Total Maximum Daily Load

Evaluation

for

Twenty Nine Stream Segments

in the

Chattahoochee River Basin

for

Sediment

22 Fish Community Impacted
6 Macroinvertebrate Community Impacted
1 Fish & Macroinvertebrate Community Impacted

Submitted to:
The U.S. Environmental Protection Agency
Region 4
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Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
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EXECUTIVE SUMMARY

The state of Georgia assesses its water bodies for compliance with water quality criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, 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 2012-2013* (GA EPD, 2014). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

The subset of the water bodies that do not meet designated uses on the 305(b) list are also assigned to Georgia's 303(d) list, named after that section of the CWA. Although the 305(b) and 303(d) lists are two distinct requirements under the CWA, Georgia reports both lists in one combined format called the Integrated 305(b)/303(d) List, which is found in Appendix A of *Water Quality in Georgia*. Water bodies on the 303(d) list are denoted as Category 5, and 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 TMDLs in this document are based on the 2014 303(d) listing, which is available on the GA EPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and instream 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 twenty-nine (29) stream segments located in the Chattahoochee River Basin as Biota Impacted. The Biota Impacted designation indicates that studies have shown a degradation of the biological populations in the stream, either in the fish community or benthic macroinvertebrate community. The water use classification of the Chattahoochee River is Recreation, the Soque River is Drinking Water, and all the impacted streams or rivers is Fishing. The general and specific water quality criteria for Fishing, Recreation, and Drinking Water streams are stated in Georgia's *Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03, Sections (5) and (6) (GA EPD, 2015).

Starting in 1998 and continuing periodically through 2013, the Georgia Department of Natural Resources (GA DNR) Wildlife Resources Division (GA WRD) has conducted studies of fish populations in rivers and streams across the state. GA WRD used the Index of Biotic Integrity (IBI) to classify fish populations as Excellent, Good, Fair, Poor, or Very Poor. For this TMDL evaluation, twenty-three (23) stream segments in the Chattahoochee River Basin have fish populations rated as Poor or Very Poor. For these stream segments, the criterion violated is listed as Bio F, denoting Biota Impacted (Fish Community). These stream segments are included on the list of streams not supporting their designated use, and placed in Category 5. These streams are water quality limited due to sedimentation. Eight (8) stream segments in the Chattahoochee River Basin were rated as Excellent or Good and assessed as supporting their designated use. These Excellent and Good rated supporting stream segments were used to set the sediment yield target for the not supporting streams.

Starting in 2000 and continuing periodically through 2016, GADNR Environmental Protection Division (GA EPD) and their contractors have conducted studies of benthic macroinvertebrate communities in wadeable rivers and streams throughout the state. GA EPD used a Multi-Metric Index (MMI) to classify benthic macroinvertebrates populations as Very Good, Good, Fair, Poor,

or Very Poor. For this TMDL evaluation, seven (7) stream segments in the Chattahoochee River Basin have benthic macroinvertebrate populations rated as Poor or Very Poor. For these stream segments, the criterion violated is listed as Bio M, denoting Biota Impacted (Macroinvertebrate Community). These stream segments are included on the list of streams not supporting their designated use, and placed in Category 5. Again, these streams are water quality limited due to sedimentation. Thirteen (13) stream segments throughout comparable Level IV ecoregions in Georgia were rated as Very Good or Good and assessed as supporting their designated use. These Very Good and Good rated supporting stream segments were used to set the sediment yield target for the not supporting streams.

The most common cause of low IBI (fish) and MMI (benthic macroinvertebrates) scores is the lack of in-stream habitat due to stream sedimentation and hydrological modifications. However, high levels of heavy metals, ammonia, chlorine, elevated temperatures, low dissolved oxygen levels, and extreme pH levels are possible sources of toxicity, and can adversely affect the aquatic communities. These parameters are typically due to point source discharges and are regulated through National Pollutant Discharge Elimination System (NPDES) permits. They are not the focus of this TMDL evaluation.

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 not supporting stream segments and their watersheds utilized the Universal Soil Loss Equation (USLE). The USLE predicts the total annual soil loss caused by sheet and rill erosion. The USLE method considers the characteristics of the watershed including land use, soil type, ground slope, and rainfall intensity. NPDES permitted discharges were also considered in the final sediment load reduction calculations. Modeling assumptions were considered to be conservative and provide the necessary implicit margin of safety for the TMDL.

This TMDL evaluation determined the sediment loads that can enter the 303(d) listed streams in the Chattahoochee River Basin without causing sediment impairments 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 will not be biologically impaired due to sediment. For fish populations, Georgia's 305(b)/303(d) Listing Assessment Methodology defines a stream as supporting its designated use when a biological assessment results in an IBI narrative rating of Excellent, Good, or Fair. Similarly, a stream is supporting its designated use when a macroinvertebrate biological assessment results in a MMI narrative ranking of Very Good or Good. MMI rankings of Fair are placed in Category 3, assessment pending.

The USLE was applied to the supporting watersheds, as well as the not supporting 303(d) listed watersheds in the same ecoregion or subecoregion, to determine both the existing sediment yields and the sediment load reductions needed to support the beneficial uses (i.e., least impacted conditions). In this TMDL, fish community health rankings are analyzed and compared at an ecoregion level (Level III). Macroinvertebrate community health rankings are analyzed and compared at a subecoregion level (Level IV). Table 1 provides the average, minimum, and maximum modeled sediment yield for the ecoregions in which fish communities have been monitored and observed. Table 2 provides the average, minimum, and maximum modeled sediment yield for the subecoregions in which macroinvertebrate communities have been monitored and observed.

Table 1. Modeled Sediment Yield Summary for Fish Bioassessment Streams

Modeled Sediment Yield (Tons/Acre/Yr) - Fish Community Assessment						
Ecoregion	Supporting Streams			Not Supporting Streams		
	Average	Minimum	Maximum	Average	Minimum	Maximum
Piedmont – 45	1.15	0.30	1.73	0.89	0.19	4.25

Table 2. Modeled Sediment Yield Summary for Macroinvertebrate Bioassessment Streams

Modeled Sediment Yield (Tons/Acre/Yr) - Macroinvertebrate Community Assessment						
Subecoregion	Supporting Streams			Not Supporting Streams		
	Average	Minimum	Maximum	Average	Minimum	Maximum
Piedmont- 45a	1.07	0.73	1.30	0.44	0.19	0.68
Piedmont- 45b	0.66	0.20	1.17	0.19	0.19	0.19
Southeastern Plain – 65d	1.13	0.09	2.97	0.84	0.14	1.39

Currently, agricultural lands may be the major source of sediment to the state's rivers and streams. However, over the last century there has been a significant 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, the streams will repair themselves over time.

In the case of both fish and macroinvertebrate watersheds evaluated, the average sediment yield of supporting watersheds was utilized to formulate the total allowable sediment load for the not supporting watersheds. The total allowable sediment loads for the not supporting fish and macroinvertebrate watersheds are summarized in Table 3 along with required sediment load reductions.

Table 3. Total Allowable Sediment Loads and the Required Sediment Load Reductions

Stream Segment	Station ID	Current Load				TMDL		
		WLA (tons/yr)	WLA_{sw} (tons/yr)	LA (tons/yr)	Total Load (tons/yr)	Total Allowable Sediment Load (tons/yr)	Maximum Allowable Daily Load (tons/day)	Required % Reduction
Not Supporting Segments - Fish Community								
Blue John Creek	WRD 226		0.0	3980.9	3980.9	3980.9	515.9	0%
Brushy Creek	WRD 1039		976.7	798.3	1959.5	1775.0	230.0	9.4%
Cane Creek	WRD 701		0.0	1335.2	1335.2	1335.2	173.0	0%
Cauley Creek	WRD 1103		193.9	357.4	551.4	551.4	71.5	0%

Stream Segment	Station ID	Current Load				TMDL		
		WLA (tons/yr)	WLA_{sw} (tons/yr)	LA (tons/yr)	Total Load (tons/yr)	Total Allowable Sediment Load (tons/yr)	Maximum Allowable Daily Load (tons/day)	Required % Reduction
Cavenders Creek	WRD 1211		0.0	1288.6	1288.6	1288.6	167.0	0%
Chattahoochee River	WRD 765		0.0	13539.3	13539.3	13539.3	1754.7	0%
Crooked Creek	WRD 1038		3187.6	2292.2	5479.8	5479.8	710.2	0%
Foe Killer Creek	WRD 1052	0.5	1321.4	1209.8	2532.1	2531.6	328.1	0%
Haw Creek	WRD 607		919.7	1537.1	4007.4	2456.8	318.4	38.7%
Johns Creek	WRD 1051		1909.5	1773.3	3682.8	3682.8	477.3	0%
Level Creek	WRD 1040		2040.2	2649.2	4689.4	4689.4	607.8	0%
Little Tesnatee Creek	WRD 702		0.0	3678.9	3678.9	3678.9	476.8	0%
Marsh Creek (aka March Creek)	WRD 1101		488.8	398.8	887.6	887.6	115.0	0%
Richland Creek	WRD 1041	11.4	2628.3	4279.4	25651.3	6919.1	896.7	73.0%
Sand Creek	WRD 1133		0.0	748.6	748.6	748.6	97.0	0%
Sope Creek	WRD 1109		5375.9	4586.6	9962.4	9962.4	1291.1	0%
Soque River	WRD 764		0.0	18750.1	18750.1	18750.1	2430.0	0%
South Fork Peachtree Creek	WRD 689	0.1	1628.4	1755.3	3384.0	3383.9	438.5	0%
Tate Creek	WRD 1210		0.0	1709.5	1709.5	1709.5	221.5	0%
Tributary #1 to the Chattahoochee River	WRD 1100		280.7	192.1	472.8	472.8	61.3	0%
Tributary #2 to the Chattahoochee River	WRD 1102		80.7	96.6	177.3	177.3	23.0	0%
Tributary to Williams Creek	WRD 1130		0.0	1145.5	1258.8	1145.5	148.5	9.0%
Williams Creek	WRD 1129		0.0	1059.3	2817.5	1059.3	137.3	62%
Not Supporting Segments - Macroinvertebrate Community								
North Fork Peachtree Creek	EPD 45b-202	0.5	1953.4	2235.7	4190.0	4189.5	543.0	0%
Olley Creek	EPD 45a-61		2843.0	3092.0	5935.0	5935.0	769.2	0%
Pataula Creek	EPD 65d-22		0.0	5906.9	7272.6	5906.9	155.9	19%
Rottenwood Creek	EPD 45a-59		739.6	460.6	1200.2	1200.2	155.5	0%
South Fork Peachtree Creek	EPD 45b-203	0.1	1628.4	1755.3	3384.0	3383.9	438.5	0%
Talipahoga Rum Creek	EPD 65d-17		0.0	3028.8	3028.8	3028.8	80.0	0%
Weracoba Creek	EPD 65d-1		399.6	220.1	619.6	619.6	16.4	0%

Definitions:

Current Total Load - Sum of modeled sediment load and approved waste load allocations (WLA)
WLA - waste load allocation for discrete point sources

WLA_{sw} - waste load allocation associated with storm water discharges from a municipal separate storm sewer system (MS4)
LA - portion of the total allowable sediment load attributed to nonpoint sources and natural background sources of sediment
Total Allowable Sediment Load - allowable sediment load calculated using the target sediment yield and the stream's watershed area
Maximum Allowable Daily Load - total allowable sediment load (annual) converted to a daily figure based on the bankfull sediment transport relationship
% Reduction - percent reduction applied to current load in order to meet total allowable sediment load

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

- Compliance with NPDES (wastewater, construction, industrial stormwater, and/or MS4) permit limits and requirements;
- Implementation of recommended Water Quality management practices in the *Coosa-North Georgia Regional Water Plan* (GA EPD, 2017) and the *Middle Chattahoochee Regional Water Plan* (GA EPD, 2017) ;
- Implementation of required Action Items in the *Water Resource Management Plan* developed by the Metro-North Georgia Water Planning District (MNGWPD, 2017)
- Implementation of *Georgia's Best Management Practices for Forestry* (GFC, 2009);
- Implementation of *Best Management Practices for Georgia Agriculture* (GSWCC, 2013) and Adoption of National Resource Conservation Service (NRCS) Conservation Practices for agriculture;
- Adherence to the Surface Mining Land Use Plan prepared as part of the Surface Mining Permit Application;
- Implementation of the *Georgia Better Back Roads Field Manual* (GA RCDC, 2009) and adoption of additional practices for proper unpaved road maintenance;
- Implementation of individual Erosion and Sedimentation Control Plans for land disturbing activities; and application of the *Manual for Erosion and Sediment Control in Georgia* (GSWCC, 2016)
- Implementation of the *Georgia Stormwater Management Manual* (ARC, 2016) to facilitate prevention and mitigation of stream bank erosion due to increased stream flow and velocities caused by urban runoff through structural storm water BMP installation.
- Where applicable, implementation of the *Coastal Stormwater Supplement to the Georgia Stormwater Management Manual* (CCSMPC, 2009).

Although 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 criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, 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 2012-2013* (GA EPD, 2014). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

The subset of the water bodies that do not meet designated uses on the 305(b) list are also assigned to Georgia's 303(d) list, named after that section of the CWA. Although the 305(b) and 303(d) lists are two distinct requirements under the CWA, Georgia reports both lists in one combined format called the Integrated 305(b)/303(d) List, which is found in Appendix A of *Water Quality in Georgia 2012-2013* (GA EPD, 2014). Water bodies on the 303(d) list are denoted as Category 5, and 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 TMDLs in this document are based on the 2014 303(d) listing, which is available on the GA EPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

1.2 Fish Community Sampling

During the years 1998 through 2013, the Georgia Department of Natural Resources (GA DNR) Wildlife Resources Division (GA WRD) conducted studies of fish community populations in several streams in the Chattahoochee River Basin. From the data collected, two indices of fish community health were established and used to assess the biotic integrity of the aquatic systems: the Index of Biotic Integrity (IBI) and the modified Index of Well-Being (IWB).The IBI and IWB numerical scores were developed by analyzing field data collected at each sampling site according to ecoregion-specific scoring criteria developed by GA WRD. These numerical scores were further classified into the integrity classes of Excellent, Good, Fair, Poor, or Very Poor.

According to the 2014 305(b)/303(d) Listing Assessment Methodology in Appendix A of *Water Quality in Georgia 2012-2013* (GA EPD, 2014), fish sampling sites and their corresponding stream segments with fish population IBI rated as Poor or Very Poor do not support their designated uses. Fish sampling sites that score in the lower end of the Fair IBI range are also determined not to be supporting their use designation if the corresponding site IWB score is either Poor or Very Poor. Starting in the 2014 listing cycle, the IWB is no longer used in assessment and listing decisions. This has resulted in all streams receiving an IBI rating of Fair being placed in the supporting designated use list. The fish sampling sites and corresponding stream segments that do not support their designated use are included in the Integrated 305(b)/303(d) List with the criterion violated noted as Biota Impacted - Fish Community, and the segments are placed in Category 5 until a TMDL is completed.

In the Chattahoochee River Basin, twenty three (23) stream segments in the Piedmont ecoregion are rated as Poor or Very Poor, and are on the 303(d) list as not supporting their designated use, and are scheduled for a TMDL evaluation, as presented in Table 4. Eight (8) stream segments in the Piedmont ecoregion are rated as Excellent or Good, and assessed as supporting their designated use. The supporting stream segments rated Excellent and Good are used to set the sediment yield target from which the total allowable sediment load for the not supporting stream segments is calculated.

Table 4. Stream Segments on the 2014 303(d) List as Biota Impacted - Fish Community

Stream Segment	Ecoregion	Location	Reach ID	Segment Length (mi)	Designated Use
Blue John Creek	Piedmont	Troup Branch to Long Cane Creek	GAR031300020910	3	Fishing
Brushy Creek	Piedmont	Headwaters to the Chattahoochee River	GAR031300010915	5	Fishing
Cane Creek	Piedmont	Tributary to Chestatee River near Dahlonega	GAR031300010604	8	Fishing
Cauley Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010914	2	Fishing
Cavenders Creek	Piedmont	Headwaters to Chestatee River	GAR031300010605	2	Fishing
Chattahoochee River	Piedmont	Ga. Hwy. 17, Helen to SR255	GAR031300010107	8	Recreation
Crooked Creek	Piedmont	Tributary to Chattahoochee River	GAR031300010909	2	Fishing
Foe Killer Creek	Piedmont	Headwaters to Big Creek	GAR031300011003	7	Fishing
Haw Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010901	3	Fishing
Johns Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010903	4	Fishing
Level Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010904	5	Fishing
Little Tesnatee Creek	Piedmont	Freeman Creek to upstream Hwy. 129	GAR031300010501	3	Fishing
Marsh Creek (aka March Creek)	Piedmont	Headwaters to Chattahoochee River	GAR031300011102	4	Fishing
Richland Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010906	5	Fishing
Sand Creek	Piedmont	Headwaters to House Creek	GAR031300021018	9	Fishing
Sope Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300011105	11	Fishing
Soque River	Piedmont	Goshen Creek to SR 17, Clarkesville	GAR031300010202	29	Fishing, Drinking Water
South Fork Peachtree Creek	Piedmont	Headwaters to Peachtree Creek, Atlanta	GAR031300011207	15	Fishing
Tate Creek	Piedmont	Headwaters to Chestatee River	GAR031300010512	4	Fishing
Tributary #1 to the Chattahoochee River	Piedmont	Headwaters to the Chattahoochee River	GAR031300010917	3	Fishing

Stream Segment	Ecoregion	Location	Reach ID	Segment Length (mi)	Designated Use
Tributary #2 to the Chattahoochee River	Piedmont	Headwaters to the Chattahoochee River	GAR031300011117	2	Fishing
Tributary to Williams Creek	Piedmont	Headwaters to Williams Creek	GAR031300021207	2	Fishing
Williams Creek	Piedmont	Headwaters to Mulberry Creek	GAR031300021212	4	Fishing

1.3 Benthic Macroinvertebrate Community Monitoring

During the years 2000 through 2004, the Department of Environmental Science at Columbus State University (CSU) conducted field studies of benthic macroinvertebrate community populations in several streams in the Chattahoochee River Basin as part of a multi-phase project to establish multi-metric indices and a numerical scoring system for the Georgia Environmental Protection Division (GA EPD). Using the data collected, multi-metric indices were produced and the biotic integrity of the streams were evaluated. The macroinvertebrate multi-metric index numerical scores were calculated by analyzing macroinvertebrate assemblage data collected at each sampling site according to ecoregion-specific scoring criteria developed by CSU. For each stream, the index numerical scores were ranked, described, and rated. A stream received a ranking between 1 and 5, which corresponded with a narrative description of Very Good, Good, Fair, Poor, and Very Poor. The stream's "health" rating combines the two top categories of Very Good and Good for an "A" rating, Fair for a "B" rating, and Poor and Very Poor for a "C" rating.

According to the 2014 305(b)/303(d) Listing Assessment Methodology in Appendix A of *Water Quality in Georgia 2012-2013* (GA EPD, 2014), macroinvertebrate sampling sites and their corresponding stream segments with narrative description of "Poor" or "Very Poor" do not support their designated uses. The macroinvertebrate sampling sites and corresponding stream segments that do not support their designated use are included in the Integrated 305(b)/303(d) List with the criterion violated noted as Biota Impacted - Macroinvertebrate Community and the segments are placed in Category 5 until a TMDL is completed.

In the Chattahoochee River Basin, two (2) stream segments in the Piedmont subecoregion 45a, two (2) stream segments in the Piedmont subecoregion 45b, and three (3) stream segments in the Southeastern Plains subecoregion 65d are rated as Poor or Very Poor, are on the 303(d) list as not supporting their designated use, and are scheduled for a TMDL evaluation, as presented in Table 5. Four (4) stream segments in the Piedmont subecoregion 45a, six (6) stream segments in the Piedmont subecoregion 45b, and three (3) stream segments in the Southeastern Plains subecoregions 65d are rated as Excellent or Good and assessed as supporting their designated use. These supporting stream segments are used to set the sediment yield target from which the total allowable sediment load for the not supporting stream segments is calculated.

Table 5. Stream Segments on the 2014 303(d) List as Biota Impacted - Macroinvertebrate Community

Stream Segment	Sub-ecoregion	Location	Reach ID	Segment Length (mi)	Designated Use
North Fork Peachtree Creek	45b	Headwaters to Peachtree Creek	GAR031300011204	14	Fishing
Olley Creek	45a	Headwaters to Sweetwater Creek	GAR031300020204	11	Fishing
Pataula Creek	65d	Headwaters to Clear Creek	GAR031300031502	9	Fishing
Rottenwood Creek	45a	Headwaters to Chattahoochee River	GAR031300011103	9	Fishing
South Fork Peachtree Creek	45b	Headwaters to Peachtree Creek, Atlanta	GAR031300011207	15	Fishing
Talipahoga Rum Creek	65d	Headwaters to Bradley Lake Tributary	GAR031300030903	4	Fishing
Weracoba Creek	65d	Columbus (upstream of Bull Creek)	GAR031300030104	6	Fishing

1.4 Water Quality Criteria

The stream segments listed in Tables 4 and 5 have the designated uses of Fishing, Drinking Water, and Recreation. The general and specific criteria for Fishing, Drinking Water, and Recreational waters are stated in Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03, Sections (5) and (6) (GA EPD, 2015). The listed criterion violated is Biota Impacted and is a violation of Georgia's narrative criteria, 391-3-6-.03(5)(e).

> "*All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life*."

Studies conducted by GA WRD and GA EPD indicate significantly degraded fish communities, and/or macroinvertebrate communities. The potential causes listed include nonpoint/unknown sources (NP) and urban runoff/urban effects (UR).

1.5 Watershed Description

The twenty three (23) not supporting fish community stream segments and their associated watersheds, located in the Chattahoochee River Basin, are within the boundaries of Cobb, DeKalb, Forsyth, Fulton, Gwinnett, Habersham, Harris, Lumpkin, Rabun, Towns, Troup, Union, and White Counties. The eight (8) supporting stream segments and their associated watersheds are located in Carroll, Harris, and Heard Counties.

The seven (7) not supporting macroinvertebrate community stream segments and their associated watersheds, located in Chattahoochee River Basin, are within the boundaries of Cobb, DeKalb, Fulton, Gwinnett, Muscogee, and Stewart Counties. The thirteen (13) supporting stream segments and their associated watersheds are distributed throughout north and central

Georgia in subecoregions that correspond to those of the not supporting macroinvertebrate stream segments.

Figure 1 shows a state-level view of the fourteen river basins in Georgia, with the Chattahoochee River Basin highlighted in yellow. Figures 2 and 3 show a detailed view of the Chattahoochee River Basin, its USGS 8-digit subbasins, major streams and waterbodies, counties, and county seats. Figures 4, 5, and 6 show the not supporting stream segments and their associated watersheds where fish communities were. Figures 7 and 8 show the not supporting stream segments and their associated watersheds where macroinvertebrate communities were sampled. All supporting and not supporting watersheds are located in either the Piedmont or Southeastern Plains ecoregions.

