%	0.09%	0.76%	0.81%	32.91%	20.06%	3.75%	0.30%	17.28%	0.20%	12.35%	4.70%	0.00%
Rocky Creek	0.09%	4.24%	4.81%	0.29%	0.20%	0.00%	34.30%	9.33%	0.66%	0.16%	38.88%	0.08%	5.02%	1.94%	0.00%
Rooty Creek	1.63%	7.04%	2.23%	0.87%	1.56%	0.00%	30.10%	4.04%	2.45%	0.14%	34.94%	0.43%	12.38%	2.18%	0.00%
Rose Creek	0.47%	2.39%	0.46%	0.10%	0.73%	0.04%	40.34%	9.64%	2.20%	0.15%	33.41%	0.20%	7.75%	2.07%	0.02%
Shoal Creek	0.89%	15.26%	4.40%	0.64%	0.78%	0.73%	33.40%	9.05%	1.41%	0.11%	22.34%	0.68%	6.93%	3.36%	0.00%

Table 5b. Land Use Percentages (Unimpaired Southeastern Plain)

NAME	Percent Total Land Use														
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial Industrial Transportation	Bare Rock Sand and Clay	Quarries, Strip Mines Gravel Pits	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Big Creek	0.24%	5.56%	0.92%	0.27%	0.00%	0.02%	12.89%	33.65%	7.79%	1.06%	10.67%	9.68%	10.02%	6.52%	0.69%
Big Sandy Creek	0.88%	2.62%	0.45%	0.18%	0.12%	3.27%	32.51%	20.33%	12.65%	1.24%	2.21%	1.68%	11.93%	9.01%	0.93%
Carter's Mill Creek	0.59%	1.77%	0.47%	0.00%	0.00%	0.00%	14.67%	40.18%	8.88%	3.33%	9.46%	4.70%	10.00%	5.47%	0.48%
Commissioner Creek	0.91%	3.94%	0.58%	0.06%	0.24%	0.69%	32.38%	20.03%	9.18%	0.76%	10.91%	3.36%	9.63%	6.99%	0.35%
Hunger and Hardship Creek	0.23%	13.46%	5.22%	2.96%	0.00%	0.09%	16.29%	13.64%	5.10%	0.36%	10.40%	16.21%	8.50%	6.88%	0.65%
Little Red Bluff Creek	0.21%	8.81%	3.39%	0.48%	0.00%	0.00%	20.05%	22.62%	7.08%	0.67%	8.29%	8.95%	15.66%	3.19%	0.62%
Little Rocky Creek	0.07%	7.35%	2.44%	0.99%	0.00%	0.11%	17.76%	16.37%	5.23%	0.19%	9.05%	22.16%	6.19%	11.75%	0.34%
Log Dam Creek	0.06%	2.04%	0.28%	0.00%	0.57%	0.00%	29.18%	47.36%	4.34%	0.23%	4.46%	0.58%	9.53%	1.37%	0.00%
Porter Creek	0.29%	0.91%	0.03%	0.04%	0.00%	1.71%	47.57%	20.84%	11.21%	1.67%	1.37%	0.61%	8.56%	4.76%	0.44%
Pughes Creek	0.29%	3.56%	0.22%	0.00%	0.00%	0.17%	11.63%	34.91%	7.26%	0.49%	12.58%	11.08%	9.38%	7.57%	0.86%
Sandy Hill Creek	0.12%	1.02%	0.16%	0.00%	0.00%	0.25%	24.04%	32.97%	10.43%	0.52%	14.68%	6.38%	5.19%	4.14%	0.10%
South Sandy Creek	0.16%	2.83%	0.14%	0.00%	0.00%	0.00%	35.46%	18.81%	11.93%	0.57%	7.36%	10.18%	6.61%	5.73%	0.21%

Table 5c. Land Use Percentages (Impaired Piedmont)

NAME	Percent Total Land Use														
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Briar Creek	0.80%	5.16%	1.03%	0.43%	5.14%	0.00%	31.83%	24.65%	2.20%	0.19%	13.21%	0.31%	10.36%	4.68%	0.00%
Carr Creek	1.60%	23.21%	19.97%	12.00%	0.00%	17.59%	10.53%	3.51%	0.00%	0.00%	5.66%	0.17%	3.78%	1.98%	0.00%
Crooked Creek	1.09%	2.83%	0.07%	0.00%	1.23%	0.00%	24.61%	6.79%	2.11%	0.32%	44.62%	1.09%	13.56%	1.69%	0.00%
Freeman Creek	0.28%	5.50%	0.66%	0.03%	0.57%	0.00%	27.96%	19.10%	2.49%	0.38%	28.87%	0.12%	11.63%	2.40%	0.00%
Hardeman Creek	2.38%	4.57%	2.87%	2.97%	0.00%	3.30%	37.14%	4.15%	1.20%	0.05%	26.40%	1.90%	10.42%	2.65%	0.00%
Little Creek	0.55%	1.21%	0.25%	0.06%	0.61%	0.00%	19.69%	57.53%	4.55%	0.09%	9.03%	0.14%	4.96%	1.32%	0.00%
Little Fishing Creek	0.09%	2.62%	0.05%	0.00%	0.29%	6.13%	33.71%	29.08%	4.17%	0.81%	6.31%	0.00%	16.22%	0.50%	0.00%
Marburg Creek	0.82%	5.85%	9.44%	1.41%	0.61%	3.99%	27.75%	12.83%	0.66%	0.28%	24.63%	0.00%	7.99%	3.75%	0.00%
Noketchee Creek	0.05%	12.89%	6.88%	0.57%	0.21%	0.22%	38.57%	10.89%	1.68%	0.05%	18.63%	0.00%	6.10%	3.28%	0.00%
Rooty Creek	1.52%	6.58%	2.05%	0.78%	1.47%	0.00%	31.06%	4.58%	2.65%	0.15%	33.89%	0.39%	12.80%	2.08%	0.00%
Sandy Run Creek	0.10%	3.11%	0.00%	0.00%	0.20%	0.00%	23.93%	47.95%	5.63%	1.58%	0.59%	0.00%	12.31%	4.60%	0.00%
Tobler Creek	0.28%	4.56%	0.24%	0.00%	2.10%	0.00%	36.01%	34.90%	6.57%	0.05%	2.42%	0.00%	9.59%	3.28%	0.00%
Zoie Brown Creek	0.32%	4.72%	0.07%	0.00%	0.00%	0.00%	30.50%	38.00%	6.45%	0.28%	4.06%	0.00%	8.85%	6.75%	0.03%

Table 5d. Land Use Percentages (Impaired Southeastern Plain)

NAME	Percent Total Land Use														
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial Industrial Transportation	Bare Rock Sand and Clay	Quarries Strip Mines Gravel Pits	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Shrubland	Pasture / Hay	Row Crops	Other Grasses (Urban Recreational)	Woody Wetland	Emergent Herbaceous Wetlands
Alligator Creek	0.00%	1.64%	0.11%	0.17%	0.17%	0.00%	57.13%	19.82%	8.04%	1.05%	1.08%	0.23%	5.79%	4.63%	0.14%
Cedar Creek	0.31%	1.51%	0.02%	0.01%	0.00%	0.01%	43.27%	24.76%	10.00%	1.03%	3.30%	3.45%	6.95%	5.00%	0.38%
Crooked Creek - Laurens	0.45%	10.95%	6.94%	1.13%	0.00%	0.00%	17.20%	18.56%	5.16%	0.70%	10.55%	13.23%	9.55%	4.84%	0.75%
Crooked Creek - Jones	0.36%	3.96%	0.44%	0.00%	0.03%	0.00%	33.09%	16.88%	7.86%	0.67%	11.23%	7.80%	12.36%	4.93%	0.40%
Cypress Creek	0.17%	3.96%	0.48%	0.01%	0.00%	0.01%	17.80%	32.74%	12.23%	0.33%	6.62%	6.27%	13.36%	5.33%	0.71%
Keg Creek	1.11%	3.19%	0.83%	0.47%	0.13%	1.76%	26.45%	22.80%	10.88%	1.66%	6.18%	3.04%	13.01%	7.91%	0.58%
Lamars Creek	0.17%	1.19%	0.16%	0.03%	0.12%	0.10%	27.92%	34.96%	9.83%	0.97%	5.10%	5.19%	8.16%	5.82%	0.28%
Limestone Creek - Montgomery	0.07%	10.35%	3.28%	0.84%	0.00%	0.05%	13.45%	30.21%	6.91%	0.49%	8.84%	7.68%	10.14%	6.78%	0.91%
Limestone Creek - Washington	2.67%	9.21%	4.06%	3.41%	0.00%	6.12%	23.62%	18.33%	9.10%	1.12%	5.82%	3.05%	10.63%	2.32%	0.54%
Little Commissioner Creek	0.51%	4.02%	1.08%	0.60%	0.00%	2.27%	32.45%	23.81%	9.86%	0.83%	4.76%	1.84%	9.72%	7.67%	0.58%
Lotts Creek	0.53%	2.55%	0.16%	0.00%	0.00%	0.00%	11.55%	54.99%	10.48%	0.72%	3.06%	1.31%	10.03%	4.33%	0.30%
Ochwalkee Creek - Laurens	0.08%	2.92%	0.08%	0.00%	0.00%	0.00%	10.45%	50.60%	8.73%	0.94%	4.64%	2.20%	10.90%	8.21%	0.24%
Ockwalkee Creek - Wheeler	0.37%	3.03%	0.09%	0.00%	0.00%	0.06%	8.15%	52.10%	9.17%	0.79%	4.00%	4.10%	10.07%	7.87%	0.21%
Peterson Creek	0.49%	7.12%	1.10%	0.24%	0.00%	0.00%	14.04%	38.16%	9.80%	0.42%	4.95%	4.63%	13.58%	4.96%	0.53%
Red Bluff Creek	0.22%	6.07%	1.34%	0.16%	0.00%	0.03%	16.92%	33.04%	9.14%	1.01%	6.65%	6.99%	12.19%	5.78%	0.47%
Reedy Creek	0.11%	4.49%	0.65%	0.10%	0.00%	0.03%	13.57%	33.25%	11.56%	0.76%	6.60%	9.09%	10.03%	9.57%	0.19%
Rocky Creek	0.58%	4.61%	1.44%	0.06%	0.00%	0.18%	15.29%	14.37%	3.23%	1.31%	12.84%	24.08%	9.79%	11.38%	0.84%
Sandy Creek	0.14%	3.81%	0.42%	0.67%	0.40%	0.00%	42.11%	13.93%	8.63%	1.77%	7.60%	2.26%	11.91%	6.00%	0.35%
Tiger Creek	4.05%	0.30%	0.00%	0.00%	0.81%	0.00%	30.95%	24.90%	6.69%	1.33%	6.74%	0.53%	20.48%	3.23%	0.00%

Table 6a. Soil Type Distribution (Unimpaired Piedmont)

Name	Drainage Area upstream from the monitoring point (sq mile)	Soil Type (acres)					
		GA041	GA032	GA031	GA030	GA026	GA025
K-Factor		**0.17**	**0.43**	**0.24**	**0.27**	**0.25**	**0.27**
Allen Creek	10.55					4140.9	2611.0
Apalachee River	248.71					65052.3	94122.9
Barber Creek	5.99					978.3	2853.4
Beaverdam Trib.	0.93		129.3			355.3	113.7
Big Bear Creek	4.40					1206.0	1607.2
Black Springs Branch	3.45	315.5		177.4		1273.3	441.9
Calls Creek	8.37					2815.0	2542.3
Cedar Creek	10.14					1293.8	5196.4
Cedar Creek	1.40				60.6	539.3	294.5
Copeland Creek	4.43		208.7		268.5	1519.7	841.2
Drowning Creek	3.76					710.8	1697.6
Kimbro Creek	3.39			622.5		17.2	1528.8
Milsap Creek	6.21	227.1			373.0	500.6	2874.2
Mulberry Creek	9.01					5618.5	149.6
Murder Creek	129.77					42946.4	40105.3
Rocky Creek	3.01					508.7	1414.9
Rooty Creek	7.62				64.6	507.2	4304.2
Rose Creek	15.79					5805.9	4300.5
Shoal Creek	13.48					4531.4	4097.5

Table 6b. Soil Type Distribution (Impaired Piedmont)

Name	Drainage Area upstream from the monitoring point (sq mile)	Soil Type (acres)					
		GA041	GA032	GA031	GA030	GA026	GA025
K-Factor		**0.17**	**0.43**	**0.24**	**0.27**	**0.25**	**0.27**
Briar Creek	5.19					905.4	2418.8
Carr Creek	1.02					140.8	511.7
Crooked Creek	3.74				127.2	579.3	1684.6
Freeman Creek	5.26					1723.4	1640.0
Hardeman Creek	2.08					76.5	1257.2
Little Creek	4.83			625.4	452.0	912.7	1101.1
Little Fishing Creek	7.69	808.2		756.6	302.5	2505.7	550.6
Marburg Creek	3.50					849.3	1388.2
Noketchee Creek	2.82					221.0	1583.9
Rooty Creek	8.47				461.2	565.6	4395.0
Sandy Run Creek	4.97	403.1		1602.6	399.4		773.5
Tobler Creek	3.06				168.8	1256.6	531.6
Zoie Brown Creek	5.93		725.9		5.1	1124.6	1938.2

Table 6c. Soil Type Distribution (Unimpaired Southeastern Plain)

Name	Drainage Area upstream from the monitoring point (sq mile)	Soil Types (acres)															
		GA057	GA056	GA055	GA051	GA050	GA049	GA047	GA046	GA041	GA040	GA039	GA038	GA032	GA030	GA026	GA025
K-Factor		**0.15**	**0.15**	**0.11**	**0.12**	**0.15**	**0.14**	**0.30**	**0.16**	**0.17**	**0.14**	**0.13**	**0.15**	**0.43**	**0.27**	**0.25**	**0.27**
Big Creek	36.66					15250.9	6244.1	923.1	574.7				471.9				
Big Sandy Creek	140.36		3328.1		5582.1			7308.2	7308.2	12153.5	8867.1	36055.0	9228.1				
Carter's Mill Creek	8.40		1195.2					2092.0	2092.0								
Commissioner Creek	96.33				4087.0					7863.5	6753.0	17223.1	1580.9		567.8	8996.7	6706.3
Hunger and Hardship Creek	16.65					10352.6			305.9								
Little Red Bluff Creek	10.38					2468.5	4174.4										
Little Rocky Creek	7.68					4912.3											
Log Dam Creek	4.08									738.8	1275.2		285.9			310.7	0.4
Porter Creek	30.09		6747.5		1040.7			2319.0	2319.0	4180.7		610.9	2041.4				
Pughes Creek	8.69																
Sand Hill Creek	6.88		968.1		23.5			1569.8	1569.8				270.7				
South Sandy Creek	25.48		1117.1		51.4	158.1		7410.3	7410.3				160.8				

Table 6d. Soil Type Distribution (Impaired Southeastern Plain)

Name	Drainage Area upstream from the monitoring point (sq mile)	Soil Types (acres)															
		GA057	GA056	GA055	GA051	GA050	GA049	GA047	GA046	GA041	GA040	GA039	GA038	GA032	GA030	GA026	GA025
K-Factor		**0.15**	**0.15**	**0.11**	**0.12**	**0.15**	**0.14**	**0.30**	**0.16**	**0.17**	**0.14**	**0.13**	**0.15**	**0.43**	**0.27**	**0.25**	**0.27**
Alligator Creek	9.22		2639.9					1348.5	1348.5			565.4					
Cedar Creek	26.42		4000.2			1076.3				7021.5				4812.6			
Crooked Creek - Laurens	6.09										1802.8	2097.0					
Crooked Creek - Jones	2.49					1595.6											
Cypress Creek	20.98	1050.0		82.7		2428.1	7692.7	2173.6									
Keg Creek	94.61		7959.2		4289.6		1013.8	17599.2	17599.2	3684.9	510.3	3847.2	4048.1				
Lamars Creek	20.71		4716.5			587.5	5.0			7750.9				197.0			
Limestone Creek - Montgomery	5.11	1419.6					1168.0	341.8	341.8								
Limestone Creek - Washington	7.33		541.0					2076.6	2076.6								
Little Commissioner Creek	43.88				2186.6					2447.7	10570.9	10011.6	2868.8				
Lotts Creek	5.35	865.1					2545.7						15.9				
Ochwalkee Creek - Laurens	11.48					2442.3	4902.9										
Ockwalkee Creek - Wheeler	61.19	4757.9				6998.5	23810.1	3379.3					216.1				
Peterson Creek	6.58	357.4			152.1		3293.1	204.5	204.5								
Red Bluff Creek	30.50					10000.6	7428.3	2088.5									
Reedy Creek	17.20					6184.8	4823.6										
Rocky Creek	62.71					37895.3	64.5	1086.2	1086.2								
Sandy Creek	5.13									447.7	1764.2	1069.8					
Tiger Creek	2.67									709.4	31.1	968.7					

2.0 WATER QUALITY ASSESSMENT

2.1 Fish Sampling

In 1998 and 1999, the Department of Natural Resources (DNR) Wildlife Resources Division (WRD) conducted studies of fish populations at a number of monitoring sites in the Oconee River Basin. 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 original listing of Biota Impacted stream segments on Georgia's 303(d) list. Stream segments with fish populations rated as Poor or Very Poor were listed as Biota Impacted. In each year between 1999 and 2003, the WRD conducted additional studies of fish populations in the Oconee River Basin, and additional stream segments were placed on the 303(d) list.