1.5.1 Ecoregions and Subecoregions

In Georgia, the criteria and metrics used to evaluate the health of both fish communities and benthic macroinvertebrates communities has been developed for geographically specific regions due to the diverse terrestrial landscape and aquatic habitats found throughout the state. GADNR, in collaboration with other state and federal agencies, have worked to establish a general-purpose, geographical framework that categorizes the state into logical divisions of similar geology, physiography, soils, vegetation, land use, and water quality.

This collaborative group of agencies, led by the United States Environmental Protection Agency (USEPA), established and further refined a nationwide framework of ecological regions for the research, assessment, management, and monitoring of ecosystems and ecosystem components. These ecological regions, or ecoregions, denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. The current level III ecoregions were refined from the dataset created in 1987 by James Omernik at the USEPA National Health and Environmental Effects Research Laboratory. Level IV ecoregions, or subecoregions, are a further subdivision of the level III ecoregions that display details at a high resolution (Griffith et al. 2001).The six level III ecoregions established in Georgia are listed in Table 6. Figure 9 shows the distribution of Level III ecoregions in Georgia. When fish community health is being studied and evaluated, ecoregions are used as a means to divide the state into geographic areas with similar characteristics. The six level III ecoregions in Georgia are divided into 27 level IV ecoregions, also known as subecoregions. These subecoregions are currently used as the means to divide the state into geographic areas for study and evaluation when the health of benthic macroinvertebrate communities is of concern. Figure 10 shows the distribution of Level IV ecoregions in Georgia.

Table 6. Ecoregions in Georgia

Ecoregion Name	Ecoregion ID	Ecoregion Description
Piedmont	**45**	The Piedmont ecoregion comprises a transitional area between the mostly mountainous ecoregions of the Appalachians to the northwest and the relatively flat coastal plain to the southeast. It is a complex mosaic of Precambrian and Paleozoic metamorphic and igneous rocks with moderately dissected irregular plains and some hills. The soils tend to be finer-textured than in coastal plain regions. Once largely cultivated, much of this region has reverted to pine and hardwood woodlands, and, more recently, spreading urban- and suburbanization.
Southeastern Plains	**65**	These irregular plains with broad interstream areas have a mosaic of cropland, pasture, woodland, and forest. Natural vegetation is mostly oak-hickory-pine and Southern mixed forest and soils consist of Cretaceous or Tertiary-age sands, silts, and clays. Elevations and relief are greater than in the Southern Coastal Plain (75), but generally less than in much of the Piedmont. Streams in this area are relatively low-gradient and sandy-bottomed.

Ecoregion Name	Ecoregion ID	Ecoregion Description
Blue Ridge	**66**	The Blue Ridge varies from narrow ridges to hilly plateaus to more massive mountainous areas with high peaks. The mostly forested slopes, high-gradient, cool, clear streams, and rugged terrain occur on a mix of igneous, metamorphic, and sedimentary geology. The southern Blue Ridge is one of the richest centers of biodiversity in the eastern U.S.
Ridge and Valley	**67**	This is a relatively low-lying region between the Blue Ridge (66) to the east and the Southwestern Appalachians (68) on the west. As a result of extreme folding and faulting events, the roughly parallel ridges and valleys come in a variety of widths, heights, and geologic materials. Springs and caves are relatively numerous. Land cover is mixed and present-day forests cover about 50% of the region. Forested ridges, and valleys with pasture and cropland, are typical. Its diverse habitats contain many unique species of terrestrial and aquatic flora and fauna.
Southwestern Appalachians	**68**	These low mountains contain a mosaic of forest and woodland with some cropland and pasture. The mixed mesophytic forest is restricted mostly to the deeper ravines and escarpment slopes, and the summit or tableland forests are dominated by mixed oaks with shortleaf pine.
Southern Coastal Plain	**75**	This is a heterogeneous region containing barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. This ecoregion is generally lower in elevation with less relief and wetter soils than ecoregion 65. Once covered by a variety of forest communities that included trees of longleaf pine, slash pine, pond pine, beech, sweetgum, southern magnolia, white oak, and laurel oak, land cover in the region is now mostly slash and loblolly pine with oak-gum-cypress forest in some low lying areas, citrus groves, pasture for beef cattle, and urban.

1.5.2 State Water Planning

The Georgia Legislature enacted the Metropolitan North Georgia Water Planning District Act in 2001 to create the Metropolitan North Georgia Water Planning District (MNGWPD) to preserve and protect water resources in the 15-county metropolitan Atlanta area. The MNGWPD is charged with the development of comprehensive regional and watershed specific water resource management plans to be implemented by local governments in the metropolitan Atlanta area. The MNGWPD issued its first water resource management plan documents in 2003.

In 2004, the Georgia Legislature enacted the Comprehensive State-wide Water Management Planning Act to ensure management of water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens on a state-wide level. GA EPD later developed the 2008 Comprehensive State-wide Water Management Plan, which established Georgia's ten Regional Water Planning Councils (RWPCs) and laid the groundwork for the RWPCs to develop their own Regional Water Plans. The boundaries of these ten RWPCs, in addition to the MNGWPD, are shown in Figure 11.

In 2011, each RWPC finished development of individualized Regional Water Plans, which were later adopted following GA EPD review. These Regional Water Plans identify a range of actions or management practices to help meet the state's water quality and water supply challenges. The MNGWPD and each RWPC subsequently updated and revised their respective management plan documents in 2017. Implementation of these plans is critical to meeting Georgia's water resource challenges. The specific Regional Water Plan(s) applicable to this TMDL are discussed in Sections 6 and 7.

1.5.3 Land Use

The land use characteristics of the Chattahoochee River Basin watersheds were determined using data from the 2008 Georgia Land Use Trends (GLUT). This raster land use trend product was developed by the University of Georgia – Natural Resources Spatial Analysis Laboratory

(NARSAL) and follows land use trends for years 1974, 1985, 1991, 1998, 2001, 2005, and 2008.The raster data sets were developed from Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+), with a resolution of 30 meters.

The distribution an percent land uses for stream segments and their associated watersheds assessed for fish communities are given in Table 7a. This table includes information for both supporting and not supporting stream segments. This table is divided into sections by use support and ecoregion.

The distribution an percent land uses for stream segments and their associated watersheds assessed for macroinvertebrate communities are given in Table 7b. This table includes information for both supporting and not supporting stream segments. This table is divided into sections by use support and subecoregion.

1.5.4 Soils

The soil characteristics of the Chattahoochee River Basin watersheds were determined using data from the Soil Survey Geographic (SSURGO) database. SSURGO soil data represents a higher spatial resolution and degree of detail when compared to the State Soil Geographic (STATSGO) Database used in previous sediment TMDLs drafted by GA EPD. Currently, SSURGO soil data represents the most detailed level of soil geographic data available from the NRCS within the United States Department of Agriculture (USDA).

This database provides detailed soil map units characterized by hydrologic soil group; percentages of clay, silt, sand, and organic matter; soil erodibility factor (K-factor); and soil hydraulic conductivity (K_{sat}). Table 8a provides a summary of the hydrologic soil groups in each watershed associated with stream segments not supporting and supporting designated uses that were evaluated for fish community health. Table 8b provides a summary of the hydrologic soil groups in each watershed associated with stream segments not supporting and supporting designated uses that were evaluated for macroinvertebrate community health. The detailed soil data for each individual soil map unit is not included in this document due to the sheer volume of tabular data. The complete soils data is available upon request from GA EPD.

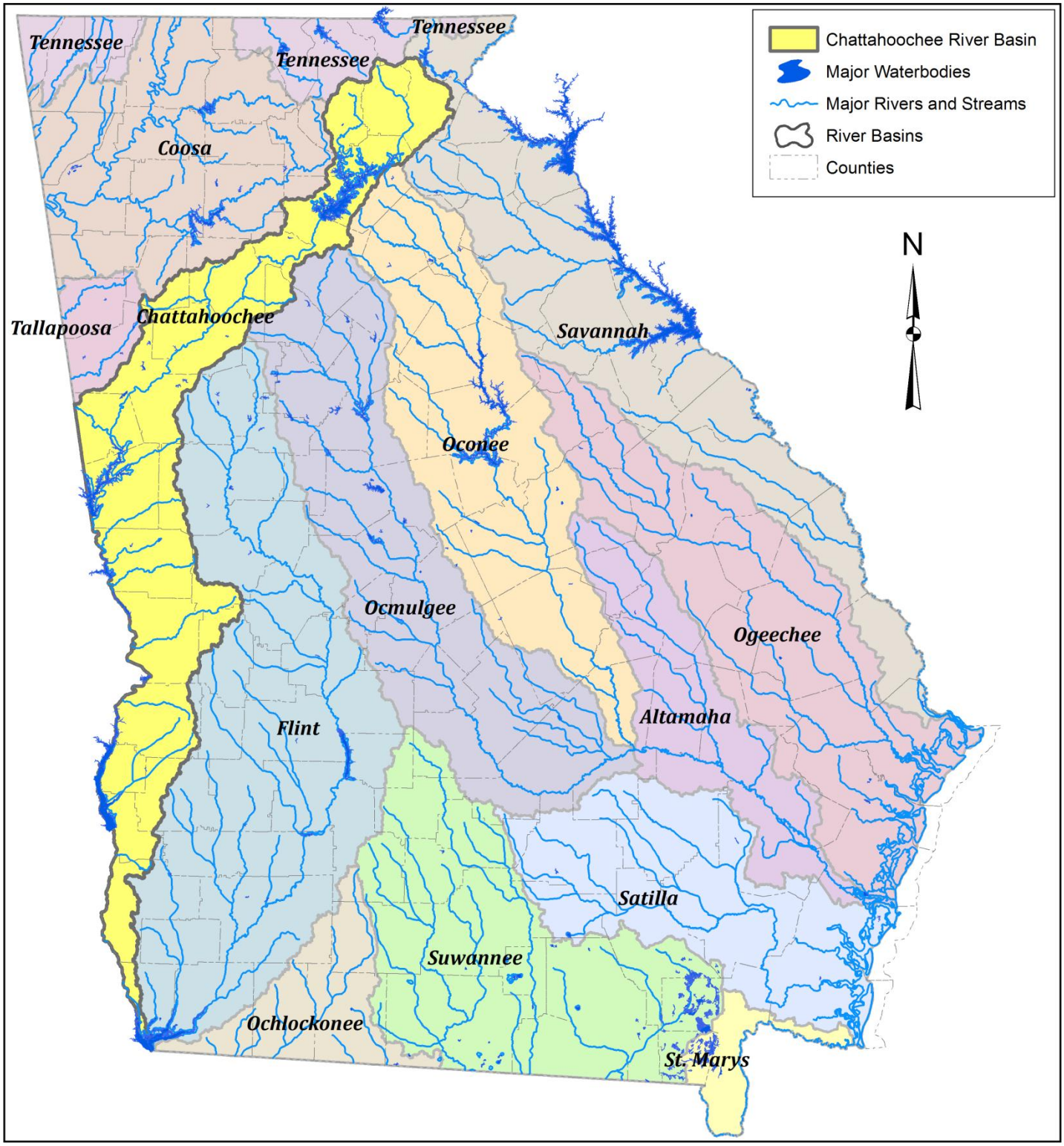

Figure 1. Chattahoochee River Basin and the River Basins of Georgia

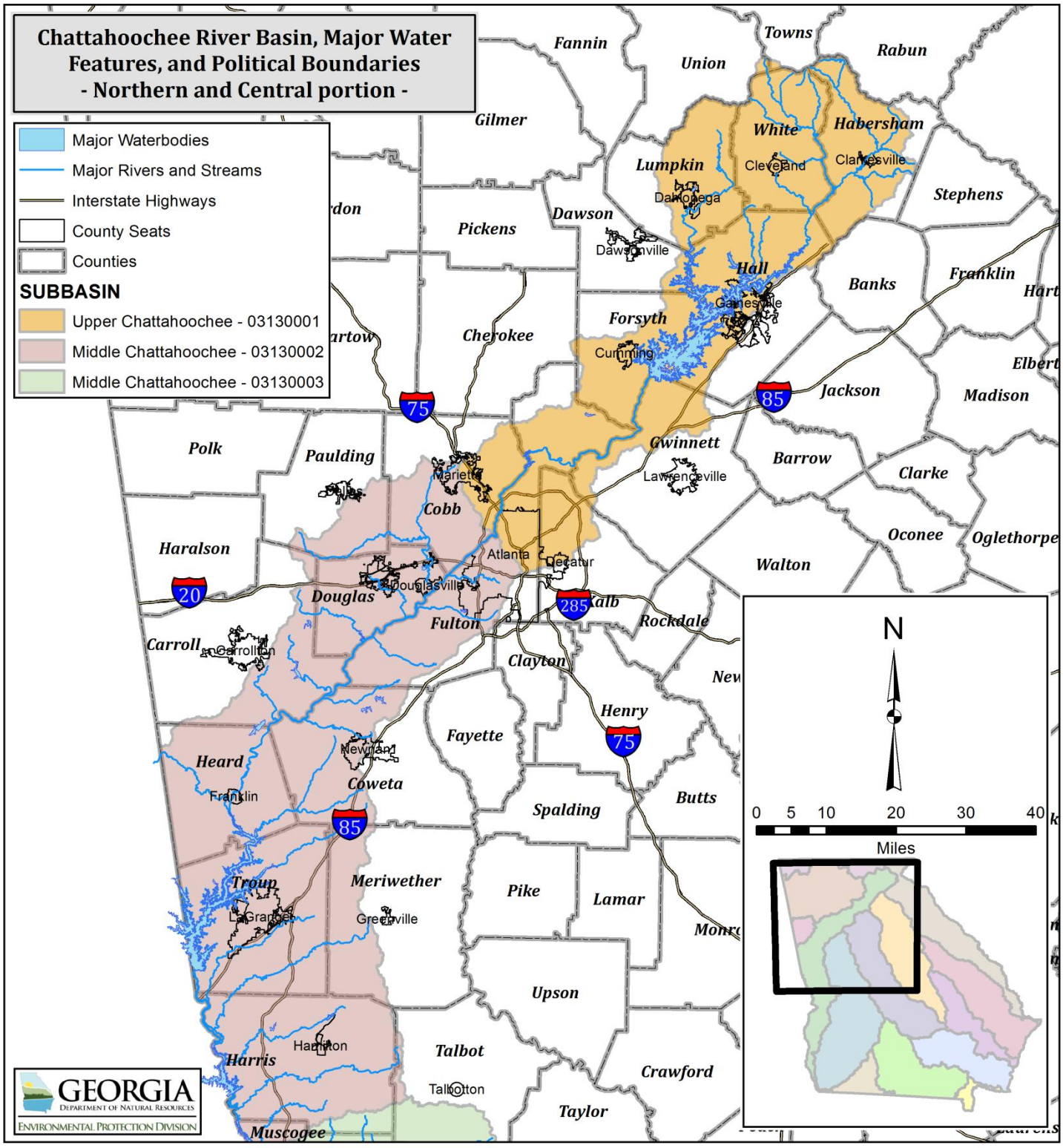

Figure 2. Chattahoochee River Basin, Upper and Middle Subbasins, Major Water Features, and Politcal Boundaries

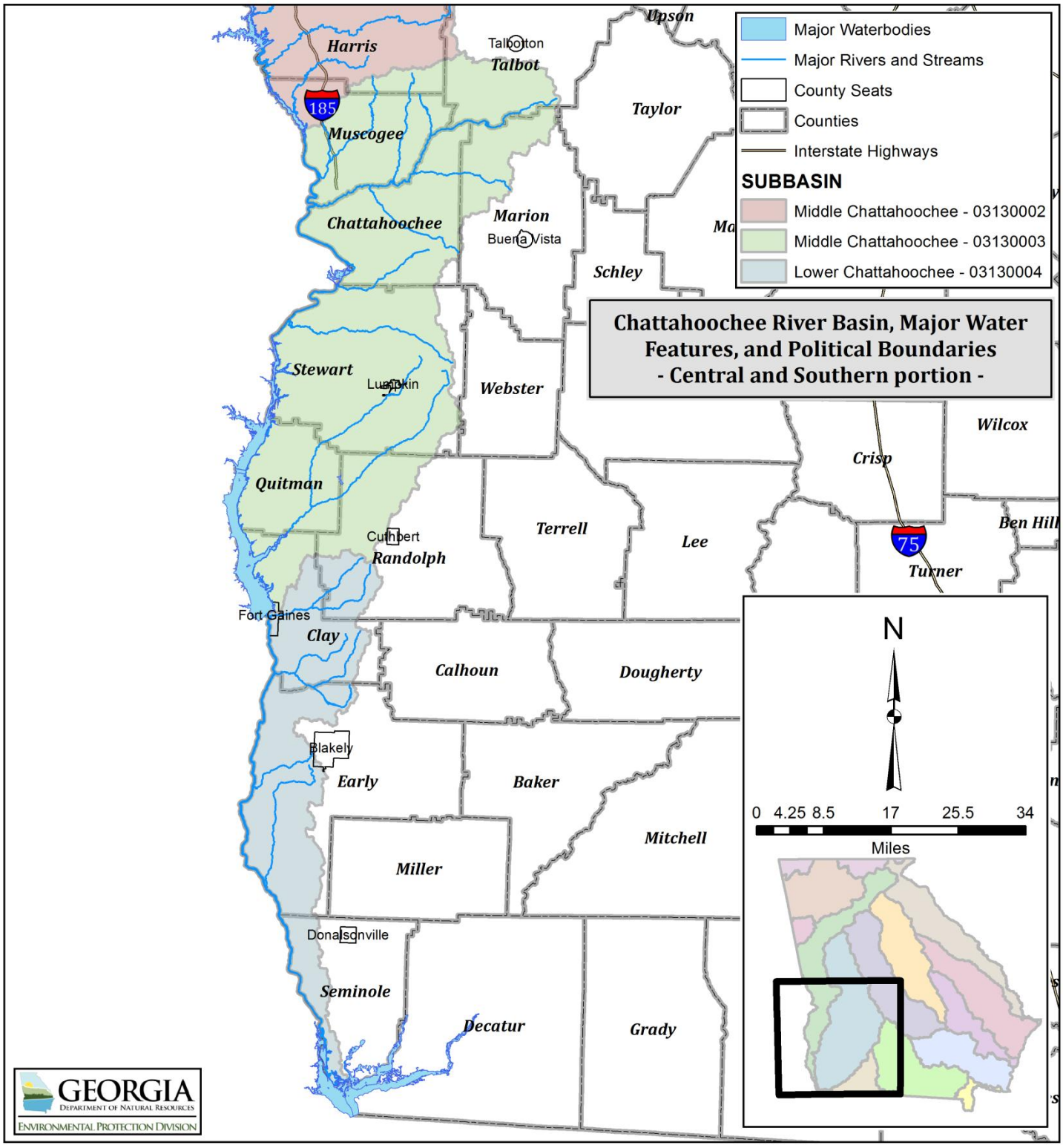

Figure 3. Chattahoochee River Basin, Middle and Lower Subbasins, Major Water Features, and Politcal Boundaries

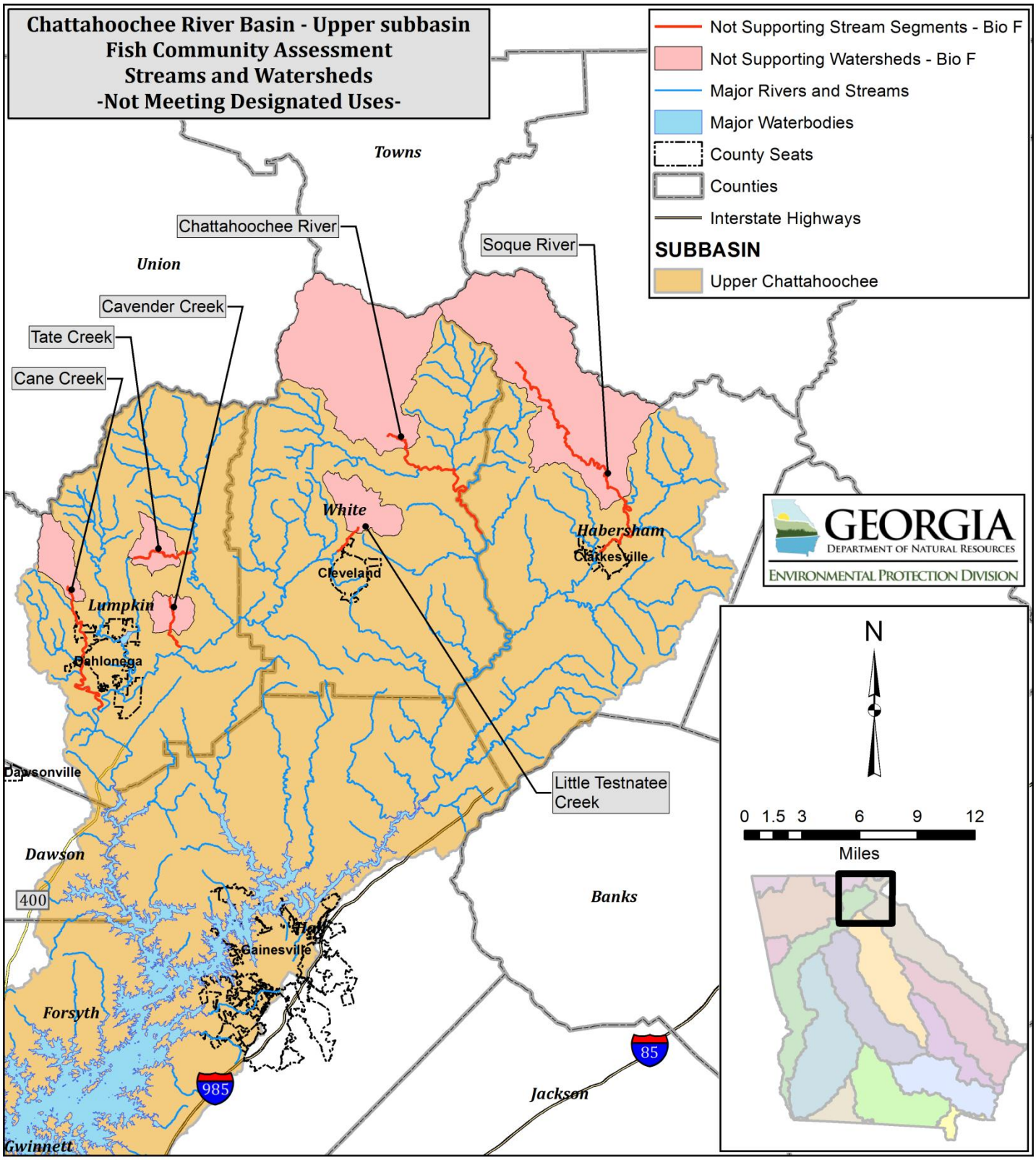

Figure 4. Fish Community Not Supporting Stream Segments and their Associated Watersheds - Upper Chattahoochee Subbasin

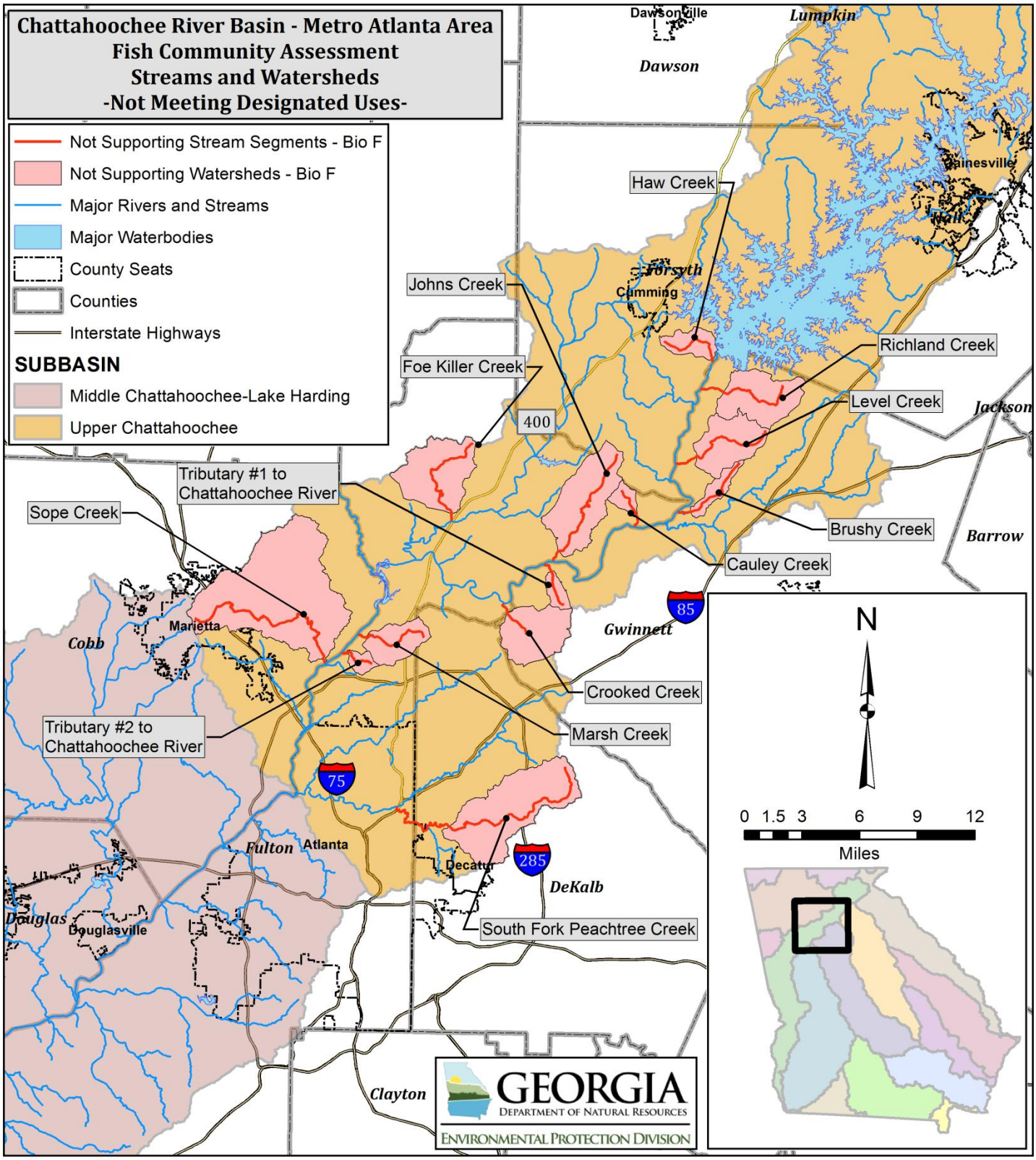

Figure 5. Fish Community Not Supporting Stream Segments and their Associated Watersheds - Upper Chattahoochee Subbasin within Metro Atlanta

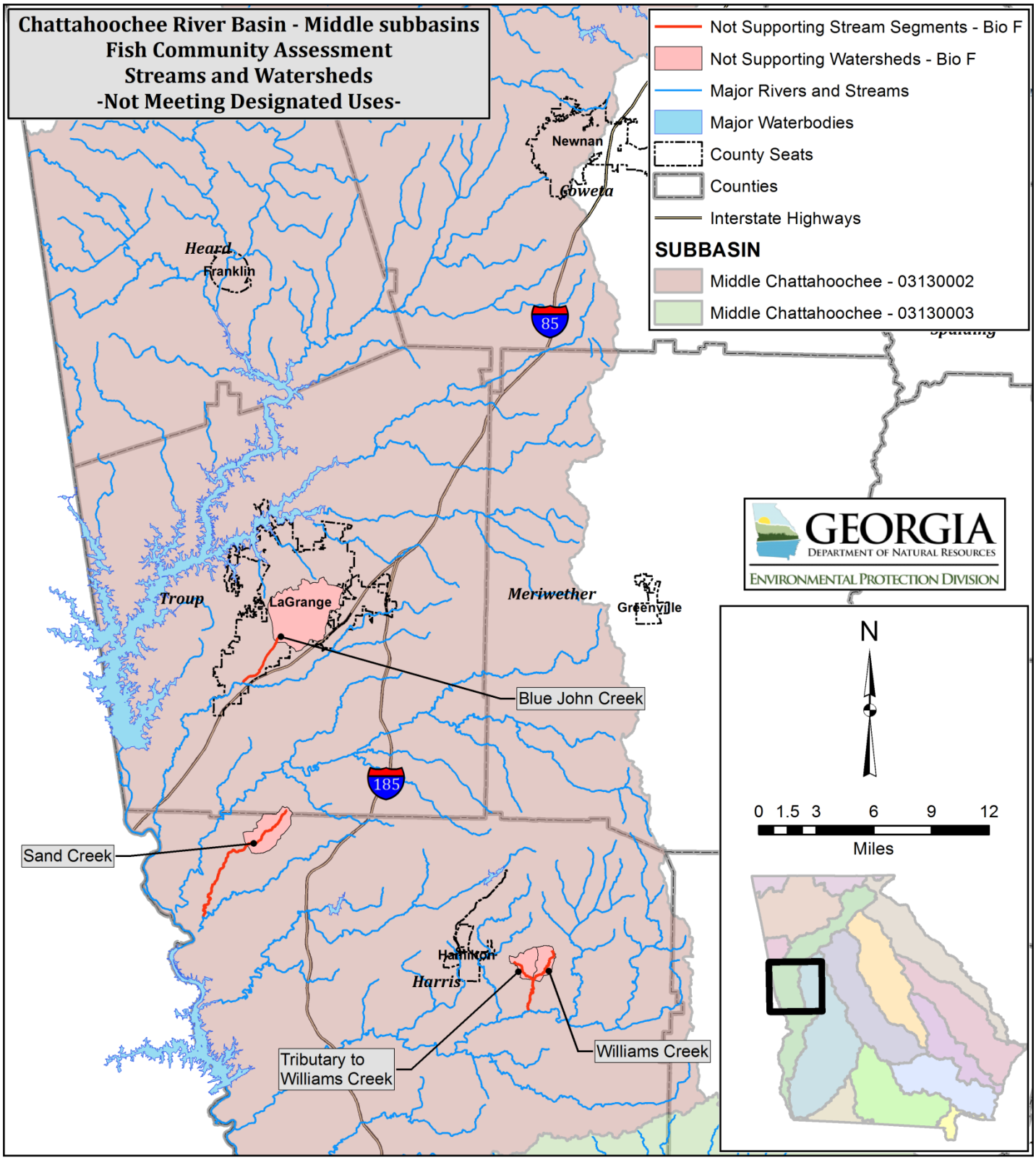

Figure 6. Fish Community Not Supporting Stream Segments and their Associated Watersheds - Middle Chattahoochee Subbasins

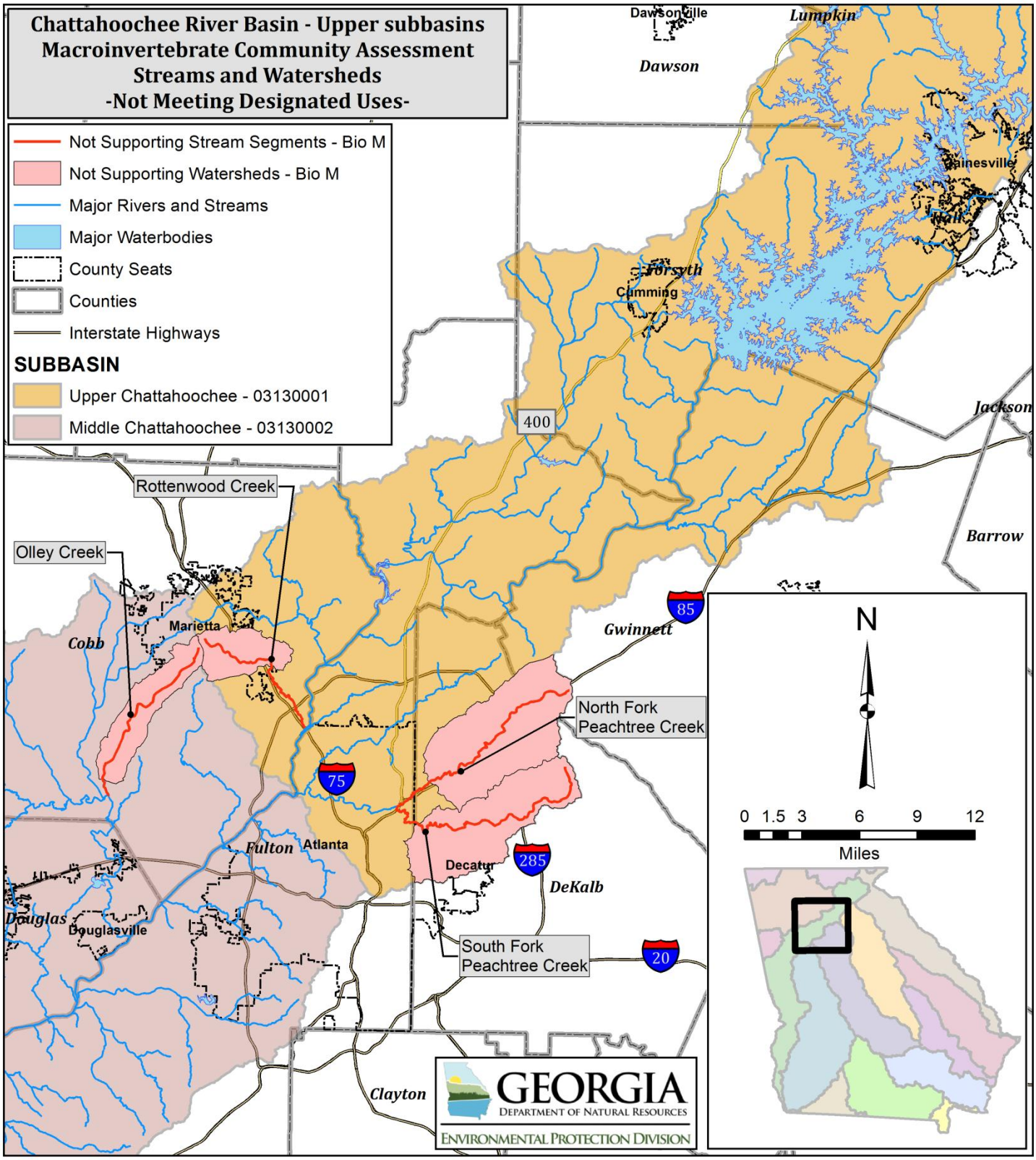

Figure 7. Macroinvertebrate Community Not Supporting Stream Segments and their Associated Watersheds - Upper Chattahoochee Subbasins

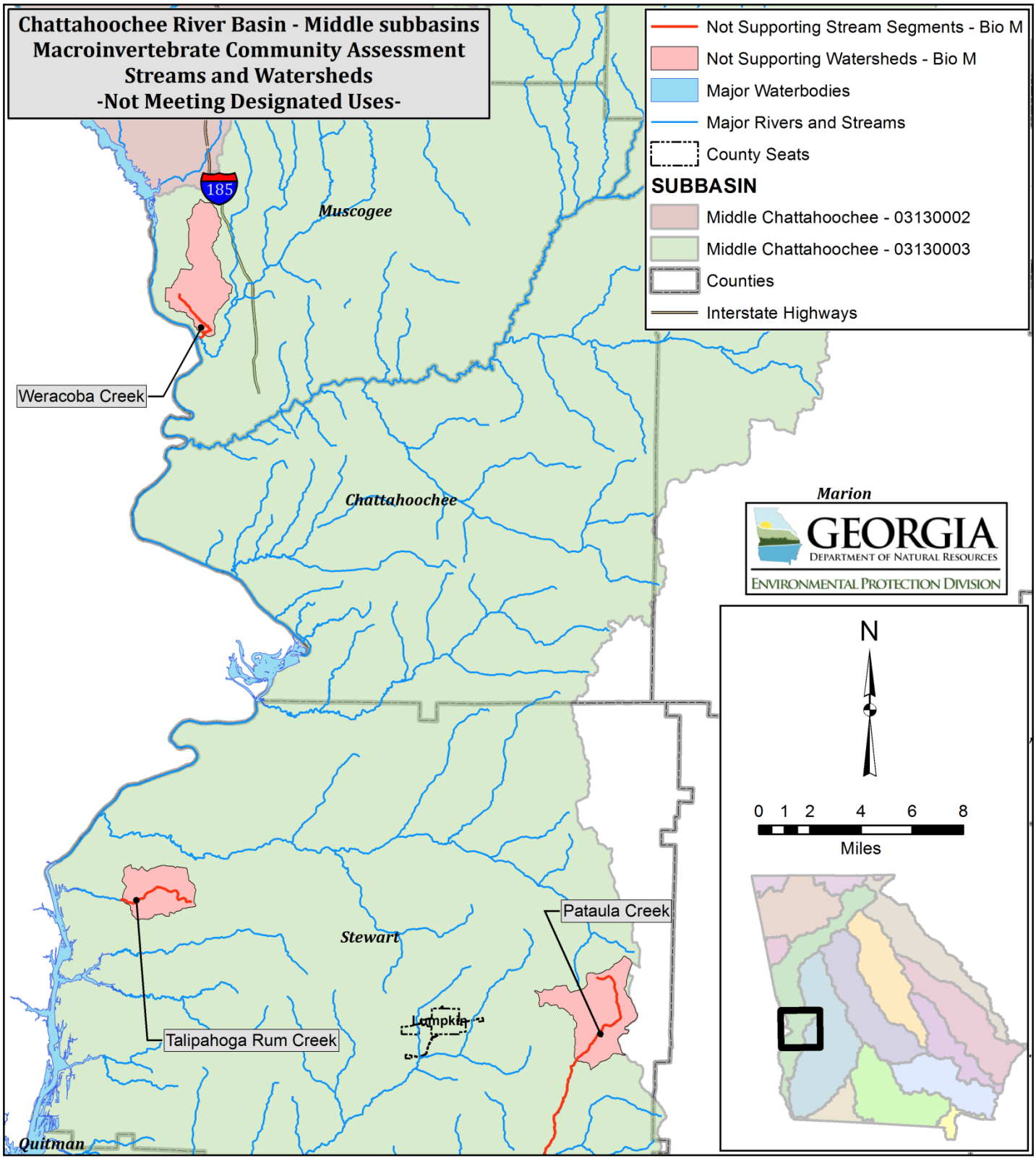

Figure 8. Macroinvertebrate Community Not Supporting Stream Segments and their Associated Watersheds - Middle portion of Chattahoochee River Basin

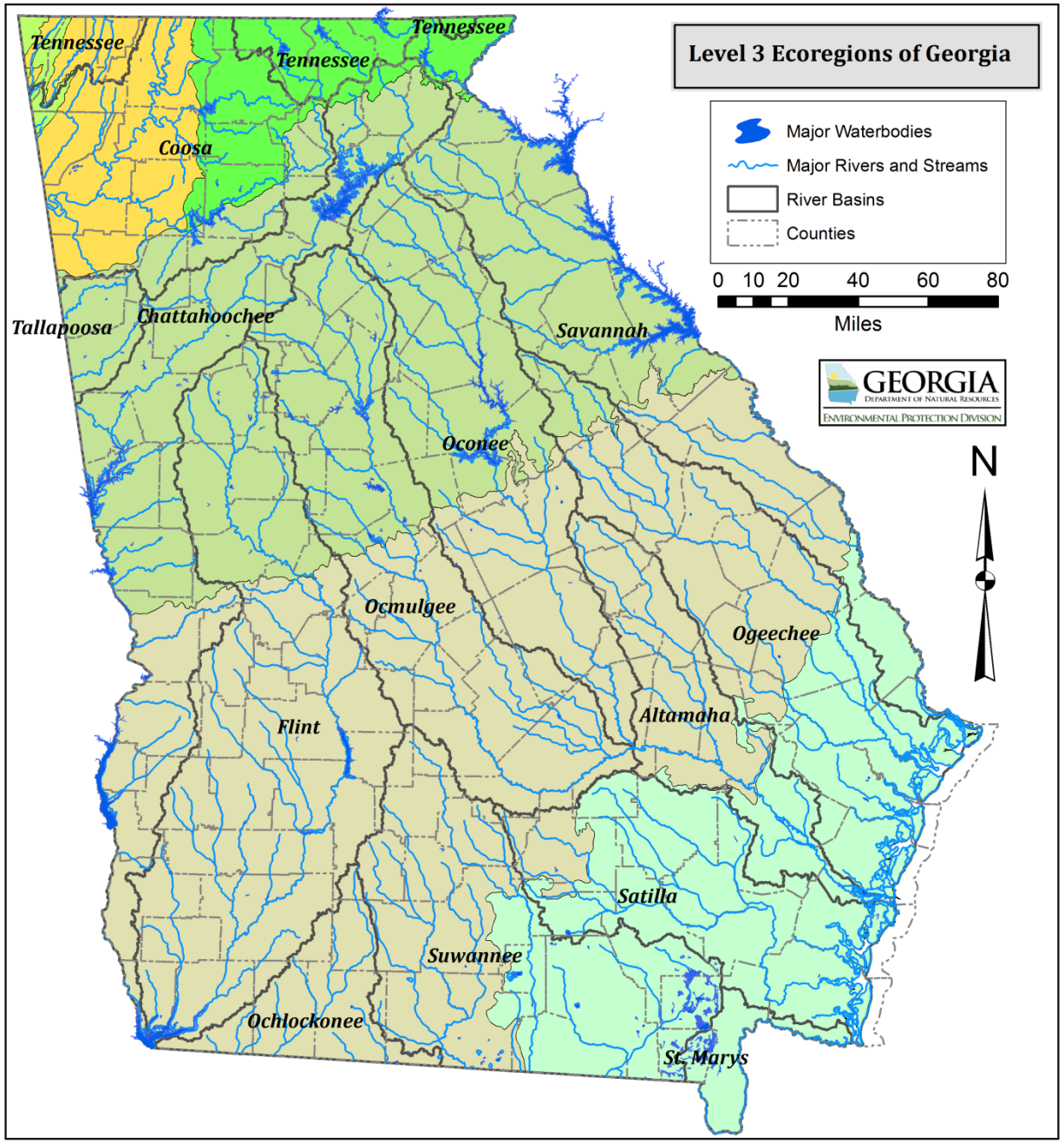

Figure 9.
Level III Ecoregions in the State of Georgia

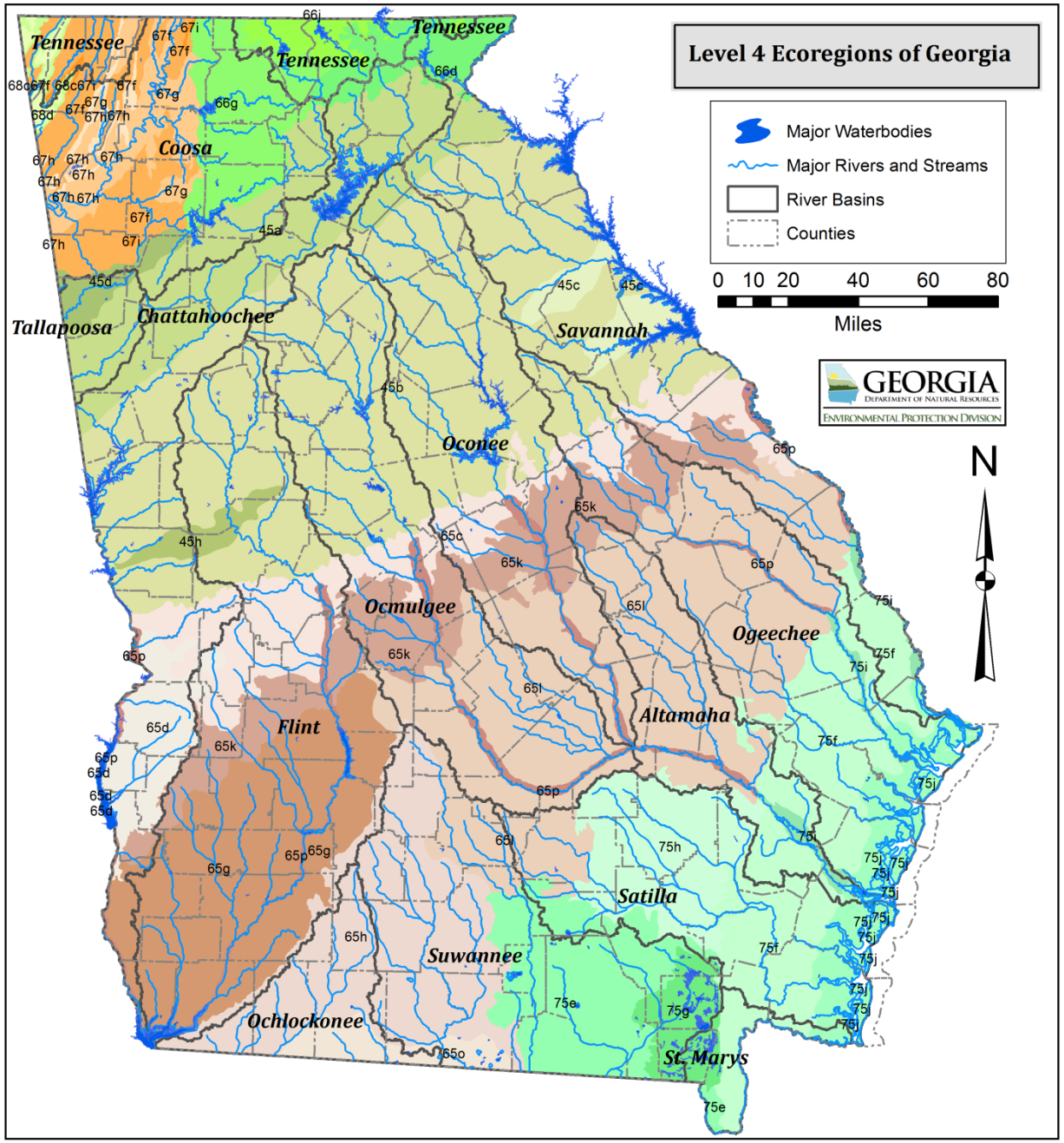

Figure 10.
Level IV Ecoregions (Subecoregions) in the State of Georgia

Level 4 Ecoregions

- 45a Southern Inner Piedmont
- 45b Southern Outer Piedmont
- 45c Carolina Slate Belt
- 45d Talladega Upland
- 45h Pine Mountain Ridges
- 65c Sand Hills
- 65d Southern Hilly Gulf Coastal Plain
- 65g Dougherty Plain
- 65h Tifton Upland
- 65k Coastal Plain Red Uplands
- 65l Atlantic Southern Loam Plains
- 65o Tallahasee Hills/Valdosta Limesink
- 65p Southeastern Floodplains and Low Terraces
- 66d Southern Crystalline Ridges and Mountains
- 66g Southern Metasedimentary Mountains
- 66j Broad Basins
- 67f Southern Limestone/Dolomite Valleys and Low Rolling Hills
- 67g Southern Shale Valleys
- 67h Southern Sandstone Ridges
- 67i Southern Dissected Ridges and Knobs
- 68c Plateau Escarpment
- 68d Southern Table Plateaus
- 75e Okefenokee Plains
- 75f Sea Island Flatwoods
- 75g Okefenokee Swamp
- 75h Bacon Terraces
- 75i Floodplains and Low Terraces
- 75j Sea Islands/Coastal Marsh