The work performed by the WRD looked at patterns of fish communities within the various ecoregions. 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 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.

Reference sites within the Piedmont and Southeastern Plains ecoregions were established. These sites represented the least impacted sites that exist given the prevalent land use within the ecoregion. Sixty-two (62) sites were sampled within the Oconee River Basin (see Tables 7, 8, and 9). These sites had to be accessible, wadeable, and representative of the stream under investigation. The length of the fish sampling site was thirty-five times the mean stream width, up to 500 meters. This sampling length was found to be long enough to include the major habitat types present. Electrofishing and seining techniques were used for sampling the fish population (GAWRD, 2000).

Two indices of fish community health were used to assess the biotic integrity of the aquatic systems: the modified Index of Well-Being (IWB) and the Index of Biotic Integrity (IBI). The IWB and IBI scores were classified as Excellent, Good, Fair, Poor, or Very Poor. Segments with fish populations rated as Poor or Very Poor were listed as Biota Impacted.

The modified IWB measures the health of the aquatic community based on the density and diversity or structural attributes of the fish community. The IWB is calculated based on four parameters: the relative density of fish, the relative biomass of fish, the Shannon-Wiener Index of Diversity based on number, and the Shannon-Wiener Index of Diversity based on biomass.

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. Each metric is scored by comparing its value to the value of the regional reference site. Factors that affect the structure and function of a fish community include stream location and size. Thus, the metrics were developed for regional drainage basins, e.g., the Atlantic Slope Drainage Basin, which includes the Ocmulgee, Oconee, Ogeechee, and Savannah River Basins. To account for the fact that streams with larger drainage basins normally have greater species richness, Maximum Species Richness plots were developed for the species richness metric (GAWRD, 2000).

To supplement the findings of the fish community data, habitat assessments were performed at each sampling site. Habitat scores evaluate the physical surroundings of a stream as they affect and influence the quality of the water resource and its resident aquatic community. These data may also help clarify the results of the biotic indices. The habitat assessment used was developed by personnel within the Watershed Protection Branch (WPB) of GA EPD and is a modification of the EPA Rapid Bioassessment Protocol III (GAWPB, 2000). It incorporates different assessment parameters for riffle / run prevalent streams. The habitat assessment evaluates the stream's physical parameters and is broken into three levels. Level one describes in-stream characteristics that directly affect biological communities (in-stream cover, epifaunal substrate, embeddedness, and riffle frequency). Level two describes the channel morphology (channel alteration, sediment deposition, and channel flow status). Level three describes the riparian zone surrounding the stream, which indirectly affects the type of habitat and food resources available in the stream (bank vegetation, bank stability, and riparian zone width). The total habitat scores obtained for each sampling station are compared to a site-specific control or regional reference site. The ratio between the station of interest and the reference site provides a percent comparability that can be used to classify the stream.

Table 7 summarizes WRD's fish community study scores. The IBI, IWB, and Habitat Assessment scores are listed and the watersheds are grouped by the unimpaired watersheds (Piedmont ecoregion, then Southeastern Plains ecoregion), followed by the impaired watersheds (Piedmont ecoregion, then Southeastern Plains ecoregion). In addition, the table includes the drainage areas upstream of the monitoring points and the county in which the monitoring points are located. Table 8 provides the detailed habitat assessment scores.

During the fish community studies, physical characteristics of the stream were measured at the monitoring sites. These characteristics included the number of pools, depth of the deepest pool, number of riffles, average stream depth, and average stream width. In addition, stream water quality measurements were taken at the time of the fish sampling. The parameters measured included water temperature, dissolved oxygen, conductivity, pH, turbidity, total hardness and alkalinity. Table 9 provides a summary of these field measurements.

Visual observations of the stream and watershed were also made by WRD personnel. The type of land use and the extent of land-disturbing activities and other pertinent features of the watershed were systematically observed from all available road accesses and were recorded. This information was used to determine the possible sources of eroded soils and other possible contaminants.

Table 7a. 1998-2003 WRD's Fish Community Study Scores (Piedmont)

Stream Name	Drainage Area upstream from the monitoring point (sq mile)	County	Date	IBI Score	IBI Category	IWB Score	IWB Category	Habitat Total
Allen Creek	11.8	Hall	08 / 27 / 2003		Good			88.9
Apalachee River	251.0	Morgan / Oconee	09 / 17 / 1999	56	Excellent	10.5	Excellent	131.0
Apalachee River	251.0	Morgan	10 / 05 / 2000	54	Excellent	10.3	Excellent	144.7
Apalachee River	251.0	Morgan	10 / 04 / 2001	52	Excellent	10.2	Excellent	116.1
Barber Creek	6.4	Barrow	05 / 05 / 2003	38	Fair	7.51	Good	108.9
Beaverdam Trib.	1.0	Hancock	07 / 20 / 1999	40	Fair	6.1	Fair	97.2
Big Bear Creek	4.7	Barrow	08 / 07 / 2003	42	Fair	7.4	Good	55.1
Black Springs Branch	3.7	Baldwin	07 / 20 / 1999	40	Fair	6.7	Fair	92.8
Calls Creek	8.7	Oconee	07 / 15 / 2003	34	Fair	7.45	Good	94.2
Cedar Creek		Barrow	08 / 14 / 2003	50	Good	8.97	Excellent	
Cedar Creek	1.5	Jasper	07 / 20 / 1999	34	Fair	6.2	Fair	81.3
Copeland Creek	4.8	Hancock	07 / 20 / 1999	42	Fair	7.6	Good	128.0
Copeland Creek	4.8	Hancock	07 / 20 / 1999	54	Excellent	8.5	Excellent	116.9
Copeland Creek	4.8	Hancock	09 / 19 / 2000	40	Fair	7.6	Good	130.9
Copeland Creek	4.8	Hancock	09 / 06 / 2001	46	Good	7.3	Good	107.0
Copeland Creek	4.8	Hancock	10 / 01 / 2002	42	Fair	7.55	Good	103.4
Drowning Creek	4.0	Gwinnett	06 / 10 / 2003	36	Fair	5.74	Fair	92.5
Kimbro Creek	3.5	Greene	05 / 28 / 2003	36	Fair	6.16	Fair	73.3
Log Dam Creek	4.3	Hancock	07 / 20 / 1999	38	Fair	6.0	Fair	108.6
Milsap Creek	6.4	Jones	07 / 02 / 1998	48	Good	8.0	Good	75.0
Mulberry Creek	9.2	Hall	08 / 27 / 2003	42	Fair	6.8	Fair	72.3
Murder Creek	130.7	Jasper	07 / 20 / 1999	48	Good	8.0	Fair	56.1
Rocky Creek	3.1	Barrow	06 / 10 / 2003	44	Good	8.55	Excellent	124.4
Rooty Creek	7.8	Putnam	07 / 02 / 1998	34	Fair	7.5	Good	52.0
Rose Creek	16.1	Oconee	07 / 30 / 2003	38	Fair	7.51	Fair	72.6
Shoal Creek	14.2	Clarke	07 / 30 / 2003	38	Fair	7.51	Good	79.6
Briar Creek	5.4	Morgan	05 / 28 / 2003	30	Poor	5.7	Poor	59.9
Crooked Creek	3.9	Putnam	04 / 21 / 1999	16	Very Poor	N / A	N / A	68.3
Freeman Creek	5.4	Oconee	07 / 30 / 2003	20	Very Poor	4.7	Very Poor	67.8
Hardeman Creek	2.2	Jackson	07 / 02 / 2001	18	Very Poor	5.4	Poor	62.8
Little Creek	5.0	Greene	06 / 06 / 2003	24	Very Poor	4.8	Very Poor	65.6
Little Fishing Creek	7.7	Baldwin	04 / 20 / 1999	22	Very Poor	4.9	Poor	60.3
Marburg Creek	3.6	Barrow	05 / 05 / 2003	20	Very Poor	5.2	Poor	61.7
Noketchee Creek	3.5	Clarke	05 / 05 / 2003	30	Poor	4.8	Very Poor	84.1
Rooty Creek	8.7	Putnam	07 / 02 / 1998	30	Poor	5.8	Fair	55.0
Sandy Run Creek	5.3	Hancock	04 / 19 / 1999	26	Poor	5.5	Poor	113.4
Tobler Creek	3.2	Baldwin	04 / 20 / 1999	32	Poor	6.4	Fair	61.4
Zoie Brown Creek	6.1	Hancock	04 / 20 / 1999	22	Very Poor	5.8	Fair	75.8

Table 7b . 1998-2003 WRD's Fish Community Study Scores (Southeastern Plains)

Stream Name	Drainage Area upstream from the monitoring point (sq mile)	County	Date	IBI Score	IBI Category	IWB Score	IWB Category	Habitat Total
Big Creek	38.6	Laurens	07 / 18 / 2000	40	Fair	6.5	Poor	109.2
Big Sandy Creek	20.7	Wilkinson	07 / 18 / 2000	46	Good	7.3	Fair	110.7
Carter's Mill Creek	8.9	Washington	07 / 20 / 1999	34	Fair	6.6	Fair	92.2
Commissioner Creek	29.1	Wilkinson	08 / 09 / 2000	36	Fair	7.3	Fair	109.1
Hunger and Hardship Creek	17.2	Laurens	04 / 12 / 2000	42	Fair	6.5	Fair	129.0
Little Red Bluff Creek	10.6	Truetlen	04 / 12 / 2000	40	Fair	7.9	Good	120.7
Little Rocky Creek	8.1	Laurens	04 / 11 / 2000	36	Fair	6.2	Fair	83.7
Porter Creek	30.4	Wilkinson	07 / 23 / 1999	38	Fair	6.8	Fair	113.7
Sandy Hill Creek	7.2	Washington	07 / 20 / 1999	36	Fair	7.8	Good	113.9
South Sandy Creek	26.0	Wilkinson	07 / 18 / 2000	46	Good	7.2	Fair	104.1
Alligator Creek	9.6	Twiggs	05 / 14 / 1999	22	Very Poor	2.6	Very Poor	53.3
Cedar Creek	27.1	Wilkinson	07 / 19 / 2000	32	Poor	6.8	Fair	107.1
Crooked Creek	6.2	Jones	05 / 14 / 1999	22	Very Poor	6.4	Fair	84.7
Crooked Creek	2.6	Laurens	04 / 11 / 2000	20	Very Poor	4.9	Very Poor	78.1
Cypress Creek	21.4	Montgomery	05 / 04 / 2000	22	Very Poor	5.5	Poor	100.7
Keg Creek	95.3	Washington	07 / 19 / 2000	28	Poor	6.1	Poor	124.6
Lamars Creek	21.2	Washington	07 / 19 / 2000	24	Very Poor	6.4	Fair	88.2
Limestone Creek	6.5	Washington	07 / 20 / 1999	12	Very Poor	5.1	Very Poor	99.4
Limestone Creek	7.6	Washington	09 / 15 / 1999	16	Very Poor	5.0	Very Poor	100.6
Limestone Creek	5.3	Montgomery	04 / 11 / 2000	30	Poor	6.0	Fair	135.8
Little Commissioner Creek	44.6	Wilkinson	08 / 03 / 1999	36	Fair	6.4	Poor	112.4
Lotts Creek	5.5	Wheeler	05 / 04 / 2000	0	No Fish	0.0	No Fish	74.2
Ochwalkee Creek	11.7	Laurens	04 / 11 / 2000	24	Very Poor	5.1	Very Poor	152.4
Ockwalkee Creek	73.6	Wheeler	07 / 12 / 2000	28	Poor	7.6	Fair	94.2
Peterson Creek	6.9	Wheeler	04 / 11 / 2000	28	Poor	3.5	Very Poor	122.2
Red Bluff Creek	41.6	Truetlen	07 / 13 / 2000	30	Poor	7.2	Fair	105.9
Reedy Creek	17.9	Laurens	04 / 12 / 2000	32	Poor	6.8	Fair	117.8
Rocky Creek	22.1	Laurens	07 / 13 / 2000	32	Poor	7.2	Fair	119.3
Sandy Creek	5.1	Jones	09 / 09 / 1998	26	Poor	7.2	Fair	74.7
Tiger Creek	2.8	Hancock	07 / 18 / 2000	30	Poor	6.6	Fair	88.3

Table 8a. 1998-2003 WRD's Habitat Assessment Scores (Piedmont)

Stream Name	Date	Embeddedness	Channel Alteration	Sediment Deposition	Riffle Frequency	Channel Flow Status	Bank Vegetation (Left)	Bank Vegetation (Right)	Bank Stability (Left)	Bank Stability (Right)	Riparian Zone (Left)	Riparian Zone (Right)	Instream Cover / Epifaunal	Velocity Depth	Habitat Total
Allen Creek	08 / 27 / 2003	7.7	13.8	6.9	9.0	11.1	2.7	1.9	2.4	2.3	1.4	3.1	12.1	14.4	88.9
Apalachee River	09 / 17 / 1999	13.0	17.8	9.2	19.5	7.5	5.0	6.5	6.3	7.5	6.0	8.2	12.3		131.0
Apalachee River	10 / 05 / 2000	12.3	16.8	12.3	19.0	12.4	6.1	6.3	7.1	7.3	5.3	8.8	17.0	13.6	144.7
Apalachee River	10 / 04 / 2001	12.3	15.9	10.1	0.0	11.0	5.9	5.9	6.3	5.8	7.1	8.2	15.2	12.5	116.1
Barber Creek	05 / 05 / 2003	11.4	16.7	9.2	16.0	12.6	2.3	1.3	2.1	1.1	4.9	6.0	13.9	11.5	108.9
Beaverdam Trib.	07 / 20 / 1999	9.4	16.7	7.3	8.0	8.1	4.5	4.1	5.9	5.5	8.3	8.3	5.5		97.2
Big Bear Creek	08 / 07 / 2003	2.2	13.1	3.7	0.0	9.5	2.3	2.3	2.7	3.0	0.7	0.5	5.6	9.7	55.1
Black Springs Branch	07 / 20 / 1999	4.7	14.2	3.9	10.3	8.8	3.9	4.4	3.3	3.6	8.3	8.3	9.5		92.8
Calls Creek	07 / 15 / 2003	7.4	14.2	7.0	14.0	12.0	2.9	2.3	3.0	2.6	4.2	6.5	8.3	9.7	94.2
Cedar Creek – Barrow	08 / 14 / 2003														
Cedar Creek – Jasper	07 / 20 / 1999	2.5	15.9	3.0	6.5	8.5	3.6	3.6	3.6	3.7	7.3	8.3	7.4		81.3
Copeland Creek	07 / 20 / 1999	16.7	10.7	12.0	15.0	12.7	6.3	5.7	5.3	5.0	9.0	4.3	12.7		128.0
Copeland Creek	07 / 20 / 1999	11.8	16.3	10.2	18.6	11.3	3.9	3.3	4.8	3.9	8.9	5.7	9.1		116.9
Copeland Creek	09 / 19 / 2000	14.2	16.3	14.2	18.0	7.9	6.2	5.8	6.1	6.2	8.8	7.8	8.0	11.4	130.9
Copeland Creek	09 / 06 / 2001	12.7	15.9	10.3	14.0	6.3	2.9	1.8	2.7	2.5	9.6	8.2	9.8	10.3	107.0
Copeland Creek	10 / 01 / 2002	9.3	17.3	7.5	13.5	7.4	2.3	1.7	3.6	3.3	9.4	9.2	9.2	9.8	103.4
Drowning Creek	06 / 10 / 2003	4.0	17.0	4.2	19.0	9.0	0.7	0.9	0.7	0.7	7.3	8.7	8.8	11.6	92.5
Kimbro Creek	05 / 28 / 2003	2.0	15.9	3.1	0.0	8.3	3.1	2.9	4.8	3.9	7.2	8.8	5.1	8.1	73.3
Log Dam Creek	07 / 20 / 1999	8.7	14	9.2	18	8.7	5.4	6	5.2	4.6	5.6	2.3	10.5		108.6
Milsap Creek	07 / 02 / 1998	5.0	6.0	6.0	4.7	9.3	3.3	2.7	2.0	1.7	9.0	9.0	8.2		75.0
Mulberry Creek	08 / 27 / 2003	3.5	13.9	3.0	13.5	7.3	2.4	2.0	2.4	1.9	0.9	4.9	6.7	9.8	72.3

Stream Name	Date	Embeddedness	Channel Alteration	Sediment Deposition	Riffle Frequency	Channel Flow Status	Bank Vegetation (Left)	Bank Vegetation (Right)	Bank Stability (Left)	Bank Stability (Right)	Riparian Zone (Left)	Riparian Zone (Right)	Instream Cover / Epifaunal	Velocity Depth	Habitat Total
Murder Creek	07 / 20 / 1999	1.2	15.3	4.7	0.0	6.1	2.6	2.0	1.9	1.5	8.7	3.4	4.4		56.1
Rocky Creek	06 / 10 / 2003	14.3	16.7	11.3	17.0	10.4	2.1	1.7	3.7	3.3	9.7	5.7	15.1	13.4	124.4
Rooty Creek	07 / 02 / 1998	2.7	4.7	4.3	2.7	8.3	4.3	5.0	2.7	2.7	1.3	2.0	5.7		52.0
Rose Creek	07 / 30 / 2003	1.7	16.2	1.6	0.0	8.6	2.5	1.9	2.3	2.1	9.7	9.7	5.2	11.1	72.6
Shoal Creek	07 / 30 / 2003	2.6	11.1	3.7	16.0	10.1	1.3	1.4	1.4	1.5	2.6	3.2	11.8	12.9	79.6
Briar Creek	05 / 28 / 2003	1.2	15.4	1.4	0.0	10.0	2.3	2.2	3.1	2.7	3.6	1.8	6.4	9.8	59.9
Crooked Creek	04 / 21 / 1999	0.7	14.2	1.3	0.0	11.5	5.9	5.6	5.3	5.2	4.9	9.0	2.4		68.3
Freeman Creek	07 / 30 / 2003	2.1	17.1	1.8	0.0	10.0	2.3	3.1	2.8	2.6	1.7	8.9	5.4	10.1	67.8
Hardeman Creek	07 / 02 / 2001	1.7	17.0	1.7	0.0	8.0	6.0	6.8	6.0	7.0	3.5	5.2	0.0	0.0	62.8
Little Creek	06 / 06 / 2003	1.8	13.1	3.9	0.0	11.0	2.0	4.8	2.2	3.3	0.3	6.7	8.5	8.0	65.6
Little Fishing Creek	04 / 20 / 1999	3.2	3.7	3.2	11.5	7.1	5.6	5.8	4.6	4.3	0.7	0.6	5.1		60.3
Marburg Creek	05 / 05 / 2003	2.2	10.5	1.8	0.0	9.1	3.7	2.8	3.3	2.1	7.7	3.7	5.4	9.3	61.7
Noketchee Creek	05 / 05 / 2003	1.6	16.4	0.7	14.5	8.0	2.5	2.7	2.1	2.8	9.1	8.2	7.3	8.2	84.1
Rooty Creek	07 / 02 / 1998	4.3	3.7	2.3	6.0	7.7	4.3	5.0	3.0	3.3	1.0	1.0	6.7		55.0
Sandy Run Creek	04 / 19 / 1999	10.6	16.0	9.4	18.0	9.6	3.8	3.8	4.0	4.2	8.7	8.7	8.4		113.4
Tobler Creek	04 / 20 / 1999	2.8	13.7	3.2	0.0	9.2	3.0	4.2	3.2	3.9	8.3	2.3	3.8		61.4
Zoie Brown Creek	04 / 20 / 1999	2.1	14.7	5.5	0.0	13.1	5.0	5.2	4.2	4.5	6.4	6.1	4.6		75.8

Table 8b. 1998-2003 WRD's Habitat Assessment Scores (Southeastern Plains)

Stream Name	Date	Embeddedness	Channel Alteration	Sediment Deposition	Riffle Frequency	Channel Flow Status	Bank Vegetation (Left)	Bank Vegetation (Right)	Bank Stability (Left)	Bank Stability (Right)	Riparian Zone (Left)	Riparian Zone (Right)	Instream Cover / Epifaunal	Velocity Depth	Habitat Total
Big Creek	07 / 18 / 2000	10.1	10.6	12.0	18.1	8.0	17.0	7.0	1.9	1.9	2.9	3.0	8.2	8.3	109.2
Big Sandy Creek	07 / 18 / 2000	12.2	9.9	11.5	16.7	7.7	18.0	8.9	4.6	3.6	5.1	4.9	6.9	1.3	110.7
Carter's Mill Creek	07 / 20 / 1999	5.4	8.5	4.2	9.9	7.4	17.0	11.3	3.4	4.1	2.4	2.7	6.8	9.0	92.2
Commissioner Creek	08 / 09 / 2000	12.3	10.9	10.7	15.5	7.8	15.0	8.6	3.0	2.8	3.9	4.4	8.1	6.1	109.1
Hunger and Hardship Creek	04 / 12 / 2000	8.7	9.6	9.4	16.3	10.0	19.0	15.0	5.8	5.6	6.0	5.3	9.8	8.5	129.0
Little Red Bluff Creek	04 / 12 / 2000	12.9	10.4	11.8	14.3	13.9	0.0	14.2	6.7	7.3	7.0	7.6	9.4	5.0	120.7
Little Rocky Creek	04 / 11 / 2000	4.0	5.7	0.8	16.4	2.3	16.0	7.3	3.2	3.5	2.8	3.7	8.7	8.8	83.7
Porter Creek	07 / 23 / 1999	10.1	8.4	4.8	19.0	9.3	18.0	8.4	4.0	3.7	5.0	4.8	9.0	9.0	113.7
Sand Hill Creek	07 / 20 / 1999	5.3	8.3	4.8	17.2	6.3	17.0	13.7	4.7	4.7	7.0	7.0	9.0	9.0	113.9
South Sandy Creek	07 / 18 / 2000	9.6	8.8	7.0	16.0	7.7	16.0	6.8	3.6	3.3	4.0	3.4	9.0	9.0	104.1
Alligator Creek	05 / 14 / 1999	1.7	0.0	0.0	16.0	0.3	0.0	5.3	4.5	4.3	3.7	3.5	5.0	9.0	53.3
Cedar Creek	07 / 19 / 2000	6.0	9.7	5.3	17.3	7.3	18.0	6.5	5.2	4.7	4.3	4.0	9.3	9.3	107.1
Crooked Creek – Jones	05 / 14 / 1999	4.3	0.0	0.0	18.0	7.0	0.0	15.7	6.7	6.5	7.5	7.1	5.0	7.0	84.7
Crooked Creek – Laurens	04 / 11 / 2000	3.8	4.1	1.0	16.7	4.1	16.0	7.3	5.0	5.0	3.1	3.1	4.7	4.3	78.1
Cypress Creek	05 / 04 / 2000	9.6	10.1	7.0	16.2	11.5	14.0	9.3	3.7	3.6	3.1	3.1	1.2	8.1	100.7
Keg Creek	07 / 19 / 2000	14.7	8.5	10.8	17.8	2.0	12.0	10.4	8.0	7.9	7.1	7.1	9.1	9.1	124.6
Lamars Creek	07 / 19 / 2000	4.8	7.7	1.3	16.0	6.3	15.0	3.8	3.8	4.0	3.3	3.3	9.3	9.3	88.2
Limestone Creek – Washington	07 / 20 / 1999	5.9	7.0	3.7	17.1	2.7	17.0	10.0	6.5	6.6	4.3	4.6	7.8	6.1	99.4
Limestone Creek – Montgomery	09 / 15 / 1999	8.5	7.0	6.3	16.6	4.3	15.0	13.7	4.9	4.9	4.0	3.6	7.2	4.7	100.6

Stream Name	Date	Embeddedness	Channel Alteration	Sediment Deposition	Riffle Frequency	Channel Flow Status	Bank Vegetation (Left)	Bank Vegetation (Right)	Bank Stability (Left)	Bank Stability (Right)	Riparian Zone (Left)	Riparian Zone (Right)	Instream Cover / Epifaunal	Velocity Depth	Habitat Total
Limestone Creek - Montgomery	04 / 11 / 2000	13.7	13.8	9.6	16.2	12.1	16.0	13.7	5.4	5.6	4.7	5.1	9.7	9.7	135.8
Little Commissioner Creek	08 / 03 / 1999	9.7	8.8	11.0	18.9	8.3	18.0	10.1	2.8	2.7	1.7	1.7	9.1	9.1	112.4
Lotts Creek	05 / 04 / 2000	6.8	5.1	2.2	16.0	4.0	4.0	6.4	5.3	4.2	5.2	4.0	9.7	1.3	74.2
Ochwalkee Creek – Laurens	04 / 11 / 2000	17.0	13.4	10.7	17.5	14.6	16.0	11.7	7.8	8.0	9.3	9.5	8.5	8.3	152.4
Ockwalkee Creek – Wheeler	07 / 12 / 2000	10.1	8.7	10.2	14.3	6.3	10.0	6.7	3.7	3.5	3.7	3.3	5.5	7.7	94.2
Peterson Creek	04 / 11 / 2000	9.3	9.6	10.3	16.7	7.8	18.0	16.7	3.2	3.5	3.8	4.0	9.9	9.5	122.2
Red Bluff Creek	07 / 13 / 2000	13.0	10.3	10.5	15.1	9.5	16.0	6.3	3.0	3.0	3.8	4.1	5.3	5.9	105.9
Reedy Creek	04 / 12 / 2000	9.1	10.9	3.4	17.5	10.8	19.0	9.5	5.1	5.6	5.1	5.5	9.3	6.9	117.8
Rocky Creek	07 / 13 / 2000	14.3	12.0	11.3	15.3	9.8	15.0	7.7	4.5	4.5	4.7	4.3	8.3	7.7	119.3
Sandy Creek	09 / 09 / 1998	12.0	0.0	0.0	11.0	0.7	0.0	16.3	7.0	7.0	8.0	8.0	2.3	2.3	74.7
Tiger Creek	07 / 18 / 2000	7.0	9.3	8.3	15.7	10.3	0.0	4.3	5.7	6.3	6.3	6.0	2.3	6.7	88.3

Table 9a. 1998-2003 WRD's Field Measurements (Piedmont)

Stream Name	Date	Average Stream Width (m)	Average Stream Depth (m)	Reach Length (m)	Number of Riffles	Number of Pools	Deep Pool (m)	Water Temp (deg C)	Dissolved Oxygen (mg / L)	Conductivity (uS)	pH (SU)	Turbidity (NTU)	Total Hardness (mg / L)	Alkalinity (mg / L)
Allen Creek	08 / 27 / 2003	7.27	0.34	254	2	14	1.25	22.2	8.02	84	7.25	6.65	34	30
Apalachee River	09 / 17 / 1999	24.00	0.40	1272	3	5	1.5	18.1	7.72	78.5	7.30	7.9	16	30
Apalachee River	10 / 05 / 2000	34.70	0.57	1839	3	13	2	18.1	9.14	68.1	7.50	8.62	20	30
Barber Creek	10 / 04 / 2001	34.10	0.64	1807	1	4	2	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Barber Creek	05 / 05 / 2003	5.11	0.20	179	5	6	0.70	21.5	7.57	57.8	7	25.5	19	40
Beaverdam Trib.	07 / 20 / 1999	1.8	0.09	63	1	0	0	9.9	10.78	48.7	7.18	5.08	24	30
Big Bear Creek	08 / 07 / 2003	5.21	0.16	182	2	1	0.52	22.5	8.92	48.4	7	5.29	14	15
Black Springs Branch	07 / 20 / 1999	3.8	0.11	133	4	0	0	15	9.2	45.5	7.26	4.78	13	25
Calls Creek	07 / 15 / 2003	6.87	0.26	238	4	5	0.80	22.6	8.43	56.7	7	13.2	16	20
Cedar Creek	08 / 14 / 2003													
Cedar Creek	07 / 20 / 1999	2.8	0.13	98	2	2	0.78	16.2	8.3	147.7	7.33	30	57	162
Copeland Creek	07 / 20 / 1999	3.9	0.13	136.5	6	6	0.71	20.3	8.33	95.1	7.55	5.69	N / A	N / A
Copeland Creek	07 / 20 / 1999	5	0.17	175	8	2	0.72	20.2	8.01	78.4	6.39	14.5	31	40
Copeland Creek	09 / 19 / 2000	3.9	0.14	137	7	1	0.75	16.9	7.7	142.6	7.25	5.39	51.3	55
Copeland Creek	09 / 06 / 2001	4.20	0.15	147	5	1	0.7	22.2	7.6	94.50	7.0	4.30	34	80
Copeland Creek	10 / 01 / 2002	3.77	0.13	133	--	--	--	20.7	6.58	104.6	7.5	5.3	32	60
Drowning Creek	06 / 10 / 2003	4.42	0.17	155	3	3	0.80	22.2	7.45	38.7	6.5	20.6	12	15
Kimbro Creek	05 / 28 / 2003	3.85	0.21	135	0	2	0.64	19.0	8.70	36.0	6.5	9.5	10	20
Log Dam Creek	07 / 20 / 1999	3.9	0.14	136.5	4	1	0.6	14.5	10.17	37.8	6.98	11.8	13	25
Milsap Creek	07 / 02 / 1998	38	0.2	1330	1	10	0.92	18.2	8.55	146	7.17	7.13	N / A	N / A
Mulberry Creek	08 / 27 / 2003	5.30	0.23	187	2	9	1.10	22.5	8.51	62.9	7.00	4.69	34	30

Stream Name	Date	Average Stream Width (m)	Average Stream Depth (m)	Reach Length (m)	Number of Riffles	Number of Pools	Deep Pool (m)	Water Temp (deg C)	Dissolved Oxygen (mg / L)	Conductivity (uS)	pH (SU)	Turbidity (NTU)	Total Hardness (mg / L)	Alkalinity (mg / L)
Murder Creek	07 / 20 / 1999	8.5	0.24	297.5	0	9	1.11	19.2	7.43	81	7.28	6.8	31	40
Rocky Creek	06 / 10 / 2003	5.95	0.22	208	6	4	0.85	21.2	9.01	44.8	7.00	10.4	15	15
Rooty Creek	07 / 02 / 1998	2.9	9.7	101.5	3	2	0.4	22.9	6.79	162.4	7.17	7.06	N / A	N / A
Rose Creek	07 / 30 / 2003	9.62	0.20	336	2	5	0.81	22.3	7.70	64.3	7.00	8.45	20	30
Shoal Creek	07 / 30 / 2003	6.83	0.36	238	4	24	1.63	22.6	7.45	72.2	7.00	9.81	22	30
Briar Creek	05 / 28 / 2003	5.00	0.12	175	1	2	0.72	18.7	7.47	116.4	7.50	28.10	30	65
Crooked Creek	04 / 21 / 1999	4.00	0.10	140	1	0	0	14.1	6.24	12.3	7.20	12.40	45	117
Freeman Creek	07 / 30 / 2003	4.50	0.22	158	1	3	0.69	21.8	7.95	51.7	6.50	4.54	16	10
Hardeman Creek	07 / 02 / 2001	2.20	0.08	77	0	0	0	24.2	7.45	55.2	7.00	27.10	17	60
Little Creek	06 / 06 / 2003	3.60	0.29	126	0	5	0.86	18.6	7.30	101.9	7.20	8.80	35	40
Little Fishing Creek	04 / 20 / 1999	4.90	5.40	172	2	0	0.00	12.8	8.98	73.9	7.05	3.86	30	45
Marburg Creek	05 / 05 / 2003	2.50	0.29	89	0	3	0.70	18.6	7.50	47.1	6.50	15.30	15	30
Noketchee Creek	05 / 05 / 2003	4.50	0.13	158	1	1	0.51	17.3	9.34	32.2	6.50	7.20	10	15
Rooty Creek	07 / 02 / 1998	4.50	6.50	158	2	2	0.35	23.8	7.25	284.7	7.13	7.88	N / A	N / A
Sandy Run Creek	04 / 19 / 1999	3.20	0.10	112	5	2	0.58	18.3	8.8	112.80	7.25	5.21	55	65
Tobler Creek	04 / 20 / 1999	2.70	0.10	95	0	1	7.00	14.8	8.5	75.80	7.03	8.97	35	45
Zoie Brown Creek	04 / 20 / 1999	4.20	0.40	147	0	1	0.98	13.5	7.4	73.80	7.0	23.30	35	55

Table 9b. 1998-2003 WRD's Field Measurements (Southeastern Plains)