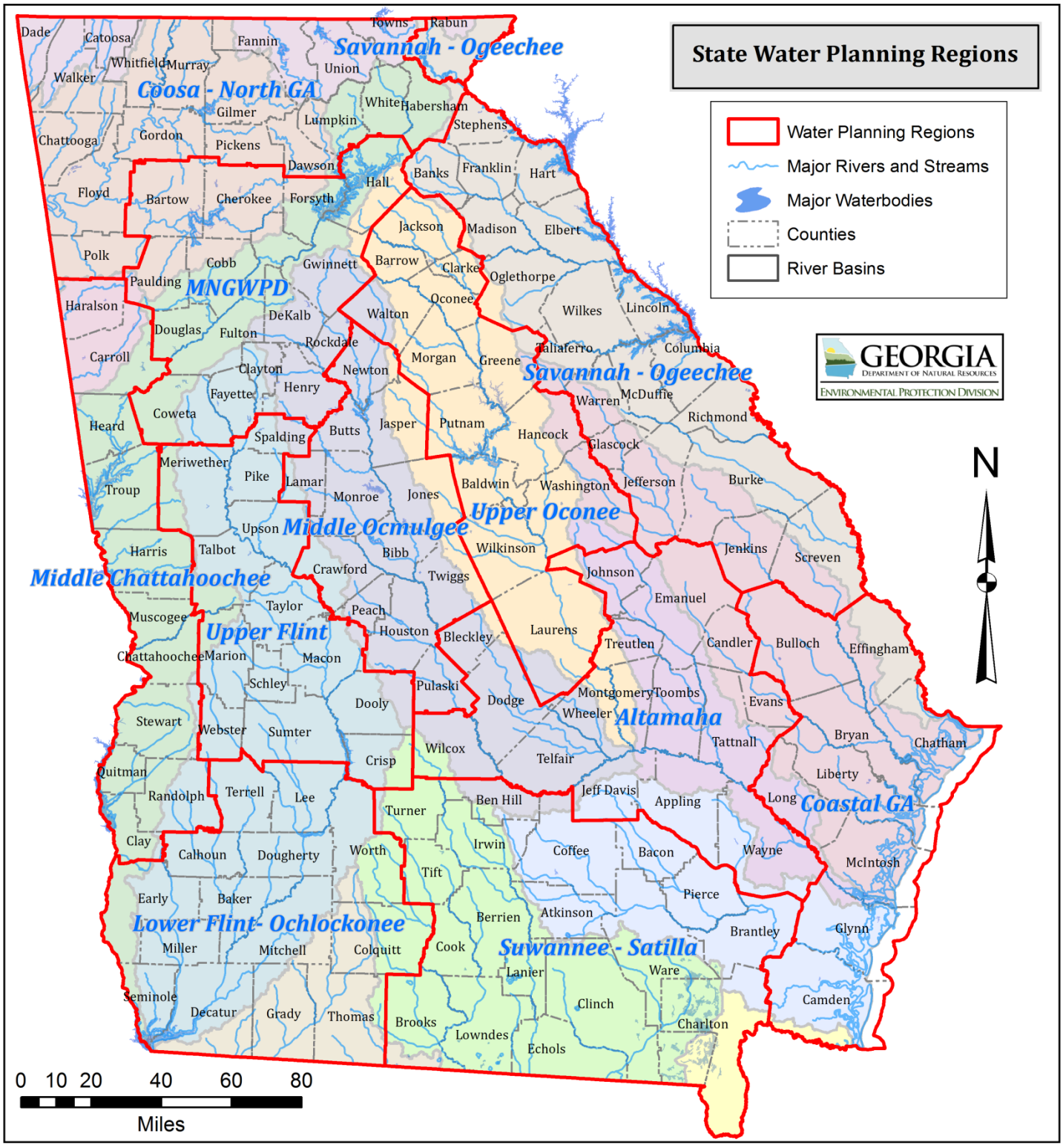

Figure 11. Water Planning Regions in Georgia

Table 7a. Land Use Distribution and Percentages for Fish Community Assessment Streams

Stream Segment and Station ID	Land Uses (acres)																		
	Beaches, Dunes, Mud	Open Water	Utility Swaths	Developed, Open Space	Developed, Low Intensity	Developed, Medium Intensity	Developed, High Intensity	Transitional, Clearcut, Sparse	Quarries, Strip Mines	Rock Outcrop	Deciduous Forest	Evergreen Forest	Mixed Forest	Golf Courses	Pasture, Hay	Row Crops	Forested Wetlands	Non-Forested Wetlands (Freshwater)	Total
Piedmont Ecoregion - Not Supporting Stream Segments																			
Blue John Creek	6.7	10.9	0.0	813.1	1844.5	711.7	406.1	309.4	0.0	0.0	549.1	740.6	4.2	1.1	665.0	0.0	143.9	0.0	6206.2
WRD 226	0.1%	0.2%	0.0%	13.1%	29.7%	11.5%	6.5%	5.0%	0.0%	0.0%	8.8%	11.9%	0.1%	0.0%	10.7%	0.0%	2.3%	0.0%	100%
Brushy Creek	2.2	2.0	0.0	132.5	413.0	446.6	181.3	73.6	0.0	0.0	145.2	91.4	22.9	0.0	18.2	0.0	18.7	0.0	1547.6
WRD 1039	0.1%	0.1%	0.0%	8.6%	26.7%	28.9%	11.7%	4.8%	0.0%	0.0%	9.4%	5.9%	1.5%	0.0%	1.2%	0.0%	1.2%	0.0%	100%
Cane Creek	0.0	0.4	0.0	161.7	23.6	2.9	0.0	6.9	0.0	0.0	3066.2	589.6	22.0	0.0	193.7	0.9	0.0	0.0	4067.8
WRD 701	0.0%	0.0%	0.0%	4.0%	0.6%	0.1%	0.0%	0.2%	0.0%	0.0%	75.4%	14.5%	0.5%	0.0%	4.8%	0.0%	0.0%	0.0%	100%
Cauley Creek	0.4	8.2	0.0	72.9	272.0	127.2	32.2	26.5	0.0	0.0	291.3	134.1	28.7	0.0	42.0	0.0	0.0	0.0	1035.7
WRD 1103	0.0%	0.8%	0.0%	7.0%	26.3%	12.3%	3.1%	2.6%	0.0%	0.0%	28.1%	12.9%	2.8%	0.0%	4.1%	0.0%	0.0%	0.0%	100%
Cavenders Creek	0.0	4.0	0.0	138.6	37.4	10.9	2.9	16.7	0.0	0.0	1642.6	130.1	29.4	0.0	537.8	0.4	17.1	0.0	2567.8
WRD 1211	0.0%	0.2%	0.0%	5.4%	1.5%	0.4%	0.1%	0.6%	0.0%	0.0%	64.0%	5.1%	1.1%	0.0%	20.9%	0.0%	0.7%	0.0%	100%
Chattahoochee River	0.2	36.3	0.0	1460.9	186.8	80.7	31.1	48.7	0.0	14.2	23576.1	4304.0	415.0	21.1	182.8	0.0	16.0	0.0	30374.0
WRD765	0.0%	0.1%	0.0%	4.8%	0.6%	0.3%	0.1%	0.2%	0.0%	0.0%	77.6%	14.2%	1.4%	0.1%	0.6%	0.0%	0.1%	0.0%	100%
Crooked Creek	6.2	42.7	0.0	737.5	1509.2	1341.3	1015.7	129.4	108.5	0.0	354.1	328.7	21.6	0.0	75.8	0.0	14.5	0.0	5685.1
WRD 1038	0.1%	0.8%	0.0%	13.0%	26.5%	23.6%	17.9%	2.3%	1.9%	0.0%	6.2%	5.8%	0.4%	0.0%	1.3%	0.0%	0.3%	0.0%	100%
Foe Killer Creek	13.3	14.0	0.0	1351.0	2326.0	1110.9	629.8	261.1	0.0	0.0	750.4	642.3	62.5	0.0	343.8	0.0	32.0	0.0	7537.2
WRD 1052	0.2%	0.2%	0.0%	17.9%	30.9%	14.7%	8.4%	3.5%	0.0%	0.0%	10.0%	8.5%	0.8%	0.0%	4.6%	0.0%	0.4%	0.0%	100%
Haw Creek	0.0	2.4	7.3	476.4	526.4	72.1	36.0	88.1	0.0	0.0	597.1	147.2	38.7	1.3	141.4	0.0	7.6	0.0	2142.1
WRD 607	0.0%	0.1%	0.3%	22.2%	24.6%	3.4%	1.7%	4.1%	0.0%	0.0%	27.9%	6.9%	1.8%	0.1%	6.6%	0.0%	0.4%	0.0%	100%
Johns Creek	12.5	40.5	17.6	1196.7	3380.0	1300.8	378.7	215.7	0.0	0.0	653.0	494.4	47.1	60.0	286.0	0.0	131.0	0.0	8213.9
WRD 1051	0.2%	0.5%	0.2%	14.6%	41.1%	15.8%	4.6%	2.6%	0.0%	0.0%	7.9%	6.0%	0.6%	0.7%	3.5%	0.0%	1.6%	0.0%	100%
Level Creek	8.2	19.8	0.0	753.3	1740.0	536.4	58.5	197.3	31.8	0.0	1010.6	405.0	112.5	0.0	289.1	0.0	79.6	0.0	5242.1
WRD 1040	0.2%	0.4%	0.0%	14.4%	33.2%	10.2%	1.1%	3.8%	0.6%	0.0%	19.3%	7.7%	2.1%	0.0%	5.5%	0.0%	1.5%	0.0%	100%
Little Tesnatee Creek	2.7	11.8	0.0	324.9	98.1	22.2	4.0	114.8	0.0	3.3	3038.4	518.0	133.9	0.0	722.8	0.0	4.9	0.0	4999.7
WRD 702	0.1%	0.2%	0.0%	6.5%	2.0%	0.4%	0.1%	2.3%	0.0%	0.1%	60.8%	10.4%	2.7%	0.0%	14.5%	0.0%	0.1%	0.0%	100%

Land Uses (acres)																			
Stream Segment and Station ID	**Beaches, Dunes, Mud**	**Open Water**	**Utility Swaths**	**Developed, Open Space**	**Developed, Low Intensity**	**Developed, Medium Intensity**	**Developed, High Intensity**	**Transitional, Clearcut, Sparse**	**Quarries, Strip Mines**	**Rock Outcrop**	**Deciduous Forest**	**Evergreen Forest**	**Mixed Forest**	**Golf Courses**	**Pasture, Hay**	**Row Crops**	**Forested Wetlands**	**Non-Forested Wetlands (Freshwater)**	**Total**
Marsh Creek (aka March Creek)	1.6	2.2	0.0	921.2	917.8	507.5	276.2	57.2	0.0	0.0	277.1	455.0	27.1	0.0	6.9	0.0	6.0	0.0	3455.8
WRD 1101	0.0%	0.1%	0.0%	26.7%	26.6%	14.7%	8.0%	1.7%	0.0%	0.0%	8.0%	13.2%	0.8%	0.0%	0.2%	0.0%	0.2%	0.0%	100%
Richland Creek	4.9	11.3	0.0	625.6	1722.7	634.0	100.5	460.4	321.4	0.0	1269.2	497.1	157.5	0.0	209.5	0.0	18.9	0.0	6032.9
WRD 1041	0.1%	0.2%	0.0%	10.4%	28.6%	10.5%	1.7%	7.6%	5.3%	0.0%	21.0%	8.2%	2.6%	0.0%	3.5%	0.0%	0.3%	0.0%	100%
Sand Creek	2.2	14.9	0.0	62.7	22.5	0.4	0.0	37.6	0.0	0.0	331.4	1243.0	0.9	0.0	426.8	0.0	85.0	0.0	2227.3
WRD 1133	0.1%	0.7%	0.0%	2.8%	1.0%	0.0%	0.0%	1.7%	0.0%	0.0%	14.9%	55.8%	0.0%	0.0%	19.2%	0.0%	3.8%	0.0%	100%
Sope Creek	22.0	79.4	0.0	5985.1	7488.3	1986.7	1349.0	421.7	0.0	0.0	2155.2	2396.3	149.9	71.8	330.7	0.0	112.3	1.3	22549.7
WRD 1109	0.1%	0.4%	0.0%	26.5%	33.2%	8.8%	6.0%	1.9%	0.0%	0.0%	9.6%	10.6%	0.7%	0.3%	1.5%	0.0%	0.5%	0.0%	100%
Soque River	0.9	19.3	1.8	1818.3	179.3	45.8	5.6	132.5	0.0	1.8	24436.7	5486.0	908.5	0.0	2793.5	0.0	32.5	0.4	35862.9
WRD 764	0.0%	0.1%	0.0%	5.1%	0.5%	0.1%	0.0%	0.4%	0.0%	0.0%	68.1%	15.3%	2.5%	0.0%	7.8%	0.0%	0.1%	0.0%	100%
South Fork Peachtree Creek	0.2	20.7	15.8	4413.2	4947.2	2608.2	2057.6	141.4	0.0	0.0	1198.7	2236.6	33.1	8.7	99.6	0.0	108.8	2.0	17891.9
WRD 689	0.0%	0.1%	0.1%	24.7%	27.7%	14.6%	11.5%	0.8%	0.0%	0.0%	6.7%	12.5%	0.2%	0.0%	0.6%	0.0%	0.6%	0.0%	100%
Tate Creek	0.2	17.3	0.0	275.1	8.2	5.3	2.0	23.8	0.0	0.0	1829.2	556.7	32.9	0.0	245.7	0.0	4.7	0.0	3001.2
WRD 1210	0.0%	0.6%	0.0%	9.2%	0.3%	0.2%	0.1%	0.8%	0.0%	0.0%	60.9%	18.5%	1.1%	0.0%	8.2%	0.0%	0.2%	0.0%	100%
Tributary #1 to the Chattahoochee River	1.1	1.8	0.0	167.5	338.3	255.8	103.4	20.9	0.0	0.0	44.9	81.6	6.2	0.0	15.6	0.0	0.0	0.0	1037.0
WRD 1100	0.1%	0.2%	0.0%	16.1%	32.6%	24.7%	10.0%	2.0%	0.0%	0.0%	4.3%	7.9%	0.6%	0.0%	1.5%	0.0%	0.0%	0.0%	100%
Tributary #2 to the Chattahoochee River	1.6	0.0	0.0	272.2	221.7	14.9	8.5	2.4	0.0	0.0	90.1	217.9	6.9	0.0	13.6	0.0	0.0	0.0	849.8
WRD 1102	0.2%	0.0%	0.0%	32.0%	26.1%	1.8%	1.0%	0.3%	0.0%	0.0%	10.6%	25.6%	0.8%	0.0%	1.6%	0.0%	0.0%	0.0%	100%
Tributary to Williams Creek	0.0	5.3	10.9	37.6	14.0	0.0	0.0	44.7	0.0	0.0	504.4	371.2	0.9	0.0	6.2	0.0	3.6	0.0	998.8
WRD 1130	0.0%	0.5%	1.1%	3.8%	1.4%	0.0%	0.0%	4.5%	0.0%	0.0%	50.5%	37.2%	0.1%	0.0%	0.6%	0.0%	0.4%	0.0%	100%
Williams Creek	0.0	2.9	10.2	35.8	12.0	0.0	0.0	53.6	0.0	0.0	413.0	383.0	2.7	0.0	4.9	0.0	5.6	0.0	923.6
WRD 1129	0.0%	0.3%	1.1%	3.9%	1.3%	0.0%	0.0%	5.8%	0.0%	0.0%	44.7%	41.5%	0.3%	0.0%	0.5%	0.0%	0.6%	0.0%	100%
Piedmont - Supporting Stream Segments																			
Gum Branch	0.9	0.9	0.0	29.8	20.9	1.8	0.0	15.1	0.0	0.0	408.3	54.3	1.1	0.0	379.4	0.0	0.0	0.0	912.5
WRD 198	0.1%	0.1%	0.0%	3.3%	2.3%	0.2%	0.0%	1.7%	0.0%	0.0%	44.7%	5.9%	0.1%	0.0%	41.6%	0.0%	0.0%	0.0%	100%

Land Uses (acres)																		
Stream Segment and Station ID	**Beaches, Dunes, Mud**	**Open Water**	**Utility Swaths**	**Developed, Open Space**	**Developed, Low Intensity**	**Developed, Medium Intensity**	**Developed, High Intensity**	**Transitional, Clearcut, Sparse**	**Quarries, Strip Mines**	**Rock Outcrop**	**Deciduous Forest**	**Evergreen Forest**	**Mixed Forest**	**Golf Courses**	**Pasture, Hay**	**Row Crops**	**Forested Wetlands**	**Non-Forested Wetlands (Freshwater)**	**Total**
Gum Creek	3.1	7.3	44.5	131.0	108.1	8.2	1.3	215.7	0.0	0.0	1896.4	1094.6	4.7	0.0	1470.0	0.0	45.4	0.9	5031.2
WRD 69	0.1%	0.1%	0.9%	2.6%	2.1%	0.2%	0.0%	4.3%	0.0%	0.0%	37.7%	21.8%	0.1%	0.0%	29.2%	0.0%	0.9%	0.0%	100%
Hillabahatchee Creek	1.3	19.6	0.0	271.3	181.5	6.4	2.2	703.4	0.0	0.0	6699.2	5295.2	48.5	0.0	1331.3	0.0	11.8	0.0	14571.8
WRD 86	0.0%	0.1%	0.0%	1.9%	1.2%	0.0%	0.0%	4.8%	0.0%	0.0%	46.0%	36.3%	0.3%	0.0%	9.1%	0.0%	0.1%	0.0%	100%
Mountain Creek	5.8	259.8	0.0	1020.8	138.3	56.7	14.9	140.6	0.0	0.0	2618.7	4288.7	4.4	56.9	238.4	0.0	388.1	0.0	9232.1
WRD 1037	0.1%	2.8%	0.0%	11.1%	1.5%	0.6%	0.2%	1.5%	0.0%	0.0%	28.4%	46.5%	0.0%	0.6%	2.6%	0.0%	4.2%	0.0%	100%
Snake Creek	21.8	722.8	205.7	1046.1	1243.9	94.5	33.8	1809.6	0.0	0.0	8761.9	8751.7	33.8	0.0	3220.5	0.0	146.1	0.0	26092.3
WRD 88	0.1%	2.8%	0.8%	4.0%	4.8%	0.4%	0.1%	6.9%	0.0%	0.0%	33.6%	33.5%	0.1%	0.0%	12.3%	0.0%	0.6%	0.0%	100%
Town Creek	3.3	8.7	0.0	179.3	66.3	5.1	1.1	258.2	0.0	0.0	2454.1	2556.0	29.4	0.0	761.9	0.0	9.1	0.0	6332.5
WRD 87	0.1%	0.1%	0.0%	2.8%	1.0%	0.1%	0.0%	4.1%	0.0%	0.0%	38.8%	40.4%	0.5%	0.0%	12.0%	0.0%	0.1%	0.0%	100%
Whooping Creek	14.9	87.2	205.9	701.2	836.6	72.3	33.4	921.8	0.0	0.0	5831.9	4601.1	20.0	0.0	3619.5	0.0	46.9	0.0	16992.7
WRD 89	0.1%	0.5%	1.2%	4.1%	4.9%	0.4%	0.2%	5.4%	0.0%	0.0%	34.3%	27.1%	0.1%	0.0%	21.3%	0.0%	0.3%	0.0%	100%
Whooping Creek	14.9	91.2	235.5	758.4	887.4	73.6	33.4	1026.4	0.0	0.0	6087.8	4919.8	21.8	0.0	3816.1	0.0	46.9	0.0	18013.1
WRD 429	0.1%	0.5%	1.3%	4.2%	4.9%	0.4%	0.2%	5.7%	0.0%	0.0%	33.8%	27.3%	0.1%	0.0%	21.2%	0.0%	0.3%	0.0%	100%

Table 7b. Land Use Distribution and Percentages for Macroinvertebrate Community Assessment Streams