Stream Name	Date	Average Stream Width (m)	Average Stream Depth (m)	Reach Length (m)	Number of Riffles	Number of Pools	Deep Pool (m)	Water Temp (deg C)	Dissolved Oxygen (mg / L)	Conductivity (uS)	pH (SU)	Turbidity (NTU)	Total Hardness (mg / L)	Alkalinity (mg / L)
Big Creek	07 / 18 / 2000	5.63	0.50	196	5	8	1.55	25.5	4.95	95.0	7.00	11.2	35	40
Big Sandy Creek	07 / 18 / 2000	7.89	0.43	277	6	17	1.43	24.6	7.49	477.3	7.00	4.01	62	51
Carter's Mill Creek	07 / 20 / 1999	3.78	0.28	133	--	5	1.10	24.3	6.68	50.3	6.79	16.1	22	20
Commissioner Creek	08 / 09 / 2000	8.15	0.54	284	4	10	1.53	23.6	5.48	37.9	6.00	7.04	15	10
Hunger and Hardship Creek	04 / 12 / 2000	4.80	0.30	168	9	6	1.45	16.1	5.73	61.8	7.00	8.24	28	30
Little Red Bluff Creek	04 / 12 / 2000	5.90	0.72	207	0	4	2.00	19.0	5.66	53.7	6.50	7.51	25	20
Little Rocky Creek	04 / 11 / 2000	4.90	0.14	172	6	1	0.58	N / A	N / A	N / A	6.50	8.04	32	25
Porter Creek	07 / 23 / 1999	5.42	0.54	189	--	6	1.40	24.9	4.16	100.4	6.85	7.87	50	55
Sand Hill Creek	07 / 20 / 1999	4.80	0.26	168	--	9	1.10	25.6	6.62	90.0	7.10	15.5	51	40
South Sandy Creek	07 / 18 / 2000	4.08	0.27	144	5	11	1.10	24.4	6.15	82.6	7.00	10.9	33	40
Alligator Creek	05 / 14 / 1999	3.24	0.04	95	--	0	0.00	19.1	7.54	89.6	6.86	9.69	66	75
Cedar Creek	07 / 19 / 2000	2.72	0.25	95	4	3	0.67	24.3	6.17	152.1	7.50	6.3	103	68
Crooked Creek	05 / 14 / 1999	3.76	0.20	133	--	3	0.56	19.8	7.58	40.5	6.95	20.4	17	25
Crooked Creek	04 / 11 / 2000	2.50	0.19	88	6	1	0.50	N / A	N / A	N / A	6.25	26.4	20	25
Cypress Creek	05 / 04 / 2000	5.60	0.76	196	3	6	1.20	19.8	4.08	34.9	5.75	8.6	11	10
Keg Creek	07 / 19 / 2000	7.37	0.54	259	7	7	1.40	26.5	5.13	1620	5.50	13.7	85.5	5
Lamars Creek	07 / 19 / 2000	2.40	0.13	84	4	1	0.50	23.7	6.85	117.4	7.50	19.1	68.4	60
Limestone Creek	07 / 20 / 1999	3.25	0.19	116	--	5	0.75	24.5	6.36	281.8	7.04	17.9	119.7	120
Limestone Creek	09 / 15 / 1999	4.42	0.31	154	--	8	1.10	24.4	8.18	1575	4.01	38.3	102.6	5
Limestone Creek	04 / 11 / 2000	3.10	0.32	109	3	9	1.02	15.6	7.54	77.1	7.00	8.04	51	40

Stream Name	Date	Average Stream Width (m)	Average Stream Depth (m)	Reach Length (m)	Number of Riffles	Number of Pools	Deep Pool (m)	Water Temp (deg C)	Dissolved Oxygen (mg / L)	Conductivity (uS)	pH (SU)	Turbidity (NTU)	Total Hardness (mg / L)	Alkalinity (mg / L)
Little Commissioner Creek	08 / 03 / 1999	5.21	0.66	182	0	10	1.50	25.6	6.31	506	6.46	7.49	47	20
Lotts Creek	05 / 04 / 2000	2.70	0.25	95	2	1	0.65	18.4	2.85	31.7	5.80	6.81	9	5
Ochwalkee Creek	04 / 11 / 2000	5.40	0.38	189	3	10	1.78	15.3	7.82	23.3	5.75	8.56	13	10
Ockwalkee Creek	07 / 12 / 2000	5.02	0.60	175	3	5	2.00	27.0	2.13	52.1	6.00	8.33	13	15
Peterson Creek	04 / 11 / 2000	3.00	0.32	105	3	5	1.03	17.4	6.67	67.0	6.50	13.2	26	30
Red Bluff Creek	07 / 13 / 2000	5.02	0.61	175	5	4	1.32	23.7	2.08	74.6	6.5	4.18	25	20
Reedy Creek	04 / 12 / 2000	5.40	0.41	189	10	10	1.02	16.1	6.83	30.9	6.25	11.2	15	15
Rocky Creek	07 / 13 / 2000	5.51	0.35	193	3	3	0.95	24.9	6.36	111.6	7.00	31.3	58	40
Sandy Creek	09 / 09 / 1998	2.68	0.39	95	--	1	0.59	25.5	5.54	46.6	6.53	25.6	N / A	N / A
Tiger Creek	07 / 18 / 2000	1.60	0.08	56	1	1	0.68	24.8	4.89	66.6	6.5	8.04	23	30

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.

3.1 Point Source Assessment

For purposes of this TMDL, NPDES permitted facilities will be considered point sources. Discharges from municipal and industrial NPDES permitted facilities may contribute sediment to receiving waters as TSS and / or turbidity. There are nineteen permitted NPDES discharges identified in the Oconee River Basin watersheds upstream from the listed segments. Table 10 provides the permitted flow, TSS concentrations, and/or turbidity levels for the NPDES permittees located in the impaired Oconee River Basin watersheds. These include municipal facilities and mining sites where material is processed and that discharge process wastewater. The average levels (whether daily, weekly, or monthly) and the highest daily maximum levels discharged over the last three years (2003-2005) are also given. These data were determined from analysis of the available Discharge Monitoring Reports (DMR).

Table 11 provides the current permitted discharges from surface mine locations that have no numeric limits. Surface mine locations are constantly changing. These discharges consist of accumulated surface water, pit-pumpout water, groundwater, and stormwater runoff associated with mining activities authorized under approved Mined Land Use Plans. These discharges shall not violate the Water Quality Standards in the receiving streams and shall not discharge floating solids or visible foam in other than trace amounts.

Table 10. NPDES Permit Limits for Facilities in the Impaired Watersheds of the Oconee River Basin

FACILITY	NPDES PERMIT NO	FACILITY TYPE	RECEIVING WATER	FLOW (MGD)		TSS (mg / L)	
				Monthly Average	Weekly Average	Monthly Average	Weekly Average
Eatonton Eastside WPCP	GA0032271	Municipal	Rooty Creek tributary	1.20	1.50	15	23
				0.95	1.96	5.9	40.0
Glenwood WPCP	GA0021377	Municipal	Peterson Creek	1.40	1.80	90	120
				0.49	1.26	40.1	166.0
Gordon WPCP	GA0020397	Municipal	Little Commissioner Creek	2.20	2.75	30	45
				1.18	2.63	6.3	27.0
Hanson Aggregates SE	GA0046132	Industrial	North Oconee River	NA	NA	55.0	110.0
				0.16	0.40	12.5	84.0
Martin Marietta Aggregates	GA0002330	Industrial	Slash Creek	NA	NA	55.0	110.0
				1.07	7.94	15.0	56.0
Mount Vernon WPCP	GA0033758	Municipal	Limestone Creek	1.50	1.88	30	45
				0.98	1.99	25.0	89.0
Sandersville WPCP	GA0032051	Municipal	Tanyard Creek tributary	3.00	3.75	30	45
				2.65	6.72	11.2	60.0
				FLOW (MGD)		TURB (NTU)	
				Daily Average	Daily Max	Daily Average	Daily Max
Engelhard Corp. - outfall 004	GA0003131	Industrial	Little Commissioner Creek	NA	NA	50.0	100.0
				3.24	11.33	4.6	21.0
Engelhard Corp. - outfall 005	GA0003131	Industrial	Little Commissioner Creek	NA	NA	50.0	100.0
				4.61	19.30	26.9	46.0

FACILITY	NPDES PERMIT NO	FACILITY TYPE	RECEIVING WATER	FLOW (MGD)		TURB (NTU)	
				Daily Average	Daily Max	Daily Average	Daily Max
Engelhard Corp. - outfall 001	GA0003271	Industrial	Little Commissioner Creek	NA	NA	50.0	100.0
				7.48	20.10	10.5	21.0
Engelhard Corp. - outfall 002	GA0003271	Industrial	Gordon Branch (Little Commissioner trib)	NA	NA	50.0	100.0
				0.06	0.06	18.5	49.0
IMERYS Clays Inc. – outfall 001	GA0002135	Industrial	unnamed trib to Keg Creek	NA	NA	50.0	100.0
				4.55	14.50	22.8	108
IMERYS Clays Inc. – outfall 002	GA0002135	Industrial	unnamed trib to Keg Creek	NA	NA	50	100
				11.18	23.00	26.7	69.0
IMERYS Clays Inc. – outfall 002	GA0002780	Industrial	Panther Run Creek	NA	NA	50.0	100.0
				0.88	3.80	13.1	72.0
IMERYS Clays Inc.	GA0046329	Industrial	Unnamed tributary to Limestone Creek	NA	NA	50.0	110.0
				0.45	0.50	19.1	48.0
IMERYS Clays Inc.	GA0047309	Industrial	Tributary to Limestone Creek	NA	NA	55.0	100.0
				14.86	23.00	17.3	56.0
Kentucky-Tennessee Clay Co.	GA0003387	Industrial	Limestone Creek tributary	NA	NA	50.0	100.0
				NA	NA	NA	NA
Thiele Kaolin - outfall 001	GA0002453	Industrial	Limestone Creek	NA	NA	50.0	100.0
				4.89	9.51	13.1	41.8
Thiele Kaolin - outfall 002	GA0002453	Industrial	Limestone Creek	NA	NA	50.0	100.0
				5.72	15.57	7.1	36.9

Permit Limits
Actual data from monthly DMR

Table 11. Surface Mine Discharges in the Impaired Watersheds of the Oconee River Basin

FACILITY	NPDES PERMIT NO.	OUTFALL NO.	RECEIVING WATER	LOCATION	PERMIT REQUIREMENTS
Engelhard Kaolin	GA0046621	G-52 M-37	Tributary to Keg Creek Little Commissioner Creek	Wilkinson Wilkinson	Shall not violate the Water Quality in the receiving streams. Shall not discharge floating solids or visible foam in other than trace amounts.
Imerys	GA0002135	003	Unnamed tributary to Keg Creek	Deepstep	Shall not violate the Water Quality in the receiving streams. Shall not discharge floating solids or visible foam in other than trace amounts.
Imerys	GA0046159	001	Tributary to Robinson Creek	Sandersville	Shall not violate the Water Quality in the receiving streams. Shall not discharge floating solids or visible foam in other than trace amounts.
Imerys Clay	GA0045934	B-36	Tributary to Commissioner Creek	Franklin	Shall not violate the Water Quality in the receiving streams. Shall not discharge floating solids or visible foam in other than trace amounts.
Thiele Kaolin	GA0002453	Dukes Mine	Lamars Creek	Sandersville	Shall not violate the Water Quality in the receiving streams. Shall not discharge floating solids or visible foam in other than trace amounts.

Some storm water runoff is covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe limits, storm water NPDES permits establish controls. Currently, regulated storm water discharges include those associated with industrial activities, including construction sites one acre or greater, and large and medium municipal separate storm sewer systems (MS4s).

Storm water discharges associated with industrial activities are currently covered under Georgia's General Storm Water NPDES Permit (GAR000000). This permit requires visual monitoring of storm water discharges, site inspections, implementation of Best Management Practices (BMPs), and record keeping. Table 12 provides a list of those facilities in the Oconee River Basin that have submitted a Notice of Intent to be covered under Georgia's General Storm Water NPDES Permit Associated with Industrial Activities (143 in total). It is unknown at this time whether these facilities are contributing sediment to the watershed.

Table 12. Industrial Facilities with a General Storm Water NPDES Permit in the Oconee River Basin

Facility Name	NOI No.	County
ABB Power T & D Company	00472	Clarke
American Freightways - Athens	03523	Clarke
Amtico International, Incorporated	03803	Morgan
APAC SRB - Macon Facility	02837	Jones
Athens Ready Mix	00310	Clarke
Athens Transit System	01313	Clarke
Athens Vehicle Maintenance Facility	02402	Clarke
Avant Salvage Company, Inc.	01646	Washington
Averitt Express, Inc.	01774	Jackson
B - H Transfer Company	01164	Washington
B & W Waste, Inc.	02668	Morgan
Baldwin County Airport	03517	Baldwin
Bassett Furniture Ind. of N.C.	00138	Laurens
Bristolpipe Corp	04161	Greene
Burgess Pigment Company	00113	Washington
C. W. Matthews - Plant #15	01129	Barrow
Carbo Ceramics, Inc.	03528	Wilkinson
Carolina Freight Carriers Corporation	01541	Clarke
Cochran Solid Waste Landfill	01012	Bleckley
Commerce Ready Mix	00305	Jackson
Concord Fabrics	00970	Baldwin
Consolidated Freightways, Inc.	00890	Clarke
Corbett Plywood Corporation	00248	Washington
CSR Polypipe	03496	Washington
Del Mar Window Coverings	00995	Clarke
Engelhard Corporation - Edgar Plant	03434	Wilkinson
Engelhard Corporation - Toddville / Daveyville	03433	Wilkinson
Evans Adhesive Corporation	03017	Washington
Flambeau Southeast	01691	Morgan
Formtech Enterprises, Inc.	01426	Clarke
Forstmann & Company, Inc.	01152	Baldwin
Fowler Flemister Concrete, Inc.	00024	Baldwin
Fowler Products Company, LLC	03755	Clarke
Garrett Paving Contractor, Inc.	00075	Barrow
Georgia - Pacific Corporation	03053	Morgan
Gold Kist Feed Mill	00847	Jackson

Facility Name	NOI No.	County
Gold Kist Processing Plant	00843	Clarke
Gold Kist Truck Shop	00844	Clarke
Griffin - Porter Lumber Company	00198	Bleckley
Gro Tec, Inc.	01695	Putnam
H & H Sand, Inc.- Garrett Mine	02739	Jackson
Haynes Auto Parts	03506	Jackson
Hep Enterprises, Inc. - South Apple Valley Mine	02743	Jackson
Hogan Lumber Company	01862	Clarke
Holox, Inc.	03221	Jackson
Horton Components	03888	Putnam
Horton Industries, Inc.	03650	Putnam
Horton Ironworks	03889	Putnam
Horton Vans	03890	Putnam
Industrial Moulding Corporation	02348	Jackson
ITT Rayonier - Sandersville Log Sorting Yard	02384	Washington
ITT Rayonier - Wrightsville Log Sorting Yard	02387	Johnson
Ivex Packaging Corporation, Inc.	04007	Morgan
J.M. Huber	01773	Jackson
J.M. Huber Corporation	03554	Jackson
Kentucky - Tennessee Clay Company	01934	Washington
Kinder Morgan Energy Partners	03891	Clarke
Kings Delight #5	03884	Jackson
Knox - Rivers Construction - Ruby Asphalt Plant	00773	Jones
Louis Dreyfus Energy Corporation	02451	Clarke
Louisiana Pacific Corporation	01777	Jackson
Louisiana Pacific Corporation - Nicholson Logyd	01295	Jackson
M. D. Hammock Oil Company, Inc.	01936	Washington
Macon Wire Company	03624	Jones
Madison County Landfill	02824	Madison
Martin Marietta Aggregates - Ruby Quarry	01907	Jones
Mason Pallet Company	01885	Wilkinson
McLane Southeast	03872	Clarke
Milledgeville Auto Salvage	02253	Baldwin
Mission Foods	03662	Jackson
Mm Systems	03851	Jackson
Mohawk - Milledgeville	4109	Baldwin
Montrose Timber And Leasing Company	01757	Laurens
Mount Vernon Mills - Commerce Plant	02168	Jackson
Murfin South	01008	Clarke
New Holland North America, Inc.	02806	Laurens
Northeast Georgia Regional Aviation	01508	Barrow
Oak Grove Landfill	02660	Barrow
Peacock's Auto Salvage	03770	Jones
Peeler Jersey Farms, Inc.	00250	Clarke
Perkins Brothers Auto Wrecking & Salvage	02595	Jones
Pioneer International (GA), Inc.	03344	Greene
Prentiss, Inc.	01707	Washington
Putnam Group, LLC	03887	Putnam
Quicksand Mine	02769	Barrow
Rail Fleet Services Of Georgia	01257	Wilkinson
Rail Fleet Services Of Georgia	01258	Wilkinson
Reeves Construction Company	01969	Jones
Reeves Construction Company	02659	Montgomery
Reeves Construction Company	02995	Wheeler

Facility Name	NOI No.	County
Roadway Express, Inc.	01286	Clarke
Rogers Cartage Company	02031	Barrow
Roper Pump Company	03532	Jackson
RPS, Inc. - Athens	03486	Clarke
Sandersville Railroad Company	01792	Washington
SCT Yarns, Inc. - Barlow Plant	00913	Jackson
Shaw Industries, Inc. Plant 88	03445	Baldwin
Shepherd Construction Company, Inc.	04005	Washington
Shiloh Industries Jefferson Blanking Division	03992	Jackson
Smith Setzer & Sons Of GA, Inc.	03601	Oconee
Sonoco Poly-Fiber Unit	03847	Greene
Southwire Company	03956	Oconee
Sparta Woodyard	02583	Hancock
Spartech Plastics - Greensboro	03612	Greene
Springs Industries, Inc. - Gordon Plant	02541	Wilkinson
Standridge Color Corporation	03590	Greene
Stepan Company	01617	Barrow
Tenneco Packaging	02556	Putnam
Tharpe Mine	02603	Twiggs
The Concrete Company - Hitchcock	03351	Jones
The William Carter Company	01711	Washington
Thomas Alloy	03742	Baldwin
Thomas Concrete	03605	Clarke
Thomas Concrete Of Georgia, Inc. (Jefferson)	03482	Jackson
Transus, Inc.	00544	Clarke
Transus, Inc. - Vidalia Terminal	01622	Montgomery
Treutlen - Wheeler County MSWLF	02469	Wheeler
Truetlen County Airport	01743	Treutlen
Trus Joist A Weyerhaeuser Business	02161	Madison
U.S. Chips, Inc. - Oconee Wood Yard	01625	Washington
UGA Vehicle, Transportation, & Maintenance	00644	Clarke
Union Camp - Higgston Landfill	00635	Montgomery
United Parcel Service, Inc. - Athens Center	00761	Clarke
Vigoro Industries, Inc.	00213	Clarke
W. H. "Bud" Barron Airport	03504	Laurens
Wayne Farms LLC	03005	Jackson
Wellington Leisure Products - Flotation Div.	01719	Morgan
Wellington Leisure Products - Madison Main Plant	01720	Morgan
Wellington Leisure Products - Water Sports Distrib	01725	Morgan
Wellington Leisure Products, Inc.	01721	Greene
Wellington Leisure Products, Inc.	01722	Putnam
Wilco Wood Works, Inc.	00868	Wilkinson
Wilkinson Kaolin - Owens Mine	02379	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Hardie Mine	03142	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Hardie Mine	03143	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Mine 108	03102	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Plant Site	03140	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Plant Site	03392	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Sims Mine	02744	Wilkinson
Wilkinson Kaolin Associates, Ltd. - Williams Mine	03141	Wilkinson
Winder Ready Mix	00304	Barrow
Woody Lumber Company	00358	Wilkinson
Yellow Freight System, Inc.	01763	Clarke

The MS4 permits have been issued under two phases. Phase I MS4 permits require the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990). A site-specific Storm Water Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. There are two Phase I MS4s in the Oconee River Basin (Table 13).

Table 13. Phase I Permitted MS4s in the Oconee River Basin

Name	Permit No.	Watershed
Dacula	GAS000139	Oconee, Ocmulgee
Gwinnett County	GAS000118	Oconee, Ocmulgee, Chattahoochee

Source: Nonpoint Source Permitting Program, GA DNR, 2006

As of March 10, 2003, small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty counties and 56 communities are permitted under the Phase II regulations in Georgia. There are twelve counties or communities located in the Oconee River Basin that are covered by the Phase II General Storm Water Permit (Table 14).

Table 14. Phase II Permitted MS4s in the Oconee River Basin

Name	Permit No.	Watershed
Athens-Clarke County	GAG610000	Oconee, Savannah
Auburn	GAG610000	Oconee
Barrow County	GAG610000	Oconee
Bogart	GAG610000	Oconee
Flowery Branch	GAG610000	Oconee, Chattahoochee
Gainesville	GAG610000	Oconee, Chattahoochee
Hall County	GAG610000	Oconee, Chattahoochee
Oakwood	GAG610000	Oconee, Chattahoochee
Oconee County	GAG610000	Oconee
Watkinsville	GAG610000	Oconee
Winterville	GAG610000	Oconee, Savannah

Source: Nonpoint Source Permitting Program, GA DNR, 2006

Those watersheds that occur within Phase I or Phase II MS4 areas as are listed in Table 15. The table provides the total area of each of these watersheds, and the percentage of the watershed that is an MS4 area.

Table 15. Percentage of Watersheds Occurring in MS4 Areas

Name	Total Area (acres)	% in MS4 area
Carr Creek	652.5	100.0
Noketchee Creek	1,804.9	66.8

Soil erosion from construction sites is also a major source of sediment in Georgia's streams. Georgia requires construction sites over one acre to have a General Storm Water NPDES permit. Since construction sites are regulated by NPDES permits, they will be considered as point sources. It is unknown if there are any construction sites in impaired watersheds of the Oconee River Basin.

3.2 Nonpoint Source Assessment

Eroded soils from forests, cropland, mining sites, and other land can be transported to Georgia streams through runoff. Excessive sediment that reaches the water bodies can cause several changes to the stream. It can make the streams shallower and wider, affecting the stream's temperature, dissolved oxygen, flow rate and velocity. It can affect the ability of the stream to assimilate pollutants. It can change the diversity of fish populations and other biological communities. 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, and 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 16 lists the percent timberland and percent harvested per year by county.

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.

Table 16. Percent Timberland and Percent Harvested per Year by County

County	Total Area (1000 acres)	Timberland (1000 acres)	Percent Timberland	Growing Stock Volume [a] (million ft^3)	Annual Volume Removal (million ft^3)	Annual percent Removal
Baldwin	165.4	118.9	71.89%	147.7	9.2	6.23%
Barrow	103.8	45.3	43.64%	73.5	4.1	5.58%
Bleckley	139.1	78.6	56.51%	139.3	2.4	1.72%
Clarke	77.3	34.9	45.15%	76.5	0.9	1.18%
Dodge	320.4	204.7	63.89%	205.2	16.8	8.19%
Greene	248.6	197.7	79.53%	297.1	26.2	8.82%
Gwinnett	277.0	104.4	37.69%	227.6	13.3	5.84%
Hall	251.9	133.9	53.16%	240.7	1.3	0.54%
Hancock	302.9	274.8	90.72%	340.6	24.7	7.25%
Jackson	219.1	126.8	57.87%	161.8	8.0	4.94%
Jasper	237.1	190.7	80.43%	304.3	9.4	3.09%
Johnson	194.8	138.8	71.25%	157.6	6.7	4.25%
Jones	252.0	210.7	83.61%	309.8	17.0	5.49%
Laurens	520.1	312.2	60.03%	332.0	18.0	5.42%
Madison	182.0	112.4	61.76%	178.7	1.9	1.06%
Montgomery	157.0	113.4	72.23%	93.4	7.4	7.92%
Morgan	223.8	138.6	61.93%	184.4	14.8	8.03%
Newton	176.9	98.7	55.79%	240.5	7.7	3.20%
Oconee	118.9	62.0	52.14%	103.0	4.4	4.27%
Oglethorpe	282.3	255.8	90.61%	309.9	23.0	7.42%
Putnam	220.5	174.5	79.14%	240.3	10.5	4.37%
Treutlen	128.5	103.4	80.47%	108.3	5.1	4.71%
Twiggs	230.6	188.5	81.74%	214.8	20.3	9.45%
Walton	210.7	114.7	54.44%	250.4	2.7	1.08%
Washington	435.5	315.4	72.42%	415.8	19.6	4.71%
Wheeler	190.5	15.4	8.08%	159.2	7.1	4.46%
Wilkinson	285.8	254.4	89.01%	328.6	13.5	4.11%

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

With the 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 per year in 1982 to 1.9 billion tons per year in 1997 (USDA-NRCS, 1997). This suggests that the source of sediment in many of the impaired streams in the Oconee 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 pastureland can leave areas of ground with little or no vegetative cover. During a rainfall runoff event, 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 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 confined periodically. 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, 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.

3.2.5 Roads

Erosion from unpaved roadways can be a significant source of sediment to rivers and streams. Road erosion occurs when soil particles are loosened and carried away from the roadway, ditch or road bank by water, wind or traffic. The actual 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 roadbed into roadway drainage ditches. Some of these particles settle out satisfactorily, but usually they settle out poorly, causing diminished ditch carrying capacity that results in roadway flooding and, subsequently, more 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 Oconee River Basin decreased by approximately 1,053 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 stream flow 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 developed 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 Oconee River Basin, the existing 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 and 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, in 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, times its maximum 30-minute intensity. It varies geographically and ranges from 250 to 300 within the Oconee River Basin. The R Factors by county are provided in Table 17.

Table 17. R Factors by County

County	R Factor
Baldwin	275
Barrow	287.5
Bleckley	300
Clarke	275
Dodge	300
Greene	250
Gwinnett	300
Hall	287.5
Hancock	250
Jackson	275
Jasper	275
Johnson	300
Jones	275
Laurens	300
Madison	275
Montgomery	300
Morgan	275
Newton	300
Oconee	262.5
Oglethorpe	250
Putnam	275
Treutlen	300
Twiggs	300
Walton	275
Washington	262.5
Wheeler	300
Wilkinson	287.5

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 and ability of the soil to resist detachment and transport during a rainfall event. It is a function of the soil type, which is provided by the STATSGO data. Table 6 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, it was decided that STATSGO data would be used for the first round or 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 of Georgia, 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 is based on the grid size and ground slope provided by the USGS 30 by 30 meter Digital Elevation Model (DEM) grids 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 the USLE factors. It incorporates effects of tillage, crop type, cropping history, and crop yield. Cropping factors for forested, agricultural, and urban lands were provided by the Georgia Forestry Commission (GFC), Natural Resources Conservation Service (NRCS), and U.S. Environmental Protection Agency (EPA), respectively.

The cropland and pastureland C factors for each county were developed by NRCS under the National Resource Inventory Program and are listed in Table 18. These values were developed based on the 2001 NLCD data. Low-level aerial photography was performed and the photographs are 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 cropland and pastureland C factors for watersheds in multiple counties were determined by area-weighting the agricultural land use within each county.

C factors for the road networks were determined based on the road surface and are given in Table 19. Road information, including road surface, was provided by the Georgia Department of Transportation (DOT). Data gaps were filled based on adjacent road surfaces and road types (i.e., state, county, private).

C factors for other land uses, including urban, mining, transitional, grass and wetlands, are listed in Table 20. These values were provided by the U.S. Environmental Protection Agency (EPA) and are used in all watersheds.

Table 18. Cropland and Pastureland C Factors by County

County	C factor	
	Cropland	Pastureland
Baldwin	0.116	0.018
Barrow	0.090	0.012
Bleckley	0.416	0.005
Clarke	0.182	0.005
Dodge	0.399	0.004
Greene	0.241	0.005
Gwinnett	0.283	0.018
Hall	0.224	0.004
Hancock	0.090	0.008
Jackson	0.130	0.013
Jasper	0.143	0.003
Johnson	0.263	0.006
Jones	0.349	0.012
Laurens	0.370	0.004
Madison	0.090	0.018
Montgomery	0.323	0.009
Morgan	0.502	0.004
Newton	0.286	0.005
Oconee	0.242	0.008
Oglethorpe	0.130	0.020
Putnam	0.240	0.012
Treutlen	0.275	0.003
Twiggs	0.421	0.003
Walton	0.192	0.003
Washington	0.315	0.004
Wheeler	0.504	0.003
Wilkinson	0.306	0.010

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

Table 19. 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

Table 20. 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
Deciduous Forest	0.00019
Evergreen Forest	0.00019
Mixed Forest	0.00019
Deciduous Shrubland	0.005
Pasture / Hay	0.003
Row Crops	0.343
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 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; and
- Evaluate the effects of land use, BMPs, and road networks on erosion and sediment delivery.

The watersheds of interest were delineated based on the RF3 stream coverage and elevation data. 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 has flow and can accumulate flow.

For each 30 by 30 meter grid cell within the watershed, the WCS Sediment Tool calculates the potential erosion using the USLE based on the specific cell 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

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

  Where: Md = 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

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

  Where: $Sf = \exp(-16.1 * r / L + 0.057) - 0.6$
  DR = sediment delivery ratio
  L = distance to the stream (m)
  r = relief to the stream (m)

- Area-based equation

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

  Where: DR = sediment delivery ratio
  A = area (sq miles)

- WEPP-based regression equation

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

  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 soil erosion and sediment delivered to the stream from each grid cell due to land use cover and from the grids representing roads.

5.0 TOTAL MAXIMUM DAILY LOAD

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. TMDLs establish allowable pollutant loadings that are less than or equal to the TMDL, and thereby provide the basis to establish water quality based controls. For some pollutants, TMDLs are expressed on a mass loading basis.

This TMDL determines the range of sediment load that can enter the impaired Oconee River Basin watersheds without causing additional impairment to the stream. This is based on the hypothesis that if an impaired watershed has an annual average sediment loading rate similar to a biologically unimpaired watershed, then the receiving stream will remain stable and not be biologically impaired due to sediment. The average sediment load in the watersheds not on the 303(d) list is 0.18 tons/acre/yr, ranging from 0.01 to 0.75 tons/acre/yr.

A TMDL is the sum of the individual waste load allocations (WLA) for point sources and load allocations (LA) for nonpoint sources and natural background (40 CFR 130.2). The sum of these components may not result in an exceedance of water quality standards for a water body. To protect against exceedances, 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. Conceptually, a TMDL can be expressed as follows:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The following sections describe the various TMDL components.

5.1 Waste Load Allocations

The waste load allocation is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. There are fifteen permitted facilities in the Oconee River Basin watersheds that discharge into listed segments or upstream of a listed segment. These include facilities with industrial process waters, municipal treatment plants, and surface mines. WLAs are provided to the point sources from municipal and industrial wastewater treatment systems with NPDES effluent limits.

There are seven active NPDES permitted facilities with TSS permit limits in the Oconee River Basin watershed that discharge into listed segments or upstream of a listed segment. These facilities include process water from hard rock mines and municipal treatment plants. The maximum allocated sediment load for these municipal and industrial wastewater treatment facilities is dependent on the discharge flow. Table 21 provides the WLAs for these seven facilities. The WLA loads are given as concentrations or as a range of daily average and daily maximum TSS limits for these facilities; however, a load can be calculated based on the permitted (where available) or design flows, and the permitted TSS concentrations.

The WLA, as a load, can be represented by the following equation:

$$WLA = Cpermitted * Q$$

Where: WLA = Wasteload Allocation sediment load
Cpermitted = permitted concentration, in TSS (mg / L)
Q = permitted (where available) or design discharge flow

Table 21. Waste Load Allocations for Permits with TSS Limits

FACILITY	NPDES PERMIT NO.	RECEIVING WATER	TSS	
			Monthly Avg (mg/L)	Weekly Avg (mg/L)
Eatonton Eastside WPCP	GA0032271	Peterson Creek	15	23
Glenwood WPCP	GA0021377	Little Commissioner Creek	90	120
Gordon WPCP	GA0020397	Carr Creek to North Oconee River	30	45
Hanson Aggregates SE	GA0046132	Slash Creek to Little Commissioner Creek	25-55	50-110
Martin Marietta Aggregates	GA0002330	Limestone Creek (Montgomery Co.)	25-55	50-110
Mount Vernon WPCP	GA0033758	Tanyard Creek tributary to Keg Creek	30	45
Sandersville WPCP	GA0032051	Peterson Creek	30	45

Average annual load assumes discharge every day at average daily flow

If there is available assimilative capacity, a new facility may be allowed, or it may be acceptable for an existing facility to expand. Any discharge increases will be allowed dependent on engineering and biological integrity study results.

Eight of the facilities have permits with turbidity limits and not TSS limits. The facilities are for process water from kaolin mines. Table 22 provides the WLA as a range of daily average and daily maximum turbidity limits for these facilities. For these facilities, the WLA (as a TSS load) can be calculated using the relationship between TSS and turbidity developed from instream data.

State and Federal Rules define storm water discharges covered by NPDES permits as point sources. However, storm water discharges are from diffuse sources and there are multiple storm water outfalls. Storm water sources (point and nonpoint) are different than traditional NPDES permitted sources in four respects: 1) they do not produce a continuous (pollutant loading) discharge; 2) their pollutant loading depends on the intensity, duration, and frequency of rainfall events, over which the permittee has no control; 3) the activities contributing to the pollutant loading may include the various allowable activities of others, and control of these activities is not solely within the discretion of the permittee; and 4) they do not have wastewater treatment plants that control specific pollutants to meet numerical limits.

The intent of storm water NPDES permits is not to treat the water after collection, but to reduce the exposure of storm water to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to control pollutant discharges from each storm water outfall. Therefore, storm water NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment.

Table 11 provides the current permitted discharges from surface mine locations. Surface mine locations are constantly changing. Discharges from these sites consist of accumulated surface water, pit-pumpout water, groundwater, and stormwater runoff associated with mining activities authorized under approved Mined Land Use Plans. These discharges are covered under NPDES permits, but have no numeric limits. However, these discharges shall not violate the Water Quality Standards in the receiving streams and shall not discharge floating solids or

visible foam in other than trace amounts. The WLA from these sites is included in the LA for the mining land use discussed in the following section.