Land Uses (acres)																			
Stream Segment and Station ID	**Beaches, Dunes, Mud**	**Open Water**	**Utility Swaths**	**Developed, Open Space**	**Developed, Low Intensity**	**Developed, Medium Intensity**	**Developed, High Intensity**	**Transitional, Clearcut, Sparse**	**Quarries, Strip Mines**	**Rock Outcrop**	**Deciduous Forest**	**Evergreen Forest**	**Mixed Forest**	**Golf Courses**	**Pasture, Hay**	**Row Crops**	**Forested Wetlands**	**Non-Forested Wetlands (Freshwater)**	**Total**
Southern Inner Piedmont Subecoregion (45a) - Not Supporting stream segments																			
Olley Creek	8.5	28.0	5.8	1813.0	2875.1	1094.8	565.3	317.6	18.9	0.0	687.4	891.6	28.5	7.8	330.9	0.0	89.8	0.0	8763.0
EPD 45a-61	0.1%	0.3%	0.1%	20.7%	32.8%	12.5%	6.5%	3.6%	0.2%	0.0%	7.8%	10.2%	0.3%	0.1%	3.8%	0.0%	1.0%	0.0%	100%
Rottenwood Creek	3.6	4.9	0.0	1115.3	1688.2	1221.8	1380.0	58.9	0.0	0.0	254.2	383.4	7.8	0.0	81.4	0.0	16.9	0.0	6216.4
EPD 45a-59	0.1%	0.1%	0.0%	17.9%	27.2%	19.7%	22.2%	0.9%	0.0%	0.0%	4.1%	6.2%	0.1%	0.0%	1.3%	0.0%	0.3%	0.0%	100%
Southern Inner Piedmont Subecoregion (45a) - Supporting stream segments																			
Davidson Creek	36.3	0.0	0.0	377.8	110.5	7.6	2.2	145.4	0.0	0.0	0.0	4352.0	1322.8	786.4	372.1	0.0	26.5	0.0	7539.6
EPD 45a-3	0.5%	0.0%	0.0%	5.0%	1.5%	0.1%	0.0%	1.9%	0.0%	0.0%	0.0%	57.7%	17.5%	10.4%	4.9%	0.0%	0.4%	0.0%	100%
Hillabahatchee Creek	17.3	0.0	0.0	249.3	167.2	4.2	0.4	465.2	1.1	0.0	0.0	4620.0	3892.8	44.5	1166.7	0.0	9.6	0.0	10638.3
EPD 45a-89	0.2%	0.0%	0.0%	2.3%	1.6%	0.0%	0.0%	4.4%	0.0%	0.0%	0.0%	43.4%	36.6%	0.4%	11.0%	0.0%	0.1%	0.0%	100%
Middle Fork Broad River	5.6	0.0	0.0	396.5	144.3	28.5	23.4	240.9	1.3	0.0	0.0	5620.1	1180.9	1102.6	342.3	0.0	30.0	0.0	9116.4
EPD 45a03//	0.1%	0.0%	0.0%	4.3%	1.6%	0.3%	0.3%	2.6%	0.0%	0.0%	0.0%	61.6%	13.0%	12.1%	3.8%	0.0%	0.3%	0.0%	100%
Town Creek	3.3	0.0	0.0	63.8	20.9	4.0	0.4	61.8	1.1	0.0	0.0	1004.3	633.2	13.3	373.8	0.0	7.1	0.0	2187.0
EPD HH16	0.2%	0.0%	0.0%	2.9%	1.0%	0.2%	0.0%	2.8%	0.1%	0.0%	0.0%	45.9%	29.0%	0.6%	17.1%	0.0%	0.3%	0.0%	100%
Southern Outer Piedmont Subecoregion (45b) - Not Supporting stream segments																			
North Fork Peachtree Creek	9.1	55.6	34.7	4787.3	5830.5	3310.3	3523.6	167.2	0.0	0.0	902.3	2523.7	46.3	0.0	115.9	0.4	206.4	4.9	21518.3
EPD 45b-202	0.0%	0.3%	0.2%	22.2%	27.1%	15.4%	16.4%	0.8%	0.0%	0.0%	4.2%	11.7%	0.2%	0.0%	0.5%	0.0%	1.0%	0.0%	100%
South Fork Peachtree Creek	0.2	20.7	15.8	4413.2	4947.2	2608.2	2057.6	141.4	0.0	0.0	1198.7	2236.6	33.1	8.7	99.6	0.0	108.8	2.0	17891.9
EPD 45b-203	0.0%	0.1%	0.1%	24.7%	27.7%	14.6%	11.5%	0.8%	0.0%	0.0%	6.7%	12.5%	0.2%	0.0%	0.6%	0.0%	0.6%	0.0%	100%
Southern Outer Piedmont Subecoregion (45b) - Supporting stream segments																			
Beaverdam Creek	4.0	15.8	0.0	146.3	123.2	5.8	0.7	36.3	0.0	0.0	386.7	156.6	39.4	0.0	1688.6	0.0	121.0	0.7	2725.1
EPD 45b-120	0.1%	0.6%	0.0%	5.4%	4.5%	0.2%	0.0%	1.3%	0.0%	0.0%	14.2%	5.7%	1.4%	0.0%	62.0%	0.0%	4.4%	0.0%	100%
Copeland Creek	4.9	12.9	25.1	87.6	37.6	0.0	0.0	375.0	0.0	0.0	534.0	1417.5	276.9	0.0	424.1	0.0	58.7	0.9	3255.2
EPD HH22	0.2%	0.4%	0.8%	2.7%	1.2%	0.0%	0.0%	11.5%	0.0%	0.0%	16.4%	43.5%	8.5%	0.0%	13.0%	0.0%	1.8%	0.0%	100%

Land Uses (acres)																			
Stream Segment and Station ID	**Beaches, Dunes, Mud**	**Open Water**	**Utility Swaths**	**Developed, Open Space**	**Developed, Low Intensity**	**Developed, Medium Intensity**	**Developed, High Intensity**	**Transitional, Clearcut, Sparse**	**Quarries, Strip Mines**	**Rock Outcrop**	**Deciduous Forest**	**Evergreen Forest**	**Mixed Forest**	**Golf Courses**	**Pasture, Hay**	**Row Crops**	**Forested Wetlands**	**Non-Forested Wetlands (Freshwater)**	**Total**
Little Falling Creek	1.8	79.2	42.5	416.5	47.1	0.2	0.0	403.4	0.0	0.0	2508.4	6475.9	854.9	0.0	319.8	0.0	1012.6	4.2	12166.5
45b-156	0.0%	0.7%	0.3%	3.4%	0.4%	0.0%	0.0%	3.3%	0.0%	0.0%	20.6%	53.2%	7.0%	0.0%	2.6%	0.0%	8.3%	0.0%	100%
Rocky Creek	11.8	70.7	125.9	703.4	270.7	58.5	4.0	1142.0	0.0	0.0	5109.5	5130.4	1080.4	0.0	2259.3	0.7	763.7	0.0	16731.0
EPD 45b-258	0.1%	0.4%	0.8%	4.2%	1.6%	0.3%	0.0%	6.8%	0.0%	0.0%	30.5%	30.7%	6.5%	0.0%	13.5%	0.0%	4.6%	0.0%	100%
Tributary to Flint River	0.0	5.3	35.4	131.2	7.1	0.0	0.0	163.9	0.0	0.0	578.9	1891.7	66.9	0.0	107.4	0.0	155.9	0.0	3143.7
EPD 45b-357	0.0%	0.2%	1.1%	4.2%	0.2%	0.0%	0.0%	5.2%	0.0%	0.0%	18.4%	60.2%	2.1%	0.0%	3.4%	0.0%	5.0%	0.0%	100%
Tributary to Murder Creek	0.2	0.0	0.0	133.0	3.8	0.0	0.0	29.4	0.0	0.0	908.9	774.6	137.0	0.0	44.9	0.0	54.7	0.0	2086.5
EPD 45b-152	0.0%	0.0%	0.0%	6.4%	0.2%	0.0%	0.0%	1.4%	0.0%	0.0%	43.6%	37.1%	6.6%	0.0%	2.2%	0.0%	2.6%	0.0%	100%
Southern Hilly Gulf Coastal Plain Subecoregion (65d) - Not Supporting stream segments																			
Pataula Creek	3.6	16.7	20.2	148.8	51.8	6.0	0.2	31.8	0.0	0.0	1350.6	1232.7	630.3	0.0	66.3	1404.4	258.0	2.4	5223.8
EPD 65d-22	0.1%	0.3%	0.4%	2.8%	1.0%	0.1%	0.0%	0.6%	0.0%	0.0%	25.9%	23.6%	12.1%	0.0%	1.3%	26.9%	4.9%	0.0%	100%
Talipahoga Rum Creek	0.7	3.1	0.0	78.7	12.7	0.0	0.0	183.7	0.0	0.0	1341.0	410.5	397.4	0.0	125.2	418.1	104.3	6.9	3082.4
EPD 65d-17	0.0%	0.1%	0.0%	2.6%	0.4%	0.0%	0.0%	6.0%	0.0%	0.0%	43.5%	13.3%	12.9%	0.0%	4.1%	13.6%	3.4%	0.2%	100%
Weracoba Creek	0.0	0.0	0.0	641.6	2034.5	745.9	752.8	9.1	0.0	0.0	150.3	39.1	87.4	10.9	5.8	65.4	7.8	1.1	4551.8
EPD 65d-1	0.0%	0.0%	0.0%	14.1%	44.7%	16.4%	16.5%	0.2%	0.0%	0.0%	3.3%	0.9%	1.9%	0.2%	0.1%	1.4%	0.2%	0.0%	100%
Southern Hilly Gulf Coastal Plain Subecoregion (65d) - Supporting stream segments																			
Hannahatchee Creek	0.7	2.0	37.6	231.7	111.2	21.1	4.7	489.5	0.0	0.0	7168.7	2505.1	1869.7	0.0	138.3	875.1	746.4	1.1	14202.8
65d-14	0.0%	0.0%	0.3%	1.6%	0.8%	0.1%	0.0%	3.4%	0.0%	0.0%	50.5%	17.6%	13.2%	0.0%	1.0%	6.2%	5.3%	0.0%	100%
Hollaca Creek	0.0	1.1	0.0	101.6	6.7	1.6	0.0	1.8	0.0	0.0	1523.4	590.7	1964.6	0.0	25.4	95.6	512.6	0.0	4825.1
65d-3	0.0%	0.0%	0.0%	2.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	31.6%	12.2%	40.7%	0.0%	0.5%	2.0%	10.6%	0.0%	100%
Sally Branch	0.0	0.0	0.0	110.3	15.1	0.7	0.0	11.1	0.0	0.0	1244.7	407.6	1726.9	0.0	18.7	87.2	351.4	0.0	3973.8
65d-4	0.0%	0.0%	0.0%	2.8%	0.4%	0.0%	0.0%	0.3%	0.0%	0.0%	31.3%	10.3%	43.5%	0.0%	0.5%	2.2%	8.8%	0.0%	100%

Table 8a. Hydrologic Soil Group Distribution for Fish Community Assessment Streams

Stream Segment	Station ID	A				B				C				D				Other	
		Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%
Piedmont – Not Supporting Stream Segments																			
Blue John Creek	WRD 226					5576.1	89.9	0.17	0.28	181.7	2.9	0.11	0.28	10.2	0.2	0.27	0.27	436.7	7.0
Brushy Creek	WRD 1039					1446.4	93.4	0.12	0.34	92.3	6.0	0.21	0.31	9.1	0.6	0.28	0.29	1.5	0.1
Cane Creek	WRD 701					2875.4	70.7	0.09	0.28	1171.1	28.8	0.08	0.32	21.9	0.5	0.30	0.30	1.1	0.0
Cauley Creek	WRD 1103					636.0	61.5	0.17	0.34	92.6	8.9	0.17	0.20	0.0	0.0	0.00	0.00	306.3	29.6
Cavenders Creek	WRD 1211					1931.2	75.2	0.09	0.28	630.9	24.6	0.08	0.32	1.6	0.1	0.30	0.30	3.8	0.1
Chattahoochee River	WRD765	8.9	0.0	0.10	0.10	23596.3	77.7	0.09	0.32	6569.1	21.6	0.08	0.32	13.9	0.0	0.30	0.30	185.1	0.6
Crooked Creek	WRD 1038					5002.6	88.0	0.09	0.34	501.0	8.8	0.16	0.31	84.4	1.5	0.28	0.29	96.4	1.7
Foe Killer Creek	WRD 1052					2279.8	30.2	0.17	0.28	487.9	6.5	0.19	0.20	156.3	2.1	0.22	0.22	4614.2	61.2
Haw Creek	WRD 607	6.3	0.3	0.12	0.12	2094.1	97.8	0.02	0.34					38.1	1.8	0.28	0.30	3.7	0.2
Johns Creek	WRD 1051	6.6	0.1	0.09	0.09	3037.9	37.0	0.02	0.36	519.0	6.3	0.17	0.20	147.0	1.8	0.22	0.28	4504.2	54.8
Level Creek	WRD 1040					4741.2	90.4	0.09	0.34	396.7	7.6	0.21	0.31	34.3	0.7	0.28	0.29	69.9	1.3
Little Tesnatee Creek	WRD 702					3630.9	72.6	0.09	0.28	1304.5	26.1	0.08	0.32	5.8	0.1	0.30	0.30	59.6	1.2
Marsh Creek (aka March Creek)	WRD 1101					1664.4	48.2	0.17	0.36	166.9	4.8	0.19	0.20	5.8	0.2	0.22	0.22	1619.3	46.8
Richland Creek	WRD 1041					5625.1	93.2	0.12	0.34	353.1	5.9	0.21	0.31	25.1	0.4	0.28	0.29	29.5	0.5
Sand Creek	WRD 1133					1948.7	87.5	0.09	0.29	0.0	0.0	0.00	0.00	23.0	1.0	0.08	0.25	256.5	11.5
Sope Creek	WRD 1109					19010.0	84.3	0.06	0.34	1307.0	5.8	0.06	0.31	46.4	0.2	0.25	0.25	2183.5	9.7
Soque River	WRD 764	233.3	0.7	0.12	0.12	34143.1	95.2	0.02	0.37	849.9	2.4	0.05	0.30	592.2	1.7	0.24	0.30	48.5	0.1
South Fork Peachtree Creek	WRD 689					12959.9	72.5	0.08	0.34	559.9	3.1	0.24	0.25	3.8	0.0	0.31	0.31	4364.4	24.4
Tate Creek	WRD 1210					1763.9	58.8	0.09	0.28	1216.6	40.5	0.08	0.32	0.0	0.0	0.00	0.00	21.6	0.7
Tributary #1 to the Chattahoochee River	WRD 1100					920.2	88.5	0.12	0.34	101.5	9.8	0.21	0.31	7.5	0.7	0.28	0.28	10.7	1.0
Tributary #2 to the Chattahoochee River	WRD 1102					633.7	74.6	0.17	0.36	24.0	2.8	0.20	0.20					192.1	22.6
Tributary to Williams Creek	WRD 1130					982.5	98.3	0.23	0.29	11.0	1.1	0.08	0.08					5.9	0.6
Williams Creek	WRD 1129					905.3	98.1	0.23	0.29	13.6	1.5	0.08	0.08					4.4	0.5

Stream Segment	Station ID	A				B				C				D				Other	
		Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%
Piedmont – Support																			
Gum Branch	WRD 198					910.0	99.6	0.04	0.30									4	0.40
Gum Creek	WRD 69					4770.3	94.8	0.04	0.36	214.6	4.3	0.20	0.30	26.8	0.5	0.27	0.27	18.8	0.4
Hillabahatchee Creek	WRD 86					14248.7	97.8	0.04	0.30	224.0	1.5	0.18	0.22	47.9	0.3	0.19	0.27	50.7	0.3
Mountain Creek	WRD 1037					7905.9	85.6	0.23	0.29	170.9	1.9	0.08	0.08	115.3	1.2	0.08	0.29	1040.6	11.3
Snake Creek	WRD 88					24016.9	92.0	0.06	0.36	1769.6	6.8	0.08	0.30	15.2	0.1	0.29	0.29	289.5	1.1
Town Creek	WRD 87					5981.0	94.5	0.04	0.31	302.4	4.8	0.18	0.18	22.7	0.4	0.19	0.19	24.8	0.4
Whooping Creek	WRD 89					15617.9	91.9	0.06	0.36	1210.8	7.1	0.08	0.30	5.5	0.0	0.29	0.29	159.8	0.9
Whooping Creek	WRD 429	5.5	0.0	0.12	0.12	16525.8	91.7	0.06	0.36	1311.4	7.3	0.08	0.30	5.5	0.0	0.29	0.29	167.3	0.9

Table 8b. Hydrologic Soil Group Distribution for Macroinvertebrate Community Assessment Streams

Stream Segment	Station ID	A				B				C				D				Other	
		Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%	Min K Factor	Max K Factor	Area (Acres)	%
Southern Inner Piedmont Subecoregion (45a) – Not Supporting Stream Segments																			
Olley Creek	EPD 45a-61					7092.1	80.9	0.06	0.34	592.6	6.8	0.20	0.31	50.2	0.6	0.25	0.25	1028.5	11.7
Rottenwood Creek	EPD 45a-59					3140.0	50.5	0.06	0.34	345.7	5.6	0.06	0.31					2730.8	43.9
Southern Inner Piedmont Subecoregion (45a) – Supporting Stream Segments																			
Davidson Creek	EPD 45a-3					7202.6	95.5	0.02	0.37	35.7	0.5	0.20	0.30	267.6	3.5	0.29	0.30		
Hillabahatchee Creek	EPD 45a-89					10349.2	97.3	0.04	0.30	224.0	2.1	0.18	0.22	47.9	0.5	0.19	0.27		
Middle Fork Broad River	EPD 45a03//	1.3	0.0	0.12	0.12	8624.6	94.6	0.02	0.37	380.7	4.2	0.06	0.30	97.0	1.1	0.29	0.30		
Town Creek	EPD HH16					1991.4	91.1	0.04	0.30	184.1	8.4	0.18	0.18	9.2	0.4	0.19	0.19		
Southern Outer Piedmont Subecoregion (45b) – Not Supporting Stream Segments																			
North Fork Peachtree Creek	EPD 45b-202					15208.4	70.7	0.09	0.34	806.9	3.7	0.16	0.31	144.2	0.7	0.28	0.31	5361.1	24.9
South Fork Peachtree Creek	EPD 45b-203					12959.9	72.5	0.08	0.34	559.9	3.1	0.24	0.25	3.8	0.0	0.31	0.31	4364.4	24.4
Southern Outer Piedmont Subecoregion (45b) – Supporting Stream Segments																			
Beaverdam Creek	EPD 45b-120					2467.0	90.6	0.20	0.28	101.0	3.7	0.19	0.32	142.0	5.2	0.28	0.28		
Copeland Creek	EPD HH22					1348.0	41.4	0.08	0.49	557.0	17.1	0.18	0.20	1311.0	40.3	0.15	0.32	16.0	0.5
Little Falling Creek	EPD 45b-156					7383.0	60.7	0.17	0.33	3062.0	25.2	0.08	0.31	71.0	0.6	0.26	0.26	1539.0	12.6
Rocky Creek	EPD 45b-258					15796.0	94.4	0.18	0.34	816.0	4.9	0.13	0.30	22.0	0.1	0.25	0.29		
Tributary to Flint River	EPD 45b-357					1787.0	56.9	0.24	0.29	1062.0	33.8	0.16	0.32	287.0	9.1	0.08	0.29		
Tributary to Murder Creek	EPD 45b-152					1938.0	92.9	0.19	0.29	143.0	6.9	0.08	0.28						
Southern Hilly Gulf Coastal Plain Subecoregion (65d) - Not Supporting Stream Segments																			
Pataula Creek	EPD 65d-22	67.1	1.3	0.13	0.18	3411.4	65.3	0.13	0.32	1435.0	27.5	0.20	0.21	30.5	0.6	0.09	0.09	281.9	5.4
Talipahoga Rum Creek	EPD 65d-17	881.0	28.6	0.10	0.13	1454.2	47.2	0.14	0.23	451.7	14.7	0.18	0.21	68.4	2.2	0.09	0.21	227.2	7.4
Weracoba Creek	EPD 65d-1					3387.3	74.5	0.10	0.14	348.5	7.7	0.14	0.28	149.1	3.3	0.30	0.32	664.1	14.6
Southern Hilly Gulf Coastal Plain Subecoregion (65d) - Supporting Stream Segments																			
Hollaca Creek	65d-3	524.5	10.9	0.10	0.11	433.1	9.0	0.17	0.32	3314.1	68.7	0.21	0.24	540.5	11.2	0.29	0.33	13.6	0.3
Hannahatchee Creek	65d-14	2380.5	16.8	0.09	0.18	4380.9	30.8	0.14	0.32	6172.3	43.5	0.18	0.21	8.0	0.1	0.09	0.09	1249.7	8.8
Sally Branch	65d-4	938.2	23.6	0.10	0.11	184.9	4.7	0.17	0.19	2404.4	60.5	0.21	0.24	447.8	11.3	0.33	0.33		

2.0 WATER QUALITY ASSESSMENT

2.1 Fish Community Sampling

The GA WRD conducted studies of fish community populations at a number of monitoring sites in the Chattahoochee River Basin. Biological monitoring of fish communities is a method used to evaluate the health of a biological system to assess degradation from various sources, both point and nonpoint. GA WRD's biological monitoring of fish communities is based on direct observations of the aquatic communities within a stream. The results of these studies were the basis for the listings of Biota Impacted - Fish Community stream segments on Georgia's 303(d) list.

The work performed by the GA WRD consisted of looking at patterns of fish communities within the various ecoregions in Georgia. From this, GA WRD has established reference sampling sites within each ecoregion. These sites represent the least impacted sites that exist given the prevalent land use within the ecoregion.

Of all the sites GA WRD sampled in the Chattahoochee River Basin, eight (8) least impacted sites were used in this TMDL evaluation. Tables 9, 10, and 11 provide the data collected during the field investigations and subsequent laboratory analysis. All sites had to be accessible, wadeable, and representative of the stream under investigation. The length of each fish sampling site was thirty-five times the mean stream width, up to a maximum length of 500 meters. This sampling length has been found to be long enough to include the major habitat types present. Electrofishing and seining techniques were used for sampling the fish population (GA WRD, 2005a).

From data collected during the GA WRD fish community studies, two indices of fish community health were developed and used to assess the biotic integrity of the aquatic systems: the Index of Biotic Integrity (IBI) and the modified Index of Well-Being (IWB).The IBI and IWB numerical scores were developed by analyzing field data collected at each sampling site according to ecoregion-specific scoring criteria developed by GA WRD. These numerical scores were further classified into the integrity classes of Excellent, Good, Fair, Poor, or Very Poor.

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 that assess three facets of the fish population: 1) species richness and composition, 2) trophic composition and dynamics, and 3) fish abundance and condition. For each sampling site, each metric is calculated by comparing the site value of a particular scoring criterion to that 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 ecoregional drainage 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 metrics.

The modified IWB measures the health of the aquatic community based on the abundance and diversity of the fish community. The IWB is calculated based on four parameters: 1) the relative density of fish, 2) the relative biomass of fish, 3) the Shannon-Wiener Index of Diversity based on number, and 4) the Shannon-Wiener Index of Diversity based on biomass (GA WRD, 2005b). As of April 2013, the modified IWB is no longer be calculated or used for listing

assessment decisions. This has resulted in all streams receiving an IBI rating of Fair being placed in the supporting designated use list.

Table 9 summarizes GA WRD's fish community study scores. The IBI, IWB, and Habitat Assessment scores are listed for each study watershed, and are grouped according to supporting or not supporting status. In addition, the table includes the drainage areas upstream of the monitoring sites and the county in which the monitoring sites are located.

To supplement the findings of the fish community data, visual habitat assessments were performed at each sampling site. Habitat scores evaluate the in-stream habitat, morphology, and riparian characteristics of a stream as they affect and influence the quality of the water resource and its resident aquatic community. These scores may help clarify the results of the biotic indices. The visual habitat assessment was developed by personnel within the Watershed Protection Branch (WPB) of GA EPD and is a modification of the USEPA Rapid Bioassessment Protocol (GAWPB, 2000).It incorporates different assessment parameters for riffle/run prevalent streams and glide/pool prevalent streams. In Georgia, streams in the Blue Ridge, Piedmont, Ridge and Valley, and Southwestern Appalachian ecoregions are considered riffle/run prevalent streams, while streams in the Southeastern Plains and Southern Coastal Plain ecoregions are considered glide/pool prevalent streams.