Table 22. Waste Load Allocations for China Clay Mines

FACILITY	NPDES PERMIT NO.	RECEIVING WATER	FLOW Monthly Avg (MGD)	TURBIDITY	
				Monthly Avg (mg/L)	Weekly Avg (mg/L)
Engelhard Corporation - outfall 001	GA0003271	Little Commissioner Creek		25-50	50-100
Engelhard Corporation - outfall 002				25-50	50-100
Engelhard Corporation - outfall 004	GA0003131	Little Commissioner Creek		25-50	50-100
Engelhard Corporation - outfall 005				25-50	50-100
IMERYS Clays Inc. - outfall 001	GA0002135	Unnamed tributary to Keg Creek		25-50	50-100
IMERYS Clays Inc. - outfall 002				25-50	50-100
IMERYS Clays Inc. - outfall 002	GA0002780	Panther Run		25-50	50-100
IMERYS Clays Inc.	GA0046329	Limestone Creek (Washington Co.)		25-50	50-110
IMERYS Clays Inc.	GA0047309	Tributary to Limestone Creek		25-55	50-100
Kentucky-Tennessee Clay Co.	GA0003387	Tributary to Limestone Creek		25-50	50-100
Thiele Kaolin - outfall 001	GA0002453	Limestone Creek (Washington Co.)		25-50	50-100
Thiele Kaolin - outfall 002				25-50	50-100

Average annual load assumes discharge every day at average daily flow

The stormwater discharges associated with industrial and mining facilities that are not covered under individual NPDES permits are regulated by a Georgia General Storm Water NPDES Permit (GAR000000). Table 12 lists the industrial facilities that are covered under the Georgia General Stormwater NPDES Permit in the Oconee River Basin. Facilities covered by this permit that discharge storm water associated with industrial activity or within one linear mile upstream and within the same watershed of an impaired stream segment are required to monitor for the pollutant of concern.

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, to determine the current sediment loading rates to the streams. The sediment load allocation for each stream by land use, including roads, is reported in Table 23. The watersheds are grouped by: those that are not on the 303(d) list and those that are on the 303(d) list. For comparison purposes, the total sediment load in tons per acre per year is also given. The average sediment load in the watersheds that are biota impacted is 0.25 tons/acre/yr, ranging from 0.02 to 2.26 tons/acre/yr. The average sediment load in the watersheds not on the 303(d) list is 0.18 tons/acre/yr, ranging from 0.01 to 0.75 tons/acre/ yr. Table 24 gives each source's percent contribution to the total sediment load.

The Total Allowable Load for each impaired segment is calculated by multiplying the watershed area in acres by an annual load per acre. This annual load is based on the average annual load per acre from all the unimpaired streams within a given ecoregion (Piedmont, 0.06 ton/acre/yr; Southeastern Plains, 0.15 ton/acre/yr). The unimpaired streams are those with an IBI score greater than 45. The LA is then calculated by subtracting the WLA from the Total Allowable 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 the 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.

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 determined.

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, the use of the average sediment loading rates for the numeric targets, and the assumption that no BMPs were used.

Table 23a. Sediment Load Allocations (Unimpaired Piedmont)

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)**
Allen Creek	0.0	220.1	51.3	15.2	0.0	3955.4	30.7	0.6	0.0	2.7	117.2		109.2	26.4		200.5	4729.4	0.70
Apalachee River	0.0	2104.1	360.0	34.7	0.0	11012.7	219.8	81.2	12.2	41.2	3470.3	451.6	761.7	1381.9	0.1	4855.8	24787.3	0.16
Barber Creek	0.0	35.9	9.1	5.5	0.0		3.5	0.8	0.1	1.2	183.8	4.6	14.9	16.7		120.7	396.6	0.10
Beaverdam Trib.	0.0	2.1					1.2	0.2	0.1	0.2	0.1		2.1	0.5		14.4	20.7	0.03
Big Bear Creek	0.0	24.6	2.1	0.1	0.0		2.8	0.5	0.1	0.4	128.2	2.7	7.8	12.8		78.9	261.1	0.09
Black Springs Branch	0.0	25.6	1.2		0.0		5.9	1.4	0.8	0.1	18.9		21.6	0.9		100.1	176.5	0.08
Calls Creek	0.0	205.3	20.6	3.4	0.0	44.2	7.5	1.2	0.2	0.5	99.8	4.4	20.2	18.2		466.3	891.9	0.17
Cedar Creek	0.0	163.9	73.0	5.4	0.0	2042.7	6.6	1.5	0.2	2.6	218.5	0.0	22.6	24.8		279.9	2841.7	0.44
Cedar Creek	0.0	8.8	0.8	0.0	0.0		2.6	0.9	0.4	0.0	2.3	7.1	5.1	7.3		45.2	80.4	0.09
Copeland Creek	0.0	9.8	0.1		0.0		1.9	3.6	0.5	1.5	10.6	1.0	2.4	9.3		126.3	166.9	0.06
Drowning Creek	0.0	55.5	25.3	1.0	0.0		3.5	0.7	0.0	0.4	198.7		13.5	11.1		171.3	481.0	0.20
Kimbro Creek		3.6	0.0			1578.1	1.4	2.2	0.2	2.3	2.8	2.5	21.0	10.5		10.0	1634.6	0.75
Milsap Creek	0.0	57.2	4.0	0.7	0.0		3.9	1.5	0.5	0.9	78.0	0.3	10.2	17.5		115.6	290.2	0.07
Mulberry Creek	0.0	327.5	83.5	3.6	0.0		20.2	1.5	0.2	4.6	152.0		52.1	2.2		586.3	1233.7	0.21
Murder Creek	0.0	684.2	9.0	0.6	0.0	13203.7	151.0	55.3	13.6	26.4	494.4	97.4	554.5	693.5	0.1	3030.1	19013.6	0.23
Rocky Creek	0.0	20.4	2.7	0.1	0.0		3.5	0.6	0.0	0.2	156.3	1.2	9.1	8.9		36.9	240.0	0.12
Rooty Creek	0.0	210.0	1.8	0.2	0.0		4.9	0.5	0.5	0.0	248.0	23.8	24.8	17.3		76.6	608.4	0.12
Rose Creek	0.0	20.4	1.5	0.4	0.0	43.6	20.4	2.3	0.6	1.5	227.2	19.0	41.2	49.1	0.1	104.4	531.7	0.05
Shoal Creek	0.0	225.8	11.0	0.3	0.0	542.6	5.0	1.2	0.2	0.7	77.8	37.4	21.1	48.9		238.5	1210.4	0.14

Table 23b. Sediment Load Allocations (Unimpaired Southeastern Plains)

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)**
Big Creek	0.0	95.9	3.6	0.2		11.0	3.8	7.2	2.1	5.5	40.4	2303.7	31.3	131.0	2.7	367.5	3005.8	0.13
Big Sandy Creek	0.0	187.5	10.0	2.9	0.0	13015.9	59.5	28.4	17.5	1.5	107.1	3914.4	232.5	457.6	12.7	1025.3	19072.8	0.21
Carter's Mill Creek	0.0	4.7	0.1				2.4	4.6	1.4	0.3	11.4	221.1	16.5	48.0	1.0	154.1	465.5	0.09
Commissioner Creek	0.0	280.7	8.3	0.8	0.0	2304.0	49.0	22.0	11.5	14.9	505.9	2223.1	163.8	370.8	3.6	1126.4	7084.9	0.11
Hunger and Hardship Creek	0.0	100.5	6.6	3.1		56.4	2.0	1.3	0.6	0.4	15.4	1230.2	8.9	56.4	1.2	214.3	1697.6	0.16
Little Red Bluff Creek	0.0	56.4	4.0	0.5			1.8	1.9	0.7	1.5	8.3	827.4	19.2	16.4	0.7	162.0	1100.8	0.17
Little Rocky Creek	0.0	13.7	0.6	0.4		0.1	1.1	0.6	0.3	0.1	7.1	986.5	2.1	44.1	0.1	52.5	1109.3	0.23
Log Dam Creek	0.0	3.0	0.1		0.0		3.5	3.7	0.5	0.2	2.9	0.8	6.6	5.5		4.0	30.7	0.01
Porter Creek	0.0	12.8	0.0	0.2		1763.2	22.8	9.7	4.8	0.9	17.9	420.1	63.8	94.8	2.3	350.8	2764.1	0.14
Pughes Creek	0.0	13.1	0.1			4.8	1.0	2.2	0.6	1.1	15.3	990.5	8.7	30.9	0.7	77.3	1146.6	0.21
Sandy Hill Creek	0.0	3.8	0.0			109.4	3.9	4.2	1.7	0.1	16.6	244.2	10.4	32.7	0.2	118.8	546.1	0.12
South Sandy Creek	0.0	20.4	0.1				14.2	3.5	4.0	0.1	34.6	1081.3	21.0	107.3	1.1		1287.6	0.08

Table 23c. Sediment Load Allocations (Impaired Piedmont)

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)**
Briar Creek	0.0	14.8	1.4	0.2	0.0		6.2	3.0	0.3	1.0	20.2	17.1	20.4	26.4		81.2	192.2	0.06
Carr Creek	0.0	46.0	8.0	2.6		1391.5	0.2	0.0			2.8	0.3	1.0	1.8		20.7	1474.9	2.26
Crooked Creek - Putnam	0.0	8.5	0.1		0.0		1.4	0.2	0.1	0.0	117.2	35.2	9.5	4.6		17.8	194.6	0.08
Freeman Creek	0.0	28.1	0.7	0.0	0.0		5.7	3.0	0.5	3.9	84.8	0.3	29.1	20.3		30.4	206.9	0.06
Hardeman Creek	0.0	18.1	3.3	1.3		571.4	3.2	0.2	0.1	0.1	95.3	19.7	8.2	7.8		212.7	941.2	0.71
Little Creek	0.0	1.8	0.1	0.0	0.0		4.9	9.9	1.0	0.6	15.8	0.1	6.1	16.6		7.6	64.5	0.02
Little Fishing Creek	0.0	17.4	0.1		0.0	5883.9	11.1	7.1	1.1	0.2	142.6		66.9	4.6		32.9	6167.7	1.25
Marburg Creek	0.0	42.2	13.4	1.3	0.0	1527.9	2.9	0.9	0.0	0.7	104.8		12.7	16.8		40.5	1764.0	0.79
Noketchee Creek	0.0	37.7	2.9	0.1	0.0	4.8	1.1	0.2	0.1	0.2	22.8		4.2	15.7		45.1	134.8	0.07
Rooty Creek	0.0	213.5	1.9	0.2	0.0		5.7	0.6	0.5	0.0	273.4	23.8	31.1	18.7		88.2	657.5	0.12
Sandy Run Creek	0.0	14.7			0.0		2.7	4.6	0.5	0.1	1.4		23.9	20.2		87.4	155.4	0.05
Tobler Creek	0.0	24.5	0.1		0.0		3.8	1.6	0.5	0.0	8.9		18.7	13.1		23.6	94.9	0.05
Zoie Brown Creek	0.0	44.3	0.3				4.3	3.8	0.9	0.1	17.0		20.5	33.9	0.0	77.3	202.4	0.05

Table 23c. Sediment Load Allocations (Impaired Southeastern Plains)

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)**
Alligator Creek		5.8	0.1	0.2	0.0		10.6	4.7	1.7	0.2	1.1	13.4	11.3	26.2	0.2	22.4	97.8	0.02
Cedar Creek	0.0	20.3	0.0	0.0		0.2	23.9	9.5	4.3	5.1	26.7	389.3	22.9	75.6	1.8	422.6	1002.1	0.06
Crooked Creek - Laurens	0.0	7.0	1.1	0.1			0.2	0.2	0.1	0.2	2.1	192.8	1.7	4.5	0.2	10.0	220.1	0.14
Crooked Creek - Jones	0.0	15.1	0.7		0.0		1.7	1.1	0.4	0.9	31.1	323.5	14.1	20.0	0.3	47.6	456.7	0.12
Cypress Creek	0.0	51.2	0.8	0.0		1.9	4.6	5.9	2.9	1.3	26.0	1510.1	45.7	89.0	2.3	178.2	1920.1	0.14
Keg Creek	0.0	181.5	10.1	3.7	0.0	7424.8	45.1	20.4	14.6	1.7	85.9	2864.2	228.2	453.6	8.8	1079.3	12422.0	0.21
Lamars Creek	0.0	10.2	0.2	0.1	0.0	59.4	17.2	11.3	4.7	6.5	15.8	1195.6	39.8	97.9	0.9	356.0	1815.5	0.14
Limestone Creek - Montgomery	0.0	19.1	0.8	0.1		32.2	0.5	1.3	0.2	0.7	13.4	416.1	4.3	20.9	0.6	26.1	536.5	0.16
Limestone Creek - Washington	0.0	65.0	3.9	2.4		3071.5	4.2	1.1	1.5	0.0	18.3	261.6	18.8	17.7	0.8	153.9	3620.6	0.77
Little Commissioner Creek	0.0	75.6	3.8	1.5	0.0	4654.7	14.6	9.8	3.7	0.4	58.5	513.9	71.6	164.9	3.8	336.9	5913.6	0.21
Lotts Creek	0.0	3.4	0.0				0.3	2.3	0.4	0.5	0.8	93.4	4.6	7.8	0.2	70.7	184.4	0.05
Ochwalkee Creek - Laurens	0.0	13.2	0.1				1.1	4.0	0.9	1.8	5.0	290.1	14.0	49.8	0.2	134.3	514.5	0.07
Ockwalkee Creek - Wheeler	0.0	114.8	0.8	0.0	0.0	41.9	5.4	29.3	6.8	12.0	35.1	3428.1	81.7	316.3	1.5	828.3	4901.7	0.11
Peterson Creek	0.0	17.9	0.5	0.0			0.6	1.6	0.5	0.2	1.3	118.4	3.8	12.7	0.2	50.3	207.9	0.05
Red Bluff Creek	0.0	157.7	8.1	0.8	0.0	26.7	6.4	11.2	3.5	7.3	26.4	2262.0	60.1	131.0	2.3	586.8	3290.3	0.13
Reedy Creek	0.0	33.1	0.8	0.0		18.4	1.5	3.6	1.6	2.4	9.1	1167.8	12.0	66.1	0.3	187.6	1504.5	0.14
Rocky Creek	0.0	683.7	6.5	0.1		256.2	7.0	3.8	1.3	0.3	79.3	10428.0	46.8	332.1	5.4	370.2	12220.7	0.30
Sandy Creek	0.0	12.9	0.3	0.7	0.0		3.2	0.6	0.7	0.1	16.1	234.5	11.1	21.8	0.3	67.4	369.5	0.11
Tiger Creek	0.2	0.1			0.0		0.9	0.6	0.1	0.7	4.7	2.3	10.5	7.8		20.8	48.9	0.03

Table 24a. Sediment Load Percentages (Unimpaired Piedmont)

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**
Allen Creek	0.00%	4.65%	1.08%	0.32%	0.00%	83.63%	0.65%	0.01%	0.00%	0.06%	2.48%	0.00%	2.31%	0.56%	0.00%	4.24%
Apalachee River	0.00%	8.49%	1.45%	0.14%	0.00%	44.43%	0.89%	0.33%	0.05%	0.17%	14.00%	1.82%	3.07%	5.58%	0.00%	19.59%
Barber Creek	0.00%	9.05%	2.28%	1.38%	0.00%	0.00%	0.88%	0.19%	0.02%	0.30%	46.35%	1.15%	3.75%	4.22%	0.00%	30.43%
Beaverdam Trib.	0.00%	10.05%	0.00%	0.00%	0.00%	0.00%	5.68%	1.11%	0.26%	0.85%	0.39%	0.00%	9.97%	2.21%	0.00%	69.49%
Big Bear Creek	0.00%	9.41%	0.82%	0.03%	0.00%	0.00%	1.08%	0.18%	0.04%	0.14%	49.12%	1.05%	3.01%	4.91%	0.00%	30.21%
Black Springs Branch	0.00%	14.53%	0.67%	0.00%	0.00%	0.00%	3.36%	0.78%	0.46%	0.07%	10.70%	0.00%	12.23%	0.49%	0.00%	56.71%
Calls Creek	0.00%	23.02%	2.31%	0.39%	0.00%	4.95%	0.85%	0.14%	0.03%	0.05%	11.18%	0.50%	2.26%	2.04%	0.00%	52.28%
Cedar Creek	0.00%	5.77%	2.57%	0.19%	0.00%	71.88%	0.23%	0.05%	0.01%	0.09%	7.69%	0.00%	0.79%	0.87%	0.00%	9.85%
Cedar Creek	0.00%	10.97%	1.01%	0.00%	0.00%	0.00%	3.21%	1.12%	0.46%	0.00%	2.88%	8.79%	6.34%	9.08%	0.00%	56.15%
Copeland Creek	0.00%	5.86%	0.06%	0.00%	0.00%	0.00%	1.13%	2.16%	0.28%	0.89%	6.32%	0.62%	1.43%	5.58%	0.00%	75.67%
Drowning Creek	0.00%	11.54%	5.25%	0.21%	0.00%	0.00%	0.72%	0.15%	0.00%	0.07%	41.31%	0.00%	2.81%	2.32%	0.00%	35.62%
Kimbro Creek	0.00%	0.22%	0.00%	0.00%	0.00%	96.54%	0.09%	0.14%	0.01%	0.14%	0.17%	0.16%	1.28%	0.64%	0.00%	0.61%
Milsap Creek	0.00%	19.69%	1.38%	0.23%	0.00%	0.00%	1.35%	0.51%	0.19%	0.30%	26.86%	0.09%	3.53%	6.04%	0.00%	39.83%
Mulberry Creek	0.00%	26.55%	6.76%	0.29%	0.00%	0.00%	1.64%	0.12%	0.02%	0.37%	12.32%	0.00%	4.22%	0.18%	0.00%	47.53%
Murder Creek	0.00%	3.60%	0.05%	0.00%	0.00%	69.44%	0.79%	0.29%	0.07%	0.14%	2.60%	0.51%	2.92%	3.65%	0.00%	15.94%
Rocky Creek	0.00%	8.50%	1.13%	0.04%	0.00%	0.00%	1.47%	0.25%	0.02%	0.09%	65.12%	0.52%	3.79%	3.70%	0.00%	15.38%
Rooty Creek	0.00%	34.51%	0.30%	0.03%	0.00%	0.00%	0.81%	0.08%	0.08%	0.00%	40.76%	3.92%	4.08%	2.85%	0.00%	12.60%
Rose Creek	0.00%	3.83%	0.29%	0.07%	0.00%	8.20%	3.85%	0.43%	0.11%	0.28%	42.74%	3.58%	7.74%	9.23%	0.03%	19.63%
Shoal Creek	0.00%	18.65%	0.91%	0.02%	0.00%	44.83%	0.41%	0.10%	0.01%	0.06%	6.43%	3.09%	1.74%	4.04%	0.00%	19.70%

Table 24b. Sediment Load Percentages (Unimpaired Southeastern Plains)

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**
Big Creek	0.00%	3.19%	0.12%	0.01%	0.00%	0.36%	0.13%	0.24%	0.07%	0.18%	1.34%	76.64%	1.04%	4.36%	0.09%	12.23%
Big Sandy Creek	0.00%	0.98%	0.05%	0.02%	0.00%	68.24%	0.31%	0.15%	0.09%	0.01%	0.56%	20.52%	1.22%	2.40%	0.07%	5.38%
Carter's Mill Creek	0.00%	1.01%	0.02%	0.00%	0.00%	0.00%	0.51%	0.99%	0.29%	0.06%	2.44%	47.50%	3.54%	10.32%	0.22%	33.11%
Commissioner Creek	0.00%	3.96%	0.12%	0.01%	0.00%	32.52%	0.69%	0.31%	0.16%	0.21%	7.14%	31.38%	2.31%	5.23%	0.05%	15.90%
Hunger and Hardship Creek	0.00%	5.92%	0.39%	0.18%	0.00%	3.32%	0.12%	0.08%	0.04%	0.03%	0.91%	72.47%	0.53%	3.32%	0.07%	12.62%
Little Red Bluff Creek	0.00%	5.12%	0.36%	0.05%	0.00%	0.00%	0.17%	0.17%	0.06%	0.13%	0.76%	75.17%	1.74%	1.49%	0.06%	14.72%
Little Rocky Creek	0.00%	1.24%	0.05%	0.03%	0.00%	0.01%	0.10%	0.06%	0.03%	0.01%	0.64%	88.93%	0.19%	3.98%	0.01%	4.73%
Log Dam Creek	0.00%	9.74%	0.20%	0.00%	0.00%	0.00%	11.27%	12.16%	1.77%	0.64%	9.36%	2.65%	21.40%	17.83%	0.00%	12.97%
Porter Creek	0.00%	0.46%	0.00%	0.01%	0.00%	63.79%	0.83%	0.35%	0.18%	0.03%	0.65%	15.20%	2.31%	3.43%	0.08%	12.69%
Pughes Creek	0.00%	1.14%	0.01%	0.00%	0.00%	0.42%	0.09%	0.20%	0.05%	0.09%	1.33%	86.39%	0.76%	2.70%	0.06%	6.75%
Sandy Hill Creek	0.00%	0.70%	0.00%	0.00%	0.00%	20.04%	0.72%	0.77%	0.32%	0.01%	3.04%	44.72%	1.90%	5.99%	0.03%	21.76%
South Sandy Creek	0.00%	1.59%	0.00%	0.00%	0.00%	0.00%	1.10%	0.27%	0.31%	0.01%	2.69%	83.98%	1.63%	8.33%	0.08%	0.00%

Table 24c. Sediment Load Percentages (Impaired Piedmont)

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**
Briar Creek	0.00%	7.68%	0.72%	0.13%	0.00%	0.00%	3.25%	1.56%	0.17%	0.53%	10.51%	8.88%	10.59%	13.75%	0.00%	42.23%
Carr Creek	0.00%	3.12%	0.54%	0.17%	0.00%	94.34%	0.01%	0.00%	0.00%	0.00%	0.19%	0.02%	0.07%	0.12%	0.00%	1.41%
Crooked Creek - Putnam	0.00%	4.36%	0.04%	0.00%	0.00%	0.00%	0.70%	0.09%	0.04%	0.02%	60.24%	18.09%	4.86%	2.39%	0.00%	9.16%
Freeman Creek	0.00%	13.57%	0.33%	0.00%	0.00%	0.00%	2.76%	1.45%	0.24%	1.90%	40.99%	0.13%	14.08%	9.83%	0.00%	14.70%
Hardeman Creek	0.00%	1.92%	0.35%	0.13%	0.00%	60.71%	0.34%	0.02%	0.01%	0.01%	10.12%	2.10%	0.87%	0.83%	0.00%	22.60%
Little Creek	0.00%	2.75%	0.11%	0.01%	0.00%	0.00%	7.58%	15.39%	1.62%	0.91%	24.54%	0.13%	9.41%	25.72%	0.00%	11.84%
Little Fishing Creek	0.00%	0.28%	0.00%	0.00%	0.00%	95.40%	0.18%	0.11%	0.02%	0.00%	2.31%	0.00%	1.08%	0.07%	0.00%	0.53%
Marburg Creek	0.00%	2.39%	0.76%	0.07%	0.00%	86.62%	0.17%	0.05%	0.00%	0.04%	5.94%	0.00%	0.72%	0.95%	0.00%	2.29%
Noketchee Creek	0.00%	27.97%	2.14%	0.05%	0.00%	3.59%	0.82%	0.18%	0.04%	0.12%	16.89%	0.00%	3.11%	11.66%	0.00%	33.42%
Rooty Creek	0.00%	32.47%	0.29%	0.03%	0.00%	0.00%	0.86%	0.09%	0.08%	0.00%	41.57%	3.62%	4.73%	2.84%	0.00%	13.41%
Sandy Run Creek	0.00%	9.47%	0.00%	0.00%	0.00%	0.00%	1.75%	2.95%	0.32%	0.04%	0.92%	0.00%	15.36%	12.99%	0.00%	56.20%
Tobler Creek	0.00%	25.84%	0.09%	0.00%	0.00%	0.00%	4.02%	1.66%	0.52%	0.01%	9.38%	0.00%	19.76%	13.83%	0.00%	24.88%
Zoie Brown Creek	0.00%	21.87%	0.13%	0.00%	0.00%	0.00%	2.13%	1.90%	0.43%	0.03%	8.41%	0.00%	10.14%	16.77%	0.01%	38.19%

Table 24d. Sediment Load Percentages (Impaired Southeastern Plains)

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**
Alligator Creek	0.00%	5.91%	0.15%	0.20%	0.00%	0.00%	10.84%	4.78%	1.70%	0.18%	1.17%	13.73%	11.52%	26.78%	0.17%	22.87%
Cedar Creek	0.00%	2.03%	0.00%	0.00%	0.00%	0.02%	2.39%	0.94%	0.43%	0.50%	2.66%	38.85%	2.28%	7.54%	0.18%	42.17%
Crooked Creek - Laurens	0.00%	3.17%	0.49%	0.04%	0.00%	0.00%	0.10%	0.10%	0.03%	0.08%	0.97%	87.60%	0.77%	2.03%	0.09%	4.53%
Crooked Creek - Jones	0.00%	3.30%	0.16%	0.00%	0.00%	0.00%	0.38%	0.24%	0.10%	0.20%	6.82%	70.84%	3.08%	4.38%	0.07%	10.42%
Cypress Creek	0.00%	2.67%	0.04%	0.00%	0.00%	0.10%	0.24%	0.31%	0.15%	0.07%	1.36%	78.65%	2.38%	4.64%	0.12%	9.28%
Keg Creek	0.00%	1.46%	0.08%	0.03%	0.00%	59.77%	0.36%	0.16%	0.12%	0.01%	0.69%	23.06%	1.84%	3.65%	0.07%	8.69%
Lamars Creek	0.00%	0.56%	0.01%	0.00%	0.00%	3.27%	0.95%	0.62%	0.26%	0.36%	0.87%	65.85%	2.19%	5.39%	0.05%	19.61%
Limestone Creek - Montgomery	0.00%	3.57%	0.15%	0.02%	0.00%	6.00%	0.10%	0.25%	0.04%	0.12%	2.49%	77.55%	0.81%	3.90%	0.12%	4.86%
Limestone Creek - Washington	0.00%	1.80%	0.11%	0.07%	0.00%	84.83%	0.12%	0.03%	0.04%	0.00%	0.50%	7.22%	0.52%	0.49%	0.02%	4.25%
Little Commissioner Creek	0.00%	1.28%	0.06%	0.03%	0.00%	78.71%	0.25%	0.17%	0.06%	0.01%	0.99%	8.69%	1.21%	2.79%	0.06%	5.70%
Lotts Creek	0.00%	1.86%	0.01%	0.00%	0.00%	0.00%	0.15%	1.22%	0.21%	0.30%	0.45%	50.66%	2.47%	4.22%	0.13%	38.34%
Ochwalkee Creek - Laurens	0.00%	2.56%	0.02%	0.00%	0.00%	0.00%	0.22%	0.79%	0.18%	0.34%	0.98%	56.39%	2.72%	9.68%	0.03%	26.10%
Ockwalkee Creek - Wheeler	0.00%	2.34%	0.02%	0.00%	0.00%	0.85%	0.11%	0.60%	0.14%	0.24%	0.72%	69.94%	1.67%	6.45%	0.03%	16.90%
Peterson Creek	0.00%	8.63%	0.26%	0.01%	0.00%	0.00%	0.27%	0.75%	0.23%	0.07%	0.61%	56.95%	1.83%	6.11%	0.11%	24.19%
Red Bluff Creek	0.00%	4.79%	0.25%	0.02%	0.00%	0.81%	0.19%	0.34%	0.11%	0.22%	0.80%	68.75%	1.83%	3.98%	0.07%	17.83%
Reedy Creek	0.00%	2.20%	0.06%	0.00%	0.00%	1.22%	0.10%	0.24%	0.11%	0.16%	0.60%	77.62%	0.80%	4.39%	0.02%	12.47%
Rocky Creek	0.00%	5.59%	0.05%	0.00%	0.00%	2.10%	0.06%	0.03%	0.01%	0.00%	0.65%	85.33%	0.38%	2.72%	0.04%	3.03%
Sandy Creek	0.00%	3.49%	0.09%	0.19%	0.00%	0.00%	0.86%	0.16%	0.18%	0.02%	4.35%	63.46%	3.00%	5.89%	0.08%	18.24%
Tiger Creek	0.38%	0.25%	0.00%	0.00%	0.00%	0.00%	1.85%	1.32%	0.26%	1.50%	9.59%	4.75%	21.50%	16.03%	0.00%	42.58%

5.5 Total Sediment Load

The total annual sediment load was determined by adding the WLA (WLA + WLAsw) and the LA. The MOS, as described above, was implicitly included in the TMDL analysis and does not factor directly into the TMDL equation as shown above.

The USLE method used calculates a total annual sediment load, as opposed to a daily load. The R factor from the USLE (the rainfall erosivity index) is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, times its maximum 30-minute intensity. It would be difficult to determine the maximum daily load of sediment to a stream, considering the episodic nature of rainfall events. Table 25 provides the rainfall statistics from six meteorological stations located throughout Georgia, and shows the variability of rainfall frequency and amount. This information may be used to calculate daily load. However, it is a course estimate and will be dependent on the antecedent conditions.

Table 25. Georgia Meteorological Rainfall Statistics

Station	Normal Monthly Precipitation (in.) / Avg. Days of Precipitation (0.1 in. or more)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Athens, GA	4.6/11	4.4/9	5.5/11	4.0/8	4.4/9	3.9/9	4.9/11	3.7/9	3.4/8	3.3/7	3.7/8	4.1/10
Atlanta, GA	4.8/11	4.8/10	5.8/11	4.3/9	4.3/9	3.6/10	5.0/12	3.7/10	3.4/8	3.1/6	3.9/8	4.3/10
Augusta, GA	4.1/10	4.3/9	4.7/10	3.3/8	3.8/9	4.1/9	4.2/11	4.5/10	3.0/7	2.8/6	2.5/7	3.4/9
Columbus, GA	4.6/10	4.9/10	5.8/10	4.3/8	4.2/8	4.1/9	5.5/13	3.7/10	3.2/8	2.2/5	3.6/8	5.0/10
Macon, GA	4.6/11	4.7/10	4.8/10	3.5/7	3.6/9	3.6/10	4.3/13	3.6/11	2.8/8	2.2/6	2.7/7	4.3/9
Savannah, GA	3.6/9	3.2/9	3.8/9	3.0/7	4.1/9	5.7/10	6.4/14	7.5/13	4.5/10	2.4/6	2.2/6	3.0/8

The total annual sediment loads for each of the impaired watersheds are summarized in Table 26, along with any required sediment load reduction. The WLAs (WLA + WLAsw) provided in Table 26 are for accounting purposes. For kaolin facilities, the WLA (as a TSS load) was calculated using a conversion factor between TSS and turbidity developed from instream data. 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 overestimate some sediment loads.

Table 26. Total Annual Sediment Loads and the Required Sediment Reduction

Name	Current Load (tons/yr)	WLA (tons/yr)	WLAsw (tons/yr)	LA (tons/yr)	Allowable Total Load (tons/yr)	% Reduction
Briar Creek	192.2			192.2	192.2	0.0
Carr Creek	1,583.4	108.5	11.2	4.8	124.5	92.1
Crooked Creek (Putnam Co.)	194.6			194.6	194.6	0.0
Freeman Creek	206.9			206.9	206.9	0.0
Hardeman Creek	941.2			254.5	254.5	73.0
Little Creek	64.5			64.5	64.5	0.0
Little Fishing Creek	6,167.7			939.7	939.7	84.8
Marburg Creek	1,764.0			427.0	427.0	75.8
Noketchee Creek	134.8		63.2	71.6	134.8	0.0
Rooty Creek	670.1	12.6		644.9	657.5	1.9
Sandy Run Creek	155.4			155.4	155.4	0.0
Tobler Creek	94.9			94.9	94.9	0.0
Zoie Brown Creek	202.4			202.4	202.4	0.0
Alligator Creek	97.8			97.8	97.8	0.0
Cedar Creek	1,002.1			1,002.1	1,002.1	0.0
Crooked Creek (Jones Co.)	456.7			220.1	220.1	51.8
Crooked Creek (Laurens Co.)	220.1			456.7	456.7	0.0
Cypress Creek	1,920.1			1,920.1	1,920.1	0.0
Keg Creek	12,499.6	2,177.2		6,641.4	8,818.6	39.6
Lamars Creek	1,815.5	42.5		1,773.0	1,815.5	2.3
Limestone Creek (Montgomery)	548.8	12.3		464.1	476.4	13.2
Limestone Creek (Washington)	3,752.8	132.2		551.4	683.6	81.8
Little Commissioner Creek	6,037.2	1,348.9		2,741.4	4,090.3	43.7
Lotts Creek	184.4			184.4	184.4	0.0
Ochwalkee Creek (Laurens Co.)	514.5			514.5	514.5	0.0
Ochwalkee Creek (Laurens / Wheeler Co.)	4,901.7			4,901.7	4,901.7	0.0
Peterson Creek	226.1	15.1		192.8	207.9	8.0
Red Bluff Creek	3,290.3			3,290.3	3,290.3	0.0
Reedy Creek	1,504.5			1,504.5	1,504.5	0.0
Rocky Creek	12,220.7			5,844.7	5,844.7	52.2
Sandy Creek	369.5			369.5	369.5	0.0
Tiger Creek	48.9			48.9	48.9	0.0

6.0 RECOMMENDATIONS

6.1 Monitoring

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 sampling work to be focused on one of the five basin groups each year. The Oconee River Basin, along with the Ocmulgee and Altamaha River Basins, were the basins of focused monitoring in 2004 and will again receive focused monitoring in 2009. One goal of the focused basin monitoring is to continue to monitor 303(d) listed waters. Therefore, 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 Oconee 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, so that these streams will 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, changes in 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 that compliance with NPDES permits and implementation of Best Management Practices (BMPs) be monitored. The anticipated effects of compliance with NPDES permits and implementation of BMPs will be the improvement of stream habitats and water quality, and thus be an indirect measurement of the TMDL.