The visual 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 (bottom substrate / available cover, pool substrate characterization, and pool variability). Level two describes the channel morphology (channel sinuosity, channel alteration, sediment deposition, and channel flow status). Level three describes the riparian zone surrounding the stream that indirectly affects the type of habitat and food resources available in the stream (bank vegetative protection, bank stability, and riparian vegetation zone width). Table 10 provides detailed habitat assessment scores for both supporting and not supporting streams.

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 bends, average stream depth, and average stream width. In addition, 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 11 provides a summary of these field measurements.

2.2 Macroinvertebrate Community Sampling

With the goal of monitoring and assessing the biological integrity of wadeable streams, GA EPD has undertaken a multi-phase project to establish macroinvertebrate stream assessment methodology and develop numerical scoring criteria for wadeable streams throughout the state. The results of the field studies completed as a part of this project were the basis for the listings of Biota Impacted - Macroinvertebrate Community stream segments on Georgia's 303(d) list.

GA EPD contracted with CSU to identify and sample streams from across the gradient of human disturbance in each of Georgia's level IV ecoregions, or subecoregions. Using data and information gathered as a part of this wide ranging sampling effort, CSU developed and validated an assortment of discrete metric indices that would take into account the ecological differences of Georgia's subecoregions. Using these indices, a standardized numerical scoring system was developed that can then be translated into a 5-step descriptive classification system that ranks a stream's health as Very Good, Good, Fair, Poor or Very Poor.

Table 9. GA WRD Fish Community Study Scores

Stream Name	GAWRD Site ID	Watershed Area (sq miles)	County	Sampling Date	IBI Score	IBI Category	IWB Score	IWB Category	Habitat Score Total (Max: 200)
Piedmont Ecoregion – Not Supporting Stream Segments									
Blue John Creek	226	9.6	Troup	4/8/1998	36	Fair	5.6	Poor	60
Blue John Creek	226	9.61	Troup	5/15/2013	22	Very Poor	---	---	67.7
Brushy Creek	1039	2.4	Gwinnett	6/26/2007	22	Very Poor	5.01	Poor	63.8
Cane Creek	701	6.4	Lumpkin	5/26/2004	20	Very Poor	6.3	Fair	109.4
Cauley Creek	1103	1.6	Fulton	6/26/2008	24	Very Poor	5.49	Poor	78.7
Cavender Creek	1211	4	Lumpkin	8/5/2010	32	Poor	8.43	Excellent	107.3
Chattahoochee River	765	47.4	White	8/24/2004	32	Poor	7.9	Fair	134.2
Crooked Creek	1038	8.9	Gwinnett	6/26/2007	28	Poor	7.75	Good	71.9
Foe Killer Creek	1052	11.8	Fulton	9/25/2007	22	Very Poor	6.06	Fair	69.2
Haw Creek	607	3.3	Forsyth	5/14/2003	44	Good	8.1	Good	120.2
Haw Creek	607	3.3	Forsyth	5/29/2007	32	Poor	6.47	Fair	---
Johns Creek	1051	12.8	Fulton	9/25/2007	28	Poor	8.35	Excellent	86.8
Level Creek	1040	8.2	Gwinnett	6/26/2007	24	Very Poor	6.53	Fair	105.8
Little Testnatee Creek	702	7.8	White	5/26/2004	28	Poor	4.8	Very Poor	117.7
Marsh Creek	1101	5.4	Fulton	6/26/2008	16	Very Poor	4.77	Very Poor	111.7
Richland Creek	1041	9.4	Gwinnett	6/26/2007	14	Very Poor	1.09	Very Poor	88.1
Sand Creek	1133	3.5	Harris	10/2/2008	30	Poor	6.26	Fair	57.7
Sope Creek	1109	35.2	Cobb	7/22/2008	16	Very Poor	6.46	Poor	68.7
Soque River	764	56	Habersham	8/24/2004	26	Poor	7.9	Fair	92.5
Soque River	764	56	Habersham	8/4/2010	32	Poor	8.03	Fair	105.3
South Fork Peachtree Creek	689	18.9	DeKalb	3/25/2004	14	Very Poor	4.5	Very Poor	67
Tate Creek	1210	4.7	Lumpkin	8/5/2010	24	Very Poor	5.9	Fair	121.2
Tributary #1 to the Chattahoochee River	1100	1.6	Gwinnett	6/26/2008	18	Very Poor	4.82	Very Poor	74.3
Tributary #2 to the Chattahoochee River	1102	1.3	Fulton	6/26/2008	30	Poor	7.11	Fair	94.8

Stream Name	GAWRD Site ID	Watershed Area (sq miles)	County	Sampling Date	IBI Score	IBI Category	IWB Score	IWB Category	Habitat Score Total (Max: 200)
Tributary to Williams Creek	1130	1.6	Harris	10/1/2008	30	Poor	6.55	Fair	95
Williams Creek	1129	1.4	Harris	10/1/2008	32	Poor	6.77	Fair	76
Piedmont Ecoregion - Supporting Stream Segments									
Gum Branch	198	1.4	Heard	8/21/1998	44	Good	6.4	Fair	134
Gum Creek	69	7.7	Heard	8/25/1998	50	Good	8.6	Excellent	120.3
Gum Creek	69	7.7	Heard	7/16/1999	50	Good	8.1	Good	121.5
Gum Creek	69	7.7	Heard	9/18/2001	50	Good	8.5	Excellent	116.9
Gum Creek	69	7.7	Heard	6/22/2006	46	Good	7.4	Good	123.7
Gum Creek	69	7.84	Heard	10/15/2013	46	Good	---	---	139
Hillabahatchee Creek	86	22.6	Heard	9/1/1999	52	Excellent	9.9	Excellent	149.9
Hillabahatchee Creek	86	22.6	Heard	9/28/2000	52	Excellent	9.9	Excellent	148.6
Hillabahatchee Creek	86	22.6	Heard	9/19/2001	46	Good	9.5	Good	141.2
Hillabahatchee Creek	86	22.6	Heard	10/29/2008	48	Good	9.66	Excellent	140.4
Hillabahatchee Creek	86	22.7	Heard	10/16/2013	44	Good	---	---	167
Mountain Creek	1037	14.4	Harris	6/6/2007	48	Good	8.4	Excellent	99.6
Snake Creek	88	40.6	Carroll	9/2/1999	48	Good	9.3	Good	70.2
Town Creek	87	9.9	Heard	8/31/1999	46	Good	7.8	Good	133.3
Whooping Creek	89	26.4	Carroll	9/2/1999	56	Excellent	10.4	Excellent	123.1
Whooping Creek	89	26.4	Carroll	9/29/2000	50	Good	10.1	Excellent	142.9
Whooping Creek	89	26.4	Carroll	9/18/2001	54	Excellent	10	Good	134.8
Whooping Creek	89	26.4	Carroll	10/30/2008	52	Excellent	9.63	Excellent	133.7
Whooping Creek	429	28	Carroll	4/19/2001	44	Good	8.5	Fair	117.2

Table 10. GA WRD Fish Community Habitat Assessment Scores - High Gradient Streams

Stream Name	GAWRD Site ID	Sampling Date	Instream Epifauna	Instream Cover	Epifauna Substrate	Velocity Depth Combinations	Embeddedness	Riffle Frequency	Channel Alteration	Sediment Deposition	Channel Flow Status	Bank Vegetation (Left)	Bank Vegetation (Right)	Bank Stability (Left)	Bank Stability (Right)	Riparian Zone (Left)	Riparian Zone (Right)	Habitat Score Total (Max: 200)
Piedmont Ecoregion – Not Supporting Stream Segments																		
Blue John Creek	226	4/8/1998	---	5	2.3	---	2	0	6.3	1.7	10.7	5.3	4.7	4	4.3	4.7	9	60
Blue John Creek	226	5/15/2013	7			10	3	0	11.3	2	10	3.7	3.3	4	2	6	5.3	67.7
Brushy Creek	1039	6/26/2007	8.3	---	---	7.5	3.3	0	16	1.7	9	4	1.7	1.7	1.5	7	2.2	63.8
Cane Creek	701	5/26/2004	12.7	---	---	12.7	9.7	17	15.3	6.7	10.7	4.2	4.2	5.5	4.8	4.3	1.7	109.4
Cauley Creek	1103	6/26/2008	10.3	---	---	7.3	7.3	7	10	4.3	5.7	4.7	3.7	4	4.3	3	7	78.7
Cavender Creek	1211	8/5/2010	11	---	---	12.3	9.3	18	14	7.3	10.3	4.3	4.3	5.7	5	2.3	3.3	107.3
Chattahoochee River	765	8/24/2004	17.2	---	---	15.9	13.1	16	16.1	8.4	13.8	3.3	3.9	5.5	5.7	9	6.4	134.2
Crooked Creek	1038	6/26/2007	12.4	---	---	11.7	0	2	12.8	0.7	10.3	2.7	3.1	2.8	3.2	2	8.4	71.9
Foe Killer Creek	1052	9/25/2007	6.1	---	---	9.8	4.5	10	11.7	1.3	6.7	2	2.2	2.2	2.3	5	5.3	69.2
Haw Creek	607	5/14/2003	12.5	---	---	14.8	12.5	15	17.1	8.6	10	3.1	2.3	3.1	2	9.3	9.9	120.2
Haw Creek	607	5/29/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Johns Creek	1051	9/25/2007	8.8	---	---	10.3	2.7	12	15.3	1.2	5.7	3.3	3.3	3.6	3.8	8.5	8.3	86.8
Level Creek	1040	6/26/2007	9.8	---	---	14.2	18.3	18	12.2	1.7	10.2	2	2.5	2.5	2.2	6.3	6	105.8
Little Testnatee Creek	702	5/26/2004	13.2	---	---	10.5	6.4	16	16	3	13.1	5.4	5.3	4.9	6	9	8.8	117.7
Marsh Creek	1101	6/26/2008	16.7	---	---	13.7	14.3	17	7.3	9.7	7.3	3.7	4	6	5	2.7	4.3	111.7
Richland Creek	1041	6/26/2007	11.1	---	---	13.5	0.7	19	15	0	14	2.7	3.3	2.2	2.4	2.1	2.1	88.1
Sand Creek	1133	10/2/2008	4.3	---	---	4.7	2.3	0	14.3	1.3	5.3	4.7	4.7	3.7	3.7	4.3	4.3	57.7
Sope Creek	1109	7/22/2008	7.7	---	---	9.8	9.7	0	9.3	4.2	11.7	2.6	2.4	3.8	3.2	2.7	1.7	68.7
Soque River	764	8/24/2004	15.7	---	---	17.5	5	0	15.4	3.3	15.1	4.2	3.6	4.2	3.8	2.5	2.2	92.5
Soque River	764	8/4/2010	14.7	---	---	17.3	6.3	17	13.3	4.3	11.7	4.7	4.3	2.8	2.5	3.5	2.8	105.3
South Fork Peachtree Creek	689	3/25/2004	9.4	---	---	12.2	2.9	0	8.2	5.8	7.7	1.5	1.5	2.3	2.5	5.8	7.2	67
Tate Creek	1210	8/5/2010	13.3	---	---	15	11	19	13	9	12	5.7	5.7	4.8	5	4	3.7	121.2

Stream Name	GAWRD Site ID	Sampling Date	Instream Epifauna	Instream Cover	Epifauna Substrate	Velocity Depth Combinations	Embeddedness	Riffle Frequency	Channel Alteration	Sediment Deposition	Channel Flow Status	Bank Vegetation (Left)	Bank Vegetation (Right)	Bank Stability (Left)	Bank Stability (Right)	Riparian Zone (Left)	Riparian Zone (Right)	Habitat Score Total (Max: 200)
Tributary #1 to the Chattahoochee River	1100	6/26/2008	7.3	---	---	10.2	5	0	15	5	7	4.5	3.3	3.7	3	4	6.3	74.3
Tributary #2 to the Chattahoochee River	1102	6/26/2008	13.7	---	---	11.3	11.3	13	7.5	8.3	6.7	4.3	3.7	5.3	3.3	2.7	3.7	94.8
Tributary to Williams Creek	1130	10/1/2008	6	---	---	8.7	5	17	14.3	4.3	4.7	4.7	4.7	4.7	5	9	7	95
Williams Creek	1129	10/1/2008	5.2	---	---	8.7	3	11	15	2.7	5.3	2.3	2.3	1.8	1.8	7.8	9	76
Piedmont Ecoregion - Supporting Stream Segments																		
Gum Branch	198	8/21/1998	---	15	15.3	---	14.3	15	16.3	13.3	10	4.3	4	3.7	2.7	9.7	9.7	134
Gum Creek	69	8/25/1998	---	14	12	---	11.3	18	8.7	10	12.3	6.3	5	6.3	4.7	9	2.7	120.3
Gum Creek	69	7/16/1999	---	7	10.1	---	7.9	19	16.4	9.9	11	7.9	6	7.3	5.3	9.1	4.2	121.5
Gum Creek	69	9/18/2001	13.6	---	---	14	10.6	18	16.3	10.6	9.8	3	2.7	2.8	2.2	7.2	5.9	116.9
Gum Creek	69	6/22/2006	14.5	---	---	9.2	14.5	17	20	5.5	13	4	3	5	4	8	6	123.7
Gum Creek	69	10/15/2013	17			15.3	12.7	18	15.3	12	11	7.3	7	4.7	3.3	8.7	6.7	139
Hillabahatchee Creek	86	9/1/1999	---	14	9.6	---	15	19	16	15.2	8.2	9	8.3	8.7	8	9.7	9.7	149.9
Hillabahatchee Creek	86	9/28/2000	---	16	13	---	11.8	18	16.7	12.8	11.5	7.9	7.1	7.6	7.2	9.7	9.7	148.6
Hillabahatchee Creek	86	9/19/2001	14.7	---	---	14.3	13.2	20	16.5	12.9	12.2	5.3	5.2	5.4	5	8.2	8.4	141.2
Hillabahatchee Creek	86	10/29/2008	15	---	---	16.5	10.5	19	15.2	7.7	15.3	6	5.8	5.6	5.6	8.8	9.3	140.4
Hillabahatchee Creek	86	10/16/2013	19			19	10.7	19	18	13	14.3	9	9	9	9	9	9	167
Mountain Creek	1037	6/6/2007	14	---	---	14.1	4	14	16.7	1.7	11	1.1	1.5	0.7	0.9	10	10	99.6
Snake Creek	88	9/2/1999	---	3	2.6	---	1.8	0	15.9	3.8	6.9	7	5.4	6.5	4.6	8.4	3.8	70.2
Town Creek	87	8/31/1999	---	8	13	---	14.9	15	16.4	15	8.9	6.1	6.6	5.5	6.5	8.7	9.1	133.3
Whooping Creek	89	9/2/1999	---	9	9.1	---	13.2	19	16.6	10.6	6.9	7.2	6	6.7	4.8	9.7	4.6	123.1
Whooping Creek	89	9/29/2000	---	13	15	---	13.7	17	16	13.8	9.1	7.4	6.5	6.6	5.5	9.7	9.7	142.9
Whooping Creek	89	9/18/2001	13.3	---	---	13.2	12.4	19	16.5	12.5	10.3	4.9	5.2	4.4	3.8	9.8	9.4	134.8
Whooping Creek	89	10/30/2008	14.9	---	---	13.1	12.5	16	15.1	10.8	13.7	5	4.2	5.3	4.4	9.3	9.3	133.7
Whooping Creek	429	4/19/2001	11.4	---	---	14	7.4	12	16.7	7.9	12.2	4.3	4.6	4.3	4.1	9.1	9.3	117.2

Table 11. GA WRD Fish Community Field Measurements

Stream Name	GAWRD Site ID	Sampling Date	Sampling Reach Length (m)	Average Stream Width (m)	Average Stream Depth (m)	Number of Pools	Deepest Pool (m)	Number Riffles	Water Temp (deg C)	Dissolved Oxygen (mg/L)	Conductivity (uS)	pH (SU)	Turbidity (NTU)	Total Hardness (mg/L)	Alkalinity (mg/L)	# of Individual Fish
Piedmont Ecoregion – Not Supporting Stream Segments																
Blue John Creek	226	4/8/1998	262	7.5	0.13	1	0.495	0	16.3	6.63	45	7.07	6.36	---	---	121
Blue John Creek	226	5/15/2013	189	5.4	0.16	0	---	0	18.8	8.1	158.9	7	4.37	85.5	70	126
Brushy Creek	1039	6/26/2007	102	2.9	0.3	2	1.1	0	21.4	4.99	75.3	7	---	28	25	96
Cane Creek	701	5/26/2004	178	5.1	0.32	5	1.21	7	19	8.83	23.7	7	4.08	9	15	236
Cauley Creek	1103	6/26/2008	70	2	0.11	0	---	2	21.94	7.3	79	7.01	5.79	30	40	128
Cavender Creek	1211	8/5/2010	144	4.1	0.23	3	0.61	6	23.93	8.83	50	7.25	4.18	27	30	1172
Chattahoochee River	765	8/24/2004	500	15.3	0.48	12	2	4	21.1	9.57	17	7	5.3	4	10	864
Crooked Creek	1038	6/26/2007	133	3.8	0.3	4	1.1	2	21.8	5.23	88.2	7	13.7	31	35	245
Foe Killer Creek	1052	9/25/2007	200	5.7	0.2	6	0.95	3	23.5	5.75	99.2	7	1.27	36	40	96
Haw Creek	607	5/14/2003	201	5.7	0.31	7	1.3	5	17.1	8.94	51.3	7	4.1	17	25	732
Haw Creek	607	5/29/2007	157	4.4	0.16	2	0.75	4	21.6	7.39	51.2	7	9.7	23	25	262
Johns Creek	1051	9/25/2007	182	5.2	0.16	4	1	2	24.1	6.63	76.6	7	4.1	27	35	607
Level Creek	1040	6/26/2007	154	4.4	0.23	7	1.3	2	21.7	6.42	71.1	7	9.4	23	35	123
Little Testnatee Creek	702	5/26/2004	245	7	0.32	8	0.71	5	19.4	7.62	30.8	6.5	7.6	11	15	168
Marsh Creek	1101	6/26/2008	186	5.3	0.19	6	0.81	7	24.13	8.65	96	7.56	3.66	34.2	40	149
Richland Creek	1041	6/26/2007	193	5.5	0.14	4	0.7	2	20.5	7.9	77.6	7	10.5	28	25	4
Sand Creek	1133	10/2/2008	88	2.5	0.17	1	0.5	0	14.24	10.02	32	7.16	7.59	10	20	271
Sope Creek	1109	7/22/2008	500	14.6	0.49	15	>2	1	25.33	7.87	133	7.63	7	39	45	823
Soque River	764	8/24/2004	500	14.7	0.66	15	1.6	1	19.5	8.13	24.6	7	8.7	8	15	1206
Soque River	764	8/4/2010	500	15.8	0.58	3	>2	6	24.52	9.66	17	7.3	4.71	9	15	1117
South Fork Peachtree Creek	689	3/25/2004	357	10.3	0.23	8	1.3	1	12	9.73	84.8	7	9.43	40	50	836
Tate Creek	1210	8/5/2010	168	4.9	0.18	5	0.63	6	23.8	8.25	16	6.32	6.18	8	15	438

Stream Name	GAWRD Site ID	Sampling Date	Sampling Reach Length (m)	Average Stream Width (m)	Average Stream Depth (m)	Number of Pools	Deepest Pool (m)	Number Riffles	Water Temp (deg C)	Dissolved Oxygen (mg/L)	Conductivity (uS)	pH (SU)	Turbidity (NTU)	Total Hardness (mg/L)	Alkalinity (mg/L)	# of Individual Fish
Tributary #1 to the Chattahoochee River	1100	6/26/2008	91	2.6	0.23	3	1.4	0	20.92	7.32	84	6.63	3.82	33	30	145
Tributary #2 to the Chattahoochee River	1102	6/26/2008	133	3.8	0.14	4	0.61	5	22.78	8.48	113	7.3	1.66	37	45	199
Tributary to Williams Creek	1130	10/1/2008	88	2.5	0.09	0	---	5	18.33	9.21	37	6.45	8.71	12	20	162
Williams Creek	1129	10/1/2008	98	2.8	0.15	0	---	3	18.17	9.61	32	7.08	6.5	14	15	247
Piedmont Ecoregion - Supporting Stream Segments																
Gum Branch	198	8/21/1998	88	2.5	0.17	8	0.7	4	21.2	7.8	24	6.81	4.21	---	---	169
Gum Creek	69	8/25/1998	259	7.4	0.25	10	1.65	7	21.3	7.81	27.8	6.92	10.1	---	---	852
Gum Creek	69	7/16/1999	242	6.9	0.21	6	1.06	7	20.5	8.02	31.1	6.39	6.56	11	20	891
Gum Creek	69	9/18/2001	250	7.1	0.3	7	0.95	7	18	8.79	29.5	6.5	5.8	9	20	865
Gum Creek	69	6/22/2006	259	7.4	0.31	6	0.95	6	23.8	8	32.8	6.5	12	10	20	545
Gum Creek	69	10/15/2013	270	7.56	0.17	8	99	6	17.1	9	34.6	6.5	2.6	8	15	694
Hillabahatchee Creek	86	9/1/1999	500	18.5	0.29	15	2	6	20.2	8.16	22.3	7.08	4.51	7	15	2999
Hillabahatchee Creek	86	9/28/2000	500	16.5	0.24	16	2	6	15	9.23	21	7	25.3	6	10	3753
Hillabahatchee Creek	86	9/19/2001	500	18.4	0.33	16	2	11	18.5	8.8	20.8	7	6.4	8	20	1866
Hillabahatchee Creek	86	10/29/2008	500	15.5	0.23	19	>2	9	7.14	13.65	18	6.77	6.3	8	10	2386
Hillabahatchee Creek	86	10/16/2013	491	16.63	0.33	32	99	8	16	9.7	26.2	7	2.6	8	20	1908
Mountain Creek	1037	6/6/2007	210	6.1	0.18	10	0.83	4	23	7.9	52.6	7	6.6	17	25	968
Snake Creek	88	9/2/1999	298	8.5	0.25	6	0.72	0	25.6	8.02	33.1	---	12.3	12	15	1755
Town Creek	87	8/31/1999	304	8.8	0.27	6	1.5	5	21.3	7.9	24	7.03	4.62	8	15	571
Whooping Creek	89	9/2/1999	388	11.1	0.2	7	0.95	8	20.2	7.98	27.9	---	4.19	9	20	1826
Whooping Creek	89	9/29/2000	392	11.2	0.17	7	0.93	6	16.4	8.95	25.6	7	8.03	6	15	2864
Whooping Creek	89	9/18/2001	483	13.9	0.29	11	1.25	7	17.1	8.7	28.7	7	5.8	8	15	1883
Whooping Creek	89	10/30/2008	390	11.2	0.18	7	0.91	5	8.48	13.33	23	6.61	4.3	9	20	2013
Whooping Creek	429	4/19/2001	406	11.6	0.45	9	1.4	3	9.3	7.52	20.6	6.5	6.15	6	10	616

The first task in this project was to identify the best attainable reference, or least impacted, conditions representative of each subecoregion. In order to assess the least impacted condition in each subecoregion, a process was established to identify candidate reference streams that were both wadeable and perennial in nature. Strahler stream order was used as the initial filtering criteria. Fourth-order streams were initially selected as they generally are found in even the smallest of subecoregions, and generally flow year-round, except in extreme drought. To increase the number of candidate streams, large second- and third-order streams with a total catchment length of over 8 kilometers (km) and small fifth-order streams with catchment length of less than 8 km were included, as they have roughly the same catchment areas as the fourth-order streams. Using geographic information system (GIS) software, land use data for the catchments areas were analyzed to quantify the level of human impact on each catchment area. For each catchment, the total land use areas and percentages, stream riparian buffer land use areas and percentages, number and density of stream/road crossings, and number and density of impoundments were analyzed. Candidate sampling sites were ranked, scored, and classified as reference (least impacted) or impaired (more heavily impacted). A separate list of candidate reference sites was also compiled from local regulatory agencies with expertise in aquatic biological integrity based on staff best professional judgment (BPJ) and institutional knowledge of least impacted streams in areas throughout the state. The list of agency candidate sites were evaluated using a similar GIS data analysis (Gore et al. 2010).

The next task involved sampling the potential reference sites. A representative sample of each stream's benthic macroinvertebrate community was collected and analyzed, each stream's water chemistry and physical properties was sampled and assessed, and available in-stream biological habitat at each candidate reference site was evaluated. Samples collected during the field investigations provided raw data for statistical analysis that subsequently yielded a set of possible metrics. These metrics were used to quantify different attributes of the biological community, and served as the method by which to compare streams with one another, and to the established reference condition. Sampling potential reference sites allowed for field validation of the GIS selection process, and helped to further refine which streams and corresponding sampling sites were included in the final reference stream determination to set the reference condition in each subecoregion.

Following the field reference site evaluations, the impaired streams identified through the GIS selection process were sampled for biological, chemical, physical conditions. The raw field data and subsequent analysis from the impaired sites was used, in combination with that of the reference sites, to identify trends and provide a statistical basis for the development of multi-metric indices (MMI) that could discriminate between reference and impaired streams. The choice of final metrics ultimately used was based, in part, on their relationship to ecoregional characteristics and response to stressors (Barbour *et al*. 1999). Metrics were selected from the following categories of biological information: richness, composition, tolerance/intolerance, and habit/trophic measures. Each category was represented when possible. Metrics were grouped into candidate indices for each subecoregion. A numerical scoring system and a 5-step descriptive classification system for evaluating the health of streams throughout Georgia were then created based on these multi-metric indices.

Following the initial establishment of the subecoregion specific MMI and numerical/descriptive scoring systems in 2007, GA EPD embarked on a further refinement of these evaluation criteria by collecting additional data at both least impacted and impaired sampling sites throughout the state. The numerical scoring system has been withdrawn until these additional data and subsequent analyses can be incorporated into each subecoregions' evaluation criteria.

The streams presented in this document as not supporting their designated use are a subset of the original streams sampled by CSU during the development of the original MMI and numerical scoring system. Despite the current withdrawal of the numerical scoring criteria for streams, it has been determined that these streams are classified as not supporting their designated use due to their degraded physical and biological condition, as documented during the initial CSU study.

The stream sampling phase of the project took place from 2000 through 2003, with all field work occurring between September and June, the designated “index period”. Within each stream, over a hundred meter sample reach, macroinvertebrate samples were collected, and a visual habitat assessment was completed using the modified USEPA Rapid Bioassessment Protocol. Water quality samples and in-situ water quality data were collected at the downstream end of the sampling reach. Macroinvertebrates were collected by the means of a D-frame net, mesh size of 595-600 microns, using the twenty-jab method, as described in *Macroinvertebrate Biological Assessment of Wadeable Streams in Georgia* (GA EPD, 2007). Samples were collected in all available stream habitats including: fast and slow riffles, undercut banks, leaf material, snags, and sandy bottoms. Macroinvertebrate sampling started at the zero meter mark and continued upstream to reduce habitat disturbance.

From each macroinvertebrate sample, a 200-organism subsample was randomly selected and the macroinvertebrates were identified to the lowest possible taxonomic level.

Table 12 summarizes CSU's macroinvertebrate community study scores. For each study watershed, the subecoregion index score, and total habitat assessment scores are listed, and are grouped according to supporting or not supporting status. In addition, the table includes the drainage areas upstream of the monitoring sites and the county in which the monitoring sites are located. Table 13a provides the individual habitat scores, total habitat score, and corresponding scoring narrative description for streams evaluated using high gradient habitat assessment criteria, grouped according to supporting or not supporting status. Table 13b provides the individual habitat scores, total habitat score, and corresponding scoring narrative description for streams evaluated using low gradient habitat assessment criteria, grouped according to supporting or not supporting status.

Table 12. GA EPD Macroinvertebrate Community Study Scores

Station ID	Waterbody Name	Watershed Area (Acres)	County	Sampling Date	Subecoregion Index Score	Subecoregion Numeric Ranking	Subecorgion Narrative Description
Southern Inner Piedmont Subecoregion (45a) - Not Supporting Stream Segments							
45a-59	Rottenwood Creek	6150.5	Cobb	11/18/2001	24	4	Poor
45a-61	Olley Creek	8660.5	Cobb	11/28/2001	12	5	Very Poor
Southern Inner Piedmont Subecoregion (45a) - Supporting Stream Segments							
45a-3	Davidson Creek	7516.2	Habersham	10/22/2000	73	2	Good
45a-89	Hillabahatchee Creek	832.8	Heard	10/28/2000	71	2	Good
45a03//	Middle Fork Broad River	9690.3	Stephens	10/28/2000	72	2	Good
HH16	Town Creek	458.7	Heard	10/28/2000	78	1	Very Good
Southern Outer Piedmont Subecoregion (45b) - Not Supporting Stream Segments							
45b-202	North Fork Peachtree Creek	21415.0	DeKalb	10/26/2002	23	4	Poor
45b-203	South Fork Peachtree Creek	17967.5	DeKalb	10/26/2002	30	4	Poor
Southern Outer Piedmont Subecoregion (45b) - Supporting Stream Segments							
45b-120	Beaverdam Creek	2632.6	Morgan	01/25/2002	63	2	Good
HH22	Copeland Creek	3269.2	Hancock	10/27/2000	62	2	Good
45b-156	Little Falling Creek	1706.2	Jones	02/01/2002	58	2	Good
45b-156	Little Falling Creek	1706.2	Jones	10/21/2010	58	2	Good
45b-258	Rocky Creek	16652.3	Monroe	01/02/2001	93	1	Very Good
45b-357	Tributary to Flint River	3170.5	Taylor	01/03/2001	62	2	Good
45b-152	Tributary to Murder Creek	2073.1	Putnam	11/05/2000	85	1	Very Good
Sand Hills Subecoregion (65c) - Not Supporting Stream Segments							
65d-1	Weracoba Creek	5343.2	Muscogee	10/18/2001	19	5	Very Poor
65d-17	Talipahoga Rum Creek	3744.2	Stewart	10/02/2002	40	4	Poor
65d-22	Pataula Creek	5362.2	Stewart	10/02/2002	31	4	Poor
Southern Hilly Gulf Coastal Plain Subecoregion (65d) - Supporting Stream Segments							
65d-3	Halloca Creek	4829.7	Chattahoochee	12/22/2000	71	2	Good
65d-14	Hannahatchee Creek	14190.3	Stewart	01/26/2001	88	1	Very Good
65d-4	Sally Branch	3892.9	Chattahoochee	12/21/2000	74	2	Good

Table 13a. GA EPD Macroinvertebrate Community Habitat Assessment Scores – High Gradient Streams

GA EPD Site ID	Stream Name	Sampling Date	Epifaunal Substrate - Available Cover	Embeddedness	Velocity/Depth Regime	Sediment Deposition	Channel Flow Status	Channel Alteration	Frequency of Riffles (or bends)	Bank Stability (Left Bank)	Bank Stability (Right Bank)	Vegetative Protection (Left Bank)	Vegetative Protection (Right Bank)	Riparian Vegetative Zone Width (Left Bank)	Riparian Vegetative Zone Width (Right Bank)	Habitat Total Score	Subecorgion Narrative Description
Not Supporting Stream Segments - High Gradient Habitat Assessment																	
45a-59	Rottenwood Creek	11/18/2001	2	9	14	4	8	7	4	5	4	2	1	6	1	67	Poor
45b-202	North Fork Peachtree Creek	10/26/2002	11	8	10	10	15	7	5	6	6	6	6	4	4	98	Poor
45b-203	South Fork Peachtree Creek	10/26/2002	18	10	10	10	10	18	10	3	3	7	7	6	2	114	Poor
65d-1	Weracoba Creek	10/18/2001	5	4	12	4	7	16	14	2	2	7	8	3	4	88	Very Poor
Supporting Stream Segments - High Gradient Habitat Assessment																	
45a-3	Davidson Creek	10/22/2000	16	15	16	14	16	15	17	5	9	9	6	9	8	155	Good
45a-89	Hillabahatchee Creek	10/28/2000	16	13	15	14	15	17	10	7	7	9	9	9	7	148	Good
45a03//	Middle Fork Broad River	10/28/2000	16	15	19	14	16	15	16	8	9	9	9	9	9	164	Good
HH16	Town Creek	10/28/2000	17	17	15	15	17	19	19	9	9	9	9	9	9	173	Very Good
45b-120	Beaverdam Creek	01/25/2002	15	5	11	5	15	19	15	7	8	5	5	9	9	128	Good
45b-258	Rocky Creek	01/02/2001	8	5	16	6	18	18	12	6	6	7	8	9	9	128	Very Good
45b-357	Tributary to Flint River	01/03/2001	15	10	17	14	17	17	16	6	5	8	8	10	10	153	Good
45b-152	Tributary to Murder Creek	11/05/2000	13	13	13	13	13	16	15	7	9	8	9	7	9	145	Very Good

Table 13b. GA EPD Macroinvertebrate Community Habitat Assessment Scores – Low Gradient Streams

GA EPD Site ID	Stream Name	Sample Date	Epifaunal Substrate - Available Cover	Pool Substrate Characterization	Pool Variability	Sediment Deposition	Channel Flow Status	Channel Alteration	Channel Sinuosity	Bank Stability (Left Bank)	Bank Stability (Right Bank)	Vegetative Protection (Left Bank)	Vegetative Protection (Right Bank)	Riparian Vegetative Zone Width (Left Bank)	Riparian Vegetative Zone Width (Right Bank)	Habitat Total Score	Subecorgion Narrative Description
Not Supporting Stream Segments - Low Gradient Habitat Assessment																	
45a-61	Olley Creek	11/28/2001	4	10	10	6	18	11	7	4	3	5	4	2	1	85	Very Poor
65d-17	Talipahoga Rum Creek	10/02/2002	16	17	10	14	11	16	13	7	8	7	8	9	6	142	Poor
65d-22	Pataula Creek	10/02/2002	7	10	10	5	15	19	14	8	8	8	8	9	9	130	Poor
Supporting Stream Segments - Low Gradient Habitat Assessment																	
HH22	Copeland Creek	10/27/2000	18	16	16	15	13	15	15	8	8	9	9	10	5	157	Good
45b-156	Little Falling Creek	02/01/2002	19	16	16	8	18	19	15	7	7	8	8	10	10	161	Good
65d-3	Hollaca Creek	12/22/2000	16	15	16	17	19	18	17	9	9	9	9	10	10	174	Good
65d-14	Hannahatchee Creek	01/26/2001	15	14	17	7	19	18	11	6	6	6	6	9	9	143	Very Good
65d-4	Sally Branch	12/21/2000	17	18	19	16	18	16	14	8	8	9	9	10	10	172	Good

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. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulation of pollutants on land surfaces that wash off as a result of storm events.

3.1 Point Source Assessment

Title IV of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permit program. There are two basic kinds of NPDES permits: 1) municipal and industrial wastewater treatment facilities, and 2) regulated stormwater discharges.

3.1.1 Wastewater Treatment Facilities

In general, municipal and industrial wastewater treatment facilities have NPDES permits with effluent limits. These permit limits are either based on federal and state effluent guidelines (technology-based limits) or on water quality standards (water quality-based limits).

The United States Environmental Protection Agency (USEPA) has developed technology-based guidelines, which establish a minimum standard of pollution control for municipal and industrial discharges without regard for the quality of the receiving waters. These are based on Best Practical Control Technology Currently Available (BPT), Best Conventional Control Technology (BCT), and Best Available Technology Economically Achievable (BAT). The level of control required by each facility depends on the type of discharge and the pollutant.

The USEPA and the states have also developed numeric and narrative water quality standards. Typically, these standards are based on the results of aquatic toxicity tests and/or human health criteria and include a margin of safety. Water quality-based effluent limits are set to protect the receiving stream. These limits are based on water quality standards that have been established for a stream based on its intended use and the prescribed biological and chemical conditions that must be met to sustain that use.

For purposes of this TMDL, NPDES permitted wastewater treatment facilities will be considered point sources. Discharges from municipal, industrial, private and federal NPDES permitted facilities are the primary point sources of sediment as total suspended solids (TSS) and/or turbidity. Based on a GIS analysis of currently available permitting databases, there are nine (9) permitted NPDES facilities discharging effluent within the watersheds upstream from the not supporting stream segments covered in the TMDL document.

Table 14a provides the current permitted flow and TSS concentrations for the NPDES permittees located within the watershed of stream segments not supporting their designated uses due to impaired fish communities. Table 14b provides the current permitted flow and TSS

concentrations for the NPDES permittees located within the watershed of stream segments not supporting their designated uses due to impaired macroinvertebrate communities. Where available, the average levels (whether daily or monthly) and the highest maximum levels (whether daily or weekly) discharged over the last three years (2014-2016) are also given. These data were obtained from available Discharge Monitoring Reports (DMRs) or Operation Monitoring Reports (OMRs). Where the facility's permitted flow is less than 0.1 MGD, the three year average values are not given.

Table 14a. Current NPDES Permit limits for Facilities that discharge within the watershed of Fish Community Not Supporting Streams

Facility	NPDES Permit No.	Facility Type	Receiving Water / Not Supporting Stream Segment	Data Source	FLOW (MGD)		TSS (mg/L)	
					Monthly Average	Weekly Average	Monthly Average	Weekly Average
Buford (City of) Westside WPCP	GA0023175	Municipal	Richland Creek	Permit Limit	0.25	0.31	30	45
				Actual Data	0.11	0.14	11.7	16.4
Gwinnett Co. - Lanier WTP	GAG640022	Municipal	Richland Creek	Permit Limit	report	report	30	45
				Actual Data	(1)	(1)	(1)	(1)
Cobb County - Marietta Water Authority - James E. Quarles WTP	GAG640068	Municipal	Sope Creek	Permit Limit	report	report	30	45
				Actual Data	(1)	(1)	(1)	(1)
Facility	**NPDES Permit No.**	**Facility Type**	**Receiving Water / Not Supporting Stream Segment**	**Data Source**	**FLOW (MGD)**		**TSS (mg/L)**	
					Daily Average	**Daily Max**	**Daily Average**	**Daily Max**
Kimberly Clark Corp	GA0046914	Industrial	Blue John Creek	Permit Limit	report	report	NL	NL
				Actual Data	(1)	(1)	NL	NL
Argos Ready Mix, LLC - Alpharetta Concrete Plant	GA0047601	Industrial	Foe Killer Creek	Permit Limit	report	report	NL	40
				Actual Data	(1)	(1)	NL	(1)

Table 14b. Current NPDES Permit limits for Facilities that discharge within the watershed of Macroinvertebrate Community Not Supporting Streams

Facility	NPDES Permit No.	Facility Type	Receiving Water / Not Supporting Stream Segment	Data Source	FLOW (MGD)		TSS (mg/L)	
					Daily Average	Daily Max	Daily Average	Daily Max
Argos Ready Mix, LLC - Doraville	GA0046906	Industrial	North Fork Peachtree Creek	Permit Limit	0.008	NL	NL	40
				Actual Data	0.32	NL	NL	26.7
Colonial Pipeline, Atlanta Junction Facility	GA0048429	Industrial	Olley Creek	Permit Limit	report	report	NL	NL
				Actual Data	(1)	(1)	NL	NL
Lockheed Martin Aeronautics Company	GA0001198	Industrial	Rottenwood Creek	Permit Limit	report	report	NL	NL
				Actual Data	(1)	(1)	NL	NL
Vulcan Construction Materials, LLC - Tucker Plant	GA0050216	Industrial	Burnt Fork Creek / South Fork Peachtree Creek	Permit Limit	0.002	0.002	NL	40
				Actual Data	(1)	(1)	NL	(1)

Notes:
(1) - Review of available DMR data shows no reported discharge during 2014 - 2016
NL - No NPDES permit limit

It is unknown if any of the point sources have contributed to the biota impairments in the Chattahoochee River Basin watersheds by discharging TSS or other pollutants. Heavy metals, ammonia, chlorine, elevated temperatures, low dissolved oxygen levels, and extreme pH levels are possible sources of toxicity, and high levels of these parameters can adversely affect the aquatic communities. These parameters are regulated through NPDES permits.

3.1.2 Regulated Storm Water Discharges

Certain sources of storm water runoff are covered under the NPDES Permit Program, and are considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe pollutant limits, storm water NPDES permits establish controls intended to reduce the quantity of pollutants storm water picks up and carries into storm sewer systems during rainfall events. Currently, regulated storm water discharges include those associated with industrial activities, construction sites one acre or greater, large and medium municipal separate storm sewer systems (MS4s), and small MS4s serving urbanized areas.

3.1.2.1 Industrial General Storm Water NPDES Permit

Storm water discharges associated with industrial activities are currently covered under the 2017 NPDES General Permit for Stormwater Discharges Associated with Industrial Activity (GAR050000) also called the Industrial General Permit (IGP). This permit requires visual monitoring of storm water discharges, site inspections, implementation of Best Management Practices (BMPs), preparation of a Storm Water Pollution Prevention Plan (SWPPP), and annual reporting. The IGP requires that stormwater discharging into an impaired stream segment or within one linear mile upstream of, and within the same watershed as, any portion of an impaired stream segment identified as “not supporting” its designated use(s), must satisfy the requirements of Appendix C of the 2017 IGP if the pollutant(s) of concern for which the impaired stream segment has been listed may be exposed to stormwater as a result of industrial activity at the site. If a facility is covered under Appendix C of the IGP, then benchmark monitoring for the pollutant(s) of concern is required. Delineations of both supporting and not supporting waterbodies are provided on the GA EPD website, and are available in ESRI ArcGIS shapefile format or in KMZ format for use in Google Earth. Interested parties may evaluate their proximity to not supporting waterbodies by utilizing these geospatial files.

Table 15 provides a list of those facilities in the Chattahoochee River Basin that have submitted a Notice of Intent to be covered under Georgia’s Industrial General Storm Water NPDES Permit, that also discharge into streams with impaired fish communities. Table 16 provides a list of those facilities in the Chattahoochee River Basin that have submitted a Notice of Intent to be covered under Georgia’s Industrial General Storm Water NPDES Permit, that also discharge into streams with impaired macroinvertebrate communities. At this time, it is unknown whether these facilities are contributing sediment to the watershed.

Table 15. Facilities Covered Under Georgia's General Industrial Storm Water NPDES Permit within watersheds with Impaired Fish Communities

Stream Segment	Site ID	Facility Name/Owner	Permit #
Blue John Creek	**WRD 226**	Custom Blenders Georgia, Llc	481
		Kimberly - Clark Corporation	2022
		Argos Ready Mix - Lagrange Concrete Plant	283
		Milliken & Company - Hillside/Valway Plant	1747
		Milliken & Company - Live Oak Plant	901
		P&G Duracell	614
		Rolling Frito Lay Sales, LP - Lagrange Bin	10599
Cauley Creek	**WRD 1103**	Alcon Laboratories	10917
Crooked Creek	**WRD 1038**	Crooked Creek WRF	628
		Dykes Paving And Construction Company	12741
		Fed Ex Ground - Norcross	12487
		Fedex Express MGEA	2916
		Immucor, Inc.	12383
		Metro Materials, Inc. - Plant #2	343
		QTG - CDSD	12370
		Valiant Steel And Equipment, Inc.	242
		Thomas Concrete - Doraville Plant #1500	4345
		Waste Eliminator, Inc.	12120
Foe Killer Creek	**WRD 1052**	Ready Mix Usa - Alpharetta Plant	10036
		Rolling Frito Lay Sales, LP - Roswell Bin	12057
		United Parcel Service - Roswell	3279
		Thomas Concrete Of Georgia Inc. - Alpharetta	2129
Level Creek	**WRD 1040**	MTI Baths, Inc.	12384
Richland Creek	**WRD 1041**	City Of Buford - Public Works Facility	12388
		Richland Creek Rd MSW Landfill	828
Sope Creek	**WRD 1109**	Amrep, Inc.	103
		El Maizal Tortilleria	4998
		Enplas (Usa) Inc	3377
		Metal Coaters Of Georgia, Inc.	940
		Ready Mix USA-Marietta Plant	1472
		Richmond Tree Experts	12884
		Sp Recycling Corporation	12074
		Tip Top Poultry	2020
		United Packers LLC	1659
		Dow Chemical	3597
South Fork Peachtree Creek	**WRD 689***	CSM Bakery Solutions - Atlanta Frozen	12480
		CSM Bakery Solutions - Atlanta Ingredients	10376
		Hormel Foods Corp.	4133
		House Of Cheatham	4130
		Marta- Avondale Yard Rail Services	1265
		Marta - Laredo Drive Bus Operating Facility	1263
		Newell Transportation LLC	397
		Oldcastle Precast East, Inc.	2490
		Rock - Tenn Company Atl Recycle Plant	884
		Southern Wall Products, Incorporated	3786
		Atlanta Kitchen	12483
		Atlanta Marble MFG	10129
		Vulcan Materials - Tucker Concrete Plant	12349

Source: Nonpoint Source Program, GA EPD, 2017
* - South Fork Peachtree Creek was sampled for Fish and Macroinvertebrate Community Health

Table 16. Facilities Covered Under Georgia's General Industrial Storm Water NPDES Permit within watersheds with Impaired Macroinvertebrate Communities

Stream Segment	Site ID	Facility Name/Owner	Permit #
Rottenwood Creek	**EPD 45a-59**	Cobb Community Transit Multi-Use Center	3093
		Dobbins Air Reserve Base	516
		General Lucius D. Clay National Guard Center (CGNC)	12860
		Lockheed Martin Aeronautics Company	1208
		Marietta City Schools Transportation Dept	10505
		Naval Air Station Atlanta	2606
Olley Creek	**EPD 45a-61**	Cobb County Transfer Station	12005
		Salvage Hunter Auto Parts	5003
		Smurfit Stone	5031
		AGC Flat Glass North America	12104
North Fork Peachtree Creek	**EPD 45b-202**	AAF International - Atlanta Plant	11038
		Applied Ceramics, Inc.	12390
		BP Doraville Terminal #1	13054
		Dekalb Peachtree Airport	337
		Argos Ready Mix - Doraville Concrete Plant	303
		Georgia-Pacific Corporation	607
		Kinder Morgan Liquids Terminal-Doraville 3 Terminal	13145
		Manna Pro Products, LLC	1839
		Metro Green, LLC - Materials Recovery And Processing	12197
		Ns Thoroughbred Bulk Terminal	12488
		OFS Fitel, LLC	2649
		Ole' Mexican Foods Inc.	10471
		Purafil	4477
		QG Printing Corporation	12395
		Sanitation- North District	10275
		United Parcel Service, Inc. - Pleasantdale	748
		United States Gypsum Company	379
		Atlanta Journal-Constitution	806
		Wilson Trucking Corp	4072
South Fork Peachtree Creek	**EPD 45b-203***	CSM Bakery Solutions - Atlanta Frozen	12480
		CSM Bakery Solutions - Atlanta Ingredients	10376
		Hormel Foods Corp.	4133
		House Of Cheatham	4130
		Marta- Avondale Yard Rail Services	1265
		Marta - Laredo Drive Bus Operating Facility	1263
		Newell Transportation LLC	397
		Oldcastle Precast East, Inc.	2490
		Rock - Tenn Company Atl Recycle Plant	884
		Southern Wall Products, Incorporated	3786
		Atlanta Kitchen	12483
		Atlanta Marble MFG	10129
		Vulcan Materials - Tucker Concrete Plant	12349
Weracoba Creek	**EPD 65d-1**	AAA Cooper Transportation	1158
		All American Recycling	13028
		All American Recycling - MLK Blvd	13029
		Columbus & Chattahoochee Railroad	12829
		Designs By Melinda	12858
		EJ Knight Scrap Material Co.	12444
		Hostess Brands, LLC	221
		Newell Recycling Of Columbus, Llc	12156
		Ready Mix USA, LLC - Andrews Road Plant	3268
		Ready Mix USA, LLC - Columbus Downtown	1122
		Schnitzer Southeast - Columbus	1155

Source: Nonpoint Source Program, GA EPD, 2017
* - South Fork Peachtree Creek was sampled for Fish and Macroinvertebrate Community Health

3.1.2.2 MS4 NPDES Permits

The collection, conveyance, and discharge of diffuse storm water to local water bodies by a public entity is regulated in Georgia by the NPDES MS4 permits. These MS4 permits have been issued under two phases. Phase I MS4 permits cover medium and large cities, and counties with populations over 100,000. Each individual Phase I MS4 permit requires 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. A program to monitor and control pollutants in storm water discharges from industrial facilities, construction sites, and highly visible pollutant sources that exist within the MS4 area must be implemented under the permit. Additionally, monitoring of not supporting streams, public education and involvement, post-construction storm water controls, low impact development, and annual reporting requirements must all be addressed by the permittee on an ongoing basis.