Management practices recommended to maintain the total annual sediment loads at current levels 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; and
- Mitigation and prevention of stream bank erosion due to increased stream flow 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 mass loading of sediment (TSS) above that identified in the TMDL. However, if there is available assimilative capacity, new discharges may be allowed based on engineering and current stream biological integrity studies.

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. It is recommended that the peak flow from mining sites be maintained at pre-development levels in order to control bank erosion and instabilities in the receiving stream. In addition, monitoring frequencies should be such that the total annual sediment loads coming from mining facilities can be characterized.

The GA EPD has developed a General Storm Water NPDES Permit for Construction Activities. The current permit is required for all construction sites disturbing one 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 Permit. 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 Permit 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 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. All construction sites will monitor their storm water runoff as required by the General Storm Water NPDES Permit for Construction Activities. It is also recommended that the peak flow from construction sites be maintained at pre-development levels.

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. Georgia is working with local governments, 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 BMPs that address nonpoint source pollution. In addition, public education efforts are being targeted to individual stakeholders to provide information regarding the use of BMPs 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 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 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 January 1, 1999 (GA EPD, 1999).

It is the responsibility of the GFC to educate and inform the forest 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 and the twelve district coordinators conduct educational programs across the state. The district coordinators receive specialized training in erosion and sediment 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 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 for the most part was very good. 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 common, 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 who is 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 site compliance inspections should be recorded each year. In addition, the number of complaints received, the actions taken, and 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 - Cooperative Extension Service
- Georgia Soil and Water Conservation Commission
- Natural Resources Conservation Service

The University of Georgia (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 Georgia Soil and Water Conservation Commission (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 Protecting Water Quality in Georgia,* for the agricultural community (GSWCC, 1994).

The Natural Resources Conservation Service (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, found in the electronic Field Office Technical Guide (eFOTG), 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 cropland close to impaired streams, and pastureland 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 to provide incentive and offer assistance to farmers to convert highly erodible and other environmentally sensitive land normally devoted to crop production, to land with other long-term resource-conserving cover. 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 NRCS conducts the National Resources Inventory (NRI). The NRI is a statistically based sample of land use and natural resource conditions and trends, and it covers non-federal land in the United States. The NRI found that 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 per year in 1997 (USDA-NRCS, 1997).

NRCS also provides a web-based database application (Performance Results System, PRS) so conservation partners and the public can gain fast and easy access to the accomplishments and the progress made toward strategies and performance goals. The web site is http://ias.sc.egov.usda.gov/prshome/default.html.

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 National Resources Inventory should be continued and GA EPD supports the PRS website.

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 are therefore regulated by NPDES permits and were 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 GA 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 activities prior to, during, and following mining to dispose of refuse and control erosion and sedimentation. 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 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 laws and regulations that affect them and provides a forum for the exchange of ideas. Through its newsletters, seminars, workshops, and annual conventions, the GMA 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, result in deterioration of the road surface. This leads to increased roadway erosion and, thus, stream sedimentation. Unpaved roads are typically maintained by 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,

dissipate turbulence or flatten flow grades 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 sediments 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 stream flows 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 stream flows 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 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 adapted 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. 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 State Soil and Water Conservation Commission, 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 Georgia Erosion and Sedimentation Act, O.C.G.A. §12-7-1 (amended in 2003). Reports of suspected violations are made to the agency that issued the permit. In cases with local issuing authority, if the violation continues, the complaint is referred to the appropriate Soil and Water Conservation District. If the situation remains unresolved, the complaint 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 Georgia 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 stream flow rates may increase significantly from pre-construction rates. These changes in the stream flow 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). Additional information on site design and best management practices to address stormwater run-off may

be found in the *Georgia Stormwater Management Manual* (the "Blue Book") (ARC, 2001) and Georgia's *Green Growth Guidelines* (GADNR, 2005), both of which are available electronically via the internet.

6.3 Reasonable Assurance

Permitted discharges will be regulated through the NPDES permitting process described in this report. Through its NPDES permitting process, GA EPD will determine whether a new discharger has a reasonable potential of discharging sediment levels equal to or greater than the total allocated load. The results of this reasonable potential analysis will determine the specific requirements in an individual facility's NPDES permit. As part of its analysis, the GA EPD will use its EPA approved 2003 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

Georgia is working with local governments, 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 to 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 was provided for this TMDL. During this time, the availability of the TMDL was public noticed, a copy of the TMDL was provided as requested, and the public was 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 best management practices 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 best management practice (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 category of contribution of the pollutant(s) of concern for the respective River Basin as identified in the TMDLs of the watersheds in the River Basin. 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, and 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 an 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 September 2009.

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 a 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 the Revised TMDL Implementation Plan is approved by GA EPD.

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

Annual Average Sediment Load Summary Memorandum

SUMMARY MEMORANDUM
Annual Average Sediment Load
Alligator Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Twiggs

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Alligator Creek
Location: Tributary to Ugly Creek
Stream Length: 6 miles
Watershed Area: 9.22 square miles
Tributary to: Big Sandy Creek

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) : 97.8 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 97.8 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Briar Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Morgan

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Briar Creek
Location: Headwaters to Hard Labor Creek
Stream Length: 4 miles
Watershed Area: 5.19 square miles
Tributary to: Hard Labor Creek

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): 192.2 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 192.2 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Carr Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Clarke

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Carr Creek
Location: Headwaters to North Oconee River, Athens
Stream Length: 2 miles
Watershed Area: 1.02 square miles
Tributary to: North Oconee River

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): 108.5 tons/yr
- Hanson Aggregates SE: 25 – 55 mg/L (49.3 – 108.5 tons/yr)
- Future Construction Sites: Meet requirements of General Storm Water Permit

Wasteload Allocations (WLAsw) : 11.2 tons/yr

Load Allocation (LA): 4.8 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 124.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Cedar Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Wilkinson

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Cedar Creek
Location: Headwaters to Maiden Creek
Stream Length: 11 miles
Watershed Area: 26.42 square miles
Tributary to: Maiden Creek

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): 1,002.1 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 1,002.1 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Crooked Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Jones

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Crooked Creek
Location: Headwaters to Commissioner Creek
Stream Length: 5 miles
Watershed Area: 2.49 square miles
Tributary to: Commissioner Creek

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): 220.1 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 220.1 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Crooked Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Laurens

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Crooked Creek
Location: Headwaters to Turkey Creek
Stream Length: 3 miles
Watershed Area: 6.09 square miles
Tributary to: Turkey Creek

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): 456.7 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 456.7 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Crooked Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Putnam

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Crooked Creek
Location: Putnam County
Stream Length: 9 miles
Watershed Area: 3.74 square miles
Tributary to: Lake Sinclair / Oconee River

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): 194.6 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 194.6 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Cypress Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Montgomery

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Cypress Creek
Location: Little Cypress Creek to Oconee River
Stream Length: 4 miles
Watershed Area: 20.98 square miles
Tributary to: Oconee River

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): 1,920.1 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 1,920.1 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Freeman Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Oconee

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Freeman Creek
Location: Headwaters to Apalachee River
Stream Length: 4 miles
Watershed Area: 5.26 square miles
Tributary to: Apalachee River

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): 206.9 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 206.9 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Hardeman Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Jackson

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Hardeman Creek
Location: Headwaters to Sandy Creek
Stream Length: 5 miles
Watershed Area: 2.08 square miles
Tributary to: Sandy Creek

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): 254.5 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 254.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Keg Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Washington

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Keg Creek
Location: Little Keg Creek to Buffalo Creek
Stream Length: 8 miles
Watershed Area: 94.61 square miles
Tributary to: Buffalo Creek

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):	**2,177.2 tons/yr**
Sandersville WPCP (GA0032051)	**30 mg/L (77.6 tons/yr)**
IMERYS Clays Inc. (GA0002135), outfall 001	**25 – 50 mg/L (148.9 – 297.9 tons/yr)**
IMERYS Clays Inc. (GA0002135), outfall 002	**25 – 50 mg/L (365.8 – 731.7 tons/yr)**
IMERYS Clays Inc. (GA0047309)	**25 – 55 mg/L (486.4 – 1,070.0 tons/yr)**
Future Construction Sites	**Meet requirements of General Storm Water Permit**
Load Allocation (LA):	**6,641.4 tons/yr**
Margin of Safety (MOS):	**implicit**
Annual Average Sediment Load:	**8,818.6 tons/yr**

SUMMARY MEMORANDUM
Annual Average Sediment Load
Lamars Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Washington

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Lamars Creek
Location: Headwaters to Buffalo Creek
Stream Length: 8 miles
Watershed Area: 20.71 square miles
Tributary to: Buffalo Creek

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): 42.5 tons/yr
IMERYS Clays Inc. (GA0002780), outfall 002: 25 – 50 mg/L (21.3 – 42.5 tons/yr)
Future Construction Sites: Meet requirements of General Storm Water Permit

Load Allocation (LA): 1,773.0 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 1,815.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Limestone Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Montgomery

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Limestone Creek
Location: Mount Vernon to Oconee River
Stream Length: 2 miles
Watershed Area: 5.11 square miles
Tributary to: Oconee River

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): 12.3 tons/yr
- Mount Vernon WPCP: 30 mg/L (12.3 tons/yr)
- Future Construction Sites: Meet requirements of General Storm Water Permit

Load Allocation (LA): 464.1 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 476.4 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Limestone Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Washington

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Limestone Creek
Location: Kaolin Road to Keg Creek
Stream Length: 8 miles
Watershed Area: 7.33 square miles
Tributary to: Keg Creek

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):	**132.2 tons/yr**
IMERYS Clays Inc. (GA0046329)	**25 – 50 mg/L (14.7 – 29.5 tons/yr)**
Kentucky-Tennessee Clay Co. (GA0003387)	**25 – 50 mg/L (5.6 – 11.1 tons/yr)**
Thiele Kaolin (GA0002453), outfall 001	**25 – 50 mg/L (22.9 – 45.8 tons/yr)**
Thiele Kaolin (GA0002453), outfall 002	**25 – 50 mg/L (22.9 – 45.8 tons/yr)**
Future Construction Sites	**Meet requirements of General Storm Water Permit**
Load Allocation (LA):	**551.4 tons/yr**
Margin of Safety (MOS):	**implicit**
Annual Average Sediment Load:	**683.6 tons/yr**

SUMMARY MEMORANDUM
Annual Average Sediment Load
Little Commissioner Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Wilkinson

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Little Commissioner Creek
Location: Ga. Hwy. 18 to Commissioner Creek
Stream Length: 9 miles
Watershed Area: 43.88 square miles
Tributary to: Commissioner Creek

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): 1,348.9 tons/yr
Gordon WPCP (GA0020397) 30 mg/L (34.2 tons/yr)
Martin Marietta Aggregates (GA0002330) 25 – 55 mg/L (40.6 – 89.3 tons/yr)
Engelhard Corp. (GA0003131), outfall 00425 – 50 mg/L (106.2 – 212.3 tons/yr)
Engelhard Corp. (GA0003131), outfall 00525 – 50 mg/L (226.4 – 452.8 tons/yr
Engelhard Corp. (GA0003271), outfall 00125 – 50 mg/L (278.2 – 556.3 tons/yr)
Engelhard Corp. (GA0003271), outfall 00225 – 50 mg/L (2.0 – 3.9 tons/yr) **Future Construction Sites** Meet requirements of General Storm Water Permit

Load Allocation (LA): 2,741.4 tons / yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 4,090.3 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Little Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Greene

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Little Creek
Location: Headwaters to Richland Creek
Stream Length: 3 miles
Watershed Area: 4.83 square miles
Tributary to: Richland Creek

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): 64.5 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 64.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Little Fishing Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Baldwin

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Little Fishing Creek
Location: Baldwin County
Stream Length: 5 miles
Watershed Area: 7.69 square miles
Tributary to: Fishing Creek

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): 939.7 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 939.7 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Lotts Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Wheeler

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Lotts Creek
Location: Headwaters to Oconee River
Stream Length: 5 miles
Watershed Area: 5.35 square miles
Tributary to: Oconee River

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): 184.4 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 184.4 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Marburg Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Barrow

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Marburg Creek
Location: Marburg Lake to Masseys Lake
Stream Length: 1 mile
Watershed Area: 3.50 square miles
Tributary to: Apalachee River

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): 427.0 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 427.0 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Noketchee Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Madison / Clarke

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Noketchee Creek
Location: Headwaters to Sandy Creek
Stream Length: 5 miles
Watershed Area: 2.82 square miles
Tributary to: Sandy Creek

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

Wasteload Allocations (WLAsw): 63.2 tons/yr

Load Allocation (LA): 71.6 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 134.8 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Ochwalkee Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Laurens

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Ochwalkee Creek
Location: Mayberry Road to U / S Little New York Road
Stream Length: 5 miles
Watershed Area: 11.48 square miles
Tributary to: Oconee River

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): 514.5 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 514.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Ochwalkee Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Laurens / Wheeler

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Ochwalkee Creek
Location: U / S Little New York Rd. to Oconee River
Stream Length: 18 miles
Watershed Area: 61.19 square miles
Tributary to: Oconee River

Constituent(s) of Concern: Sediment

Designated Use: Fishing (not 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): 4,901.7 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 4,901.7 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Peterson Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Wheeler

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Peterson Creek
Location: Headwaters to Oconee River
Stream Length: 8 miles
Watershed Area: 6.58 square miles
Tributary to: Oconee River

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): 15.1 tons/yr
- Glenwood WPCP: 90 mg/L (15.1 tons/yr)
- Future Construction Sites: Meet requirements of General Storm Water Permit

Load Allocation (LA): 192.8 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 207.9 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Red Bluff Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Treutlen

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Red Bluff Creek
Location: Little Red Bluff Creek to Oconee River
Stream Length: 3 miles
Watershed Area: 30.50 square miles
Tributary to: Oconee River

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): 3,290.3 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 3,290.3 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Reedy Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Laurens

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Reedy Creek
Location: Headwaters to Turkey Creek
Stream Length: 7 miles
Watershed Area: 17.20 square miles
Tributary to: Turkey Creek

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): 1,504.5 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 1,504.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Rocky Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Laurens

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Rocky Creek
Location: Bay Branch to Buckhorn Branch
Stream Length: 6 miles
Watershed Area: 62.71 square miles
Tributary to: Turkey Creek

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): 5,844.7 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 5,844.7 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Rooty Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Putnam

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Rooty Creek
Location: Rd. S926, Eatonton to Little Creek
Stream Length: 9 miles
Watershed Area: 8.47 square miles
Tributary to: Lake Sinclair / Oconee River

Constituent(s) of Concern: Sediment

Designated Use: Fishing (not 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): 12.6 tons/yr
Eatonton Eastside WPCP: 15 mg/L (12.6 tons/yr)
Future Construction Sites: Meet requirements of General Storm Water Permit

Load Allocation (LA): 644.9 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 657.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Sandy Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Jones / Twiggs

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Sandy Creek
Location: Headwaters to Harrison's Lake / Little Sandy Creek
Stream Length: 6 miles
Watershed Area: 5.13 square miles
Tributary to: Big Sandy Creek

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): 369.5 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 369.5 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Sandy Run Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Hancock

Major River Basin: Upper Oconee
8-Digit Hydrologic Unit Code(s): 03070101

Waterbody Name: Sandy Run Creek
Location: Hancock County
Stream Length: 5 miles
Watershed Area: 4.97 square miles
Tributary to: Lake Sinclair / Oconee River

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): 155.4 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 155.4 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Tiger Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Hancock / Washington

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Tiger Creek
Location: Headwaters to Buffalo Creek
Stream Length: 5 miles
Watershed Area: 2.67 square miles
Tributary to: Buffalo Creek

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): 48.9 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 48.9 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Tobler Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Baldwin

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Tobler Creek
Location: Baldwin County
Stream Length: 8 miles
Watershed Area: 3.06 square miles
Tributary to: Oconee River

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): 94.9 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 94.9 tons/yr

SUMMARY MEMORANDUM
Annual Average Sediment Load
Zoie Brown Creek

1. 303(d) Listed Waterbody Information

State: Georgia
County: Hancock

Major River Basin: Lower Oconee
8-Digit Hydrologic Unit Code(s): 03070102

Waterbody Name: Zoie Brown Creek
Location: Tributary to Buffalo Creek
Stream Length: 3 miles
Watershed Area: 5.93 square miles
Tributary to: Buffalo Creek

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): 202.4 tons/yr

Margin of Safety (MOS): implicit

Annual Average Sediment Load: 202.4 tons/yr