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 area with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. As of 2015, Seventy-three (73) municipalities, thirty-five (35) counties, five (5) Department of Defense facilities, and the Georgia Department of Transportation (GDOT) are permitted under the Phase II storm water regulations in Georgia. All municipal Phase II permitees are authorized to discharge under Storm Water General Permit GAG610000. Department of Defense facilities are authorized to discharge under Storm Water General Permit GAG480000. GDOT owned or operated facilities are authorized to discharge under Storm Water General Permit GAR041000. Under these general permits, each permittee must design and implement a SWMP that incorporates BMPs that focus on public education and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction storm water management, and pollution prevention in municipal operations. Table 17 lists the permitted MS4s that discharge into stream segments not supporting their designated use for biota.

Table 17. Permitted MS4s in the Chattahoochee River Basin Discharging to Not Supporting Streams

MS4 Permittee	Permit Number	Permit Phase
Alpharetta	GAS000101	1
Atlanta	GAS000100	1
Austell	GAS000103	1
Avondale Estates	GAS000137	1
Brookhaven	GAG610000	2
Buford	GAS000104	1
Clarkston	GAS000106	1
Cobb County	GAS000108	1
Columbus-Muscogee County	GAS000202	1
Decatur	GAS000110	1
DeKalb County	GAS000111	1
Dunwoody	GAG610000	2

MS4 Permittee	Permit Number	Permit Phase
Forsyth County	GAS000300	1
Fulton County	GAS000117	1
Gwinnett County	GAS000118	1
Johns Creek	GAG610000	2
Marietta	GAS000125	1
Milton	GAG610000	2
Norcross	GAS000127	1
Roswell	GAS000131	1
Sandy Springs	GAG610000	2
Sugar Hill	GAS000135	1
Suwanee	GAS000144	1

Source: Nonpoint Source Program, GA EPD, 2017

The total area of each not supporting watershed and the percentage of urbanized area in the permitted MS4 area contained within each watershed are provided in Table 18. The land use types considered urbanized include 1) developed open space, 2) developed low intensity, 3) developed medium intensity, 4) developed high intensity, 5) utility swaths, and 6) golf courses.

Table 18. Percentage of Watersheds Located in urbanized MS4 Areas

Stream Segment	Site ID	Watershed Area (Acres)	Percentage Urbanized MS4	MS4 Permittee
Fish Community Not Supporting Segments				
Blue John Creek	**WRD 226**	6206.2	0.0%	
Brushy Creek	**WRD 1039**	1547.6	78.6%	Gwinnett County, Sugar Hill, Suwannee
Cane Creek	**WRD 701**	4067.8	0.0%	
Cauley Creek	**WRD 1103**	1035.7	50.2%	Johns Creek, Fulton County
Cavenders Creek	**WRD 1211**	2567.8	0.0%	
Chattahoochee River	**WRD765**	30374	0.0%	
Crooked Creek	**WRD 1038**	5685.1	83.1%	DeKalb County, Dunwoody, Gwinnett County, Norcross
Foe Killer Creek	**WRD 1052**	7537.2	74.6%	Alpharetta, Fulton County, Milton, Roswell
Haw Creek	**WRD 607**	2142.1	53.5%	Forsyth County
Johns Creek	**WRD 1051**	8213.9	74.1%	Forsyth County, Fulton County, John's Creek
Level Creek	**WRD 1040**	5242.1	62.2%	Gwinnett County, Sugar Hill, Suwannee
Little Tesnatee Creek	**WRD 702**	4999.7	0.0%	
Marsh Creek (aka March Creek)	**WRD 1101**	3455.8	78.7%	DeKalb County, Dunwoody, Fulton County, Sandy Springs
Richland Creek	**WRD 1041**	6032.9	54.4%	Buford, Gwinnett County, Sugar Hill
Sand Creek	**WRD 1133**	2227.3	0.0%	
Sope Creek	**WRD 1109**	22549.7	77.1%	Cobb County, Marietta
Soque River	**WRD 764**	35862.9	0.0%	
South Fork Peachtree Creek	**WRD 689**	17891.9	68.8%	Atlanta, Avondale Estates, Clarkston, Decatur, DeKalb County, Fulton County
Tate Creek	**WRD 1210**	3001.2	0.0%	
Tributary #1 to the Chattahoochee River	**WRD 1100**	1037	84.8%	Gwinnett County
Tributary #2 to the Chattahoochee River	**WRD 1102**	849.8	65.0%	Fulton County, Sandy Springs
Tributary to Williams Creek	**WRD 1130**	998.8	0.0%	
Williams Creek	**WRD 1129**	923.6	0.0%	
Macroinvertebrate Community Not Supporting Segments				
Olley Creek	**EPD 45a-61**	8763.0	68.4%	Austell, Cobb County, Marietta
Rottenwood Creek	**EPD 45a-59**	6216.4	88.0%	Cobb County, Marietta
North Fork Peachtree Creek	**EPD 45b-202**	21518.3	66.6%	Brookhaven, DeKalb County, Gwinnett County
South Fork Peachtree Creek	**EPD 45b-203**	17891.9	68.8%	Atlanta, Avondale Estates, Clarkston, Decatur, DeKalb County, Fulton County
Pataula Creek	**EPD 65d-22**	5223.8	0%	
Talipahoga Rum Creek	**EPD 65d-17**	3082.4	0%	
Weracoba Creek	**EPD 65d-1**	4551.8	92.1%	Columbus-Muscogee County

Source: Nonpoint Source Program, GA EPD, 2017

Soil erosion from construction sites has historically been a major source of sediment in Georgia's streams. Georgia requires construction sites over one acre to have a General Storm Water NPDES permit. General permits have been created to cover construction projects that fall

into three distinct categories; stand-alone construction projects (General Permit No. GAR100001), infrastructure construction projects (General Permit No. GAR100002), and construction that occurs under a common plan of development where the primary permittee chooses to use secondary permittees for land disturbance activities (General Permit No. GAR100003). Since construction sites are regulated by NPDES permits, they are considered point sources. It is unknown if there are any construction sites in the not supporting watersheds of the Chattahoochee 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 a variety of 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 cause increased flooding. It can affect the ability of the stream to assimilate pollutants. Excessive sediment can change the diversity of fish populations and other biological communities. In addition, harmful pollutants can attach to the sediment and 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. The Georgia Forestry Commission (GFC) was consulted for information and parameters regarding silviculture activities. Table 19 lists the percent timberland and percent harvested per year for counties that contain modeled watersheds.

Table 19. Timberland, Growing Stock and Annual Removal

County	Forest Area (acres)	Timberland (acres)	Net Growing Stock Volume (ft^3) [a]	Annual Average Harvest Removal (ft^3)
Carroll	184,492	184,492	405,688,474	11,113,150
Chattahoochee	131,751	131,751	178,190,550	971,018
Cobb	24,350	24,350	65,453,713	1,571,085
DeKalb	48,589	48,589	85,941,971	81,715
Forsyth	65,672	65,672	102,280,394	29,836
Fulton	118,076	118,076	352,579,486	5,258,387
Greene	210,816	210,816	405,756,714	6,907,498
Gwinnett	87,241	87,241	201,915,073	2,117,274
Habersham	112,381	112,381	283,886,910	1,399,717

County	Forest Area (acres)	Timberland (acres)	Net Growing Stock Volume (ft^3) [a]	Annual Average Harvest Removal (ft^3)
Hancock	270,117	270,117	350,204,535	26,799,030
Harris	234,198	234,198	347,472,978	14,147,341
Heard	119,426	119,426	193,908,701	4,111,348
Jasper	200,351	188,435	366,691,884	12,729,722
Jones	208,431	184,780	293,583,554	4,886,978
Lamar	95,723	95,723	122,078,715	2,833,253
Lumpkin	145,083	133,507	366,095,406	1,028,247
Monroe	187,624	187,624	325,300,502	13,985,783
Morgan	165,589	165,589	308,337,949	7,483,052
Muscogee	74,486	74,486	104,371,887	506,764
Putnam	149,183	149,183	233,831,259	6,407,223
Rabun	225,480	202,327	499,099,339	1,077,787
Stephens	95,062	95,062	110,520,211	5,065,079
Stewart	238,150	238,150	237,175,993	9,211,368
Talbot	212,095	212,095	293,031,772	9,464,619
Taliaferro	120,027	120,027	168,178,631	2,152,148
Taylor	233,364	233,364	152,801,881	10,142,182
Towns	68,612	52,435	92,834,850	1,364,351
Troup	195,591	195,591	385,716,684	3,777,247
Union	166,053	125,536	244,733,934	108,715
White	124,670	107,306	232,150,722	1,358,123

[a] - Estimate - does not include trees less than 5" diameter at breast height (DBH).
Source: Forest Inventory EVALIDator web-application, USDA-FS, Northern Research Station, 2015

3.2.2 Agriculture

Agriculture can be a significant contributor of nonpoint pollutants to rivers and streams including sediment and nutrients. Cropland is one of the major sources of soil loss due to sheet and rill erosion. The NRCS was consulted for information and parameters regarding agricultural activities. Over the last century there has been a significant decrease in the amount of land farmed in Georgia. In 1950, there were approximately 198,000 farms encompassing 25.7 million acres in Georgia (U.S. Bureau of the Census, 1954). In 1982, there were approximately 12.3 million acres of farmland in Georgia, with the number of farms estimated to be 50,000 and the average farm size being approximately 248 acres. This represents a 52 percent reduction in farmland acreage. The number and acreage of farms has continued to decrease as time has gone on. In 2012, it was reported that approximately 42,000 farms covering 9.6 million acres existed in Georgia, which represents a 63 percent reduction from 1950 (USDA-NASS, 2012).

With the reduction in farmland, there has also been a decrease in the amount of soil erosion from agricultural lands. 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 not supporting streams in the Chattahoochee 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 has found that gully erosion typically contributes less than 30 percent of the total sediment load; however, contributions can range from 0 to 89 percent (USEPA, 2001b).

Beef cattle spend most of 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 flow 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 ranging 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 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 resulting 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. Since the early 80's the area classified as commercial forest within the Chattahoochee River Basin has significantly decreased. 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 newly developed and existing urban areas also has an impact on the transport of sediment to and within streams. As urbanization increases imperviousness across a watershed, the resulting hydrological response is almost always seen as an increase in the runoff volume and erosive force delivered to streams and other waterbodies over a shorter amount of time. As these compressed duration, high volume, high velocity stormwater discharges enter streams from the built environment they tend to cause stream bank erosion and stream bottom down cutting, further compounding sedimentation issues downstream.

Table 20 provides the amount and overall percentage of impervious cover within the watershed of each not supporting stream segment covered in this TMDL document. These data were extracted from the 2008 Georgia Land Use Trends (GLUT). This raster impervious cover trend product was developed by the University of Georgia – Natural Resources Spatial Analysis Laboratory (NARSAL) and follows land use trends for years 1991, 2001, 2005, and 2008. The raster data sets were developed from 1 meter aerial photography, and Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) datasets, with a resolution of 30 meters.

Table 20. Amount and Percentage of Impervious Area in Not Supporting Watersheds

Stream Segment	Station ID	Total Area (Acres)	Impervious Area (Acres)	% Impervious Area
Not Supporting Segments - Fish Community Assessment				
Blue John Creek	WRD 226	6205.3	1545.9	24.9%
Brushy Creek	WRD 1039	1547.7	617.8	39.9%
Cane Creek	WRD 701	4066.5	17.4	0.4%
Cauley Creek	WRD 1103	1033	218.3	21.1%
Cavenders Creek	WRD 1211	2565.3	32.0	1.2%
Chattahoochee River	WRD765	30362.8	193.0	0.6%

Stream Segment	Station ID	Total Area (Acres)	Impervious Area (Acres)	% Impervious Area
Crooked Creek	WRD 1038	5682.7	2423.7	42.7%
Foe Killer Creek	WRD 1052	7534.9	2227.6	29.6%
Haw Creek	WRD 607	2141.6	297.9	13.9%
Johns Creek	WRD 1051	8209.3	2501.6	30.5%
Level Creek	WRD 1040	5238.1	1071.7	20.5%
Little Tesnatee Creek	WRD 702	4996.0	72.8	1.5%
Marsh Creek (aka March Creek)	WRD 1101	3456.3	975.5	28.2%
Richland Creek	WRD 1041	6028.1	1158.5	19.2%
Sand Creek	WRD 1133	2226.1	11.2	0.5%
Sope Creek	WRD 1109	22538.8	5544.8	24.6%
Soque River	WRD 764	35852.5	174.6	0.5%
South Fork Peachtree Creek	WRD 689	17880.3	5603.4	31.3%
Tate Creek	WRD 1210	2998.8	17.1	0.6%
Tributary #1 to the Chattahoochee River	WRD 1100	1038.4	391.3	37.7%
Tributary #2 to the Chattahoochee River	WRD 1102	850.7	112.7	13.2%
Tributary to Williams Creek	WRD 1130	997.5	7.7	0.8%
Williams Creek	WRD 1129	920.8	5.4	0.6%
Not Supporting Segments - Macroinvertebrate Community Assessment				
North Fork Peachtree Creek	EPD 45b-202	21509.7	7844.4	36.5%
Olley Creek	EPD 45a-61	8758.2	2368.5	27.0%
Pataula Creek	EPD 65d-22	5221.2	30.1	0.6%
Rottenwood Creek	EPD 45a-59	6215.5	2765.6	44.5%
South Fork Peachtree Creek	EPD 45b-203	17880.3	5603.4	31.3%
Talipahoga Rum Creek	EPD 65d-17	3081.7	9.9	0.3%
Weracoba Creek	EPD 65d-1	4546.7	1944.4	42.8%

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 the identification of sources and their relative contribution, as well as the examination of potential water quality changes resulting from varying management options used to meet the water quality standards. 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 available prevents GA EPD from using a dynamic watershed runoff model to determine the daily sediment loads since these models require a great deal of data for model development and calibration. Instead, GA EPD has determined the annual sediment loads delivered to a stream from the watersheds. This TMDL document does not address in-stream sedimentation processes, such as bank erosion and stream bottom downcutting, 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 40 years ago. It is the most widely accepted and 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 its 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 BMPs.

4.2 Universal Soil Loss Equation

For each of the watersheds monitored in the Chattahoochee 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
L = slope length factor
S = slope steepness factor
C = cover management factor
P = conservation practice factor

4.2.1 Rainfall Erosivity Index

The R factor, or rainfall erosivity index, is a measure of the cumulative erosive force of individual precipitation events. When other factors are constant, soil losses from storm rainfall are directly proportional to the product of the total kinetic energy of the storm (E) times its maximum 30-minute intensity (I_{30}); this is termed the single-storm erosion index (EI_{30}). The mean annual R-factor represents the sum of EI_{30} values for all storms in a year, averaged over all years of record (Daly and Taylor, 2002). Daily rain-gauge data for the period 1971-2000 were used to compute R-factor values for the conterminous United States. The R-factor values are specified by a raster dataset with a spatial resolution of 2.5 minutes (about 4 km cell size), which was produced by the Spatial Climate Analysis Service at Oregon State University. R factor varies geographically and ranges from 279 to 475 within the Chattahoochee River Basin. Table 21 provides the rainfall statistics from six meteorological stations located throughout Georgia, and shows the variability of rainfall frequency and amount.

Table 21. 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

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. The factor reflects the fact that different soils erode at different rates when the other factors that affect erosion (e.g., infiltration rate, permeability, total water capacity, dispersion, rain splash, and abrasion) are the same. Texture is the principal factor affecting erodibility, but structure, organic matter, and permeability also contribute (Goldman et al. 1986).

The soil erodibility factor is a raster dataset generated for each modeled watershed from the SSURGO database. The erodibility of the soil horizons and components of each soil map unit are proportioned and summed to compute the overall K-factor for each soil map unit. Soil map units are the basic geographic unit utilized in the SSURGO database. Tables 8a and 8b provides a summary of hydrologic soil groups in each supporting and not supporting watershed that was modeled and the corresponding range of K-factors.

4.2.3 Slope Length and Steepness Factors

L is the slope length factor, representing the effect of slope length on erosion. It is the ratio of soil loss from the field slope length to that from a unit plot length on the same soil type and gradient. In practice, slope length is the distance from the origin of overland flow along its flow path to the location of either concentrated flow or deposition. Longer slopes generally

accumulate more runoff from larger areas and also result in higher overflow velocities. The slope length factor is computed with the equation:

$$L = (x_i^{m+1} - x_{i-1}^{m+1})/[\lambda_u^m (x_i - x_{i-1})]$$

Where:

x_i = distance to the lower end of the segment

x_{i-1} = distance to the upper end of the segment

λ_u = length of the unit plot (72.6 ft)

m = $\frac{\beta}{1+\beta}$ = slope length exponent

β = $\left[\frac{k_r}{k_i}\right] * \left[\frac{c_r}{c_i}\right] * \left[\frac{\exp(-0.05\ G_c)}{\exp(-0.025\ G_c)}\right] * \left[\frac{\left(\frac{\sin\theta}{0.0896}\right)}{\left[3\left(\frac{\sin\theta}{0.896}\right)^{0.8}+0.56\right]}\right]$

$\left[\frac{k_r}{k_i}\right]$ = the ratio of rill erodibility to interrill erodibility, assumed to be 1

$\left[\frac{c_r}{c_i}\right]$ = the ratio for below ground effects for rill and interrill erosion, assumed to be 1

$\left[\frac{\exp(-0.05\ G_c)}{\exp(-0.025\ G_c)}\right]$ = ratio of the ground cover effect on rill and interrill erosion, assumed to be 1

θ = slope angle of the segment

S is the slope steepness factor, representing the effect of slope steepness on erosion. Steeper slopes generally produce higher overland flow velocities. Soil loss increases more rapidly with slope steepness than it does with slope length. The slope steepness factor is computed by the equation:

$$S = 10.8 \sin\theta + 0.03 \quad \text{for slopes} < 9\%$$
$$S = 16.8 \sin\theta - 0.50 \quad \text{for slopes} \geq 9\%$$

Both the L and S factor equations depend on the slope angle (θ) of the given watershed. Slope angle is calculated using digital elevation model (DEM) data obtained from the United States Geological Survey (USGS) National Elevation Dataset (NED).

4.2.4 Cropping Factor

The C-factor, or cover management factor, is a dimensionless number, ranging between 0 and 1, that represents the degree of protection from erosion provided by crops, vegetation, and other soil cover. For this application of USLE, the C-factor has been utilized to convey the inherent erosion potential of the different land covers in each modeled watershed.

For agricultural lands, the C-factor incorporates the effects of tillage, crop type, cropping history, and crop yield on both soil erosivity and erodibility. ARS has continually refined C-factor values for specific crop and pasture types throughout the years. These values are easily obtained and well distributed. A review of available literature yielded generalized C-factor values for all land cover types and is given in Table 22.

Table 22. C-Factor for Land Cover types in Georgia

Land Cover Type	C-factor
Open Water/Beaches/Dunes/Mud	0
Utilities Swaths / Golf Courses	0.011
Developed	0.003
Clearcut/Sparse	0.2
Quarries/Strip Mines	0.2
Rock Outcrops	0
Forested	0.001
Pasture	0.011
Row Crops	0.2
Wetland	0.011

Source: Soil & Water Assessment Tool Documentation, 2012

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

USEPA 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. The Sediment Tool extension, which utilized the USLE, was used to estimate the potential sediment delivery to a defined water body of concern. This original version of WCS was used for modeling of sediment TMDLs issued by GA EPD through 2012.

GA EPD has updated and modernized the code and originally developed by USEPA and Tetra Tech. The original WCS program and code was evaluated to determine what functionality and features should be incorporated into the updated system.

The utilization of a GIS-based platform was considered a high priority so large amounts of high resolution geospatial data could be efficiently analyzed for water quality limited streams. The Natural Resources Spatial Analysis Lab (NARSAL), within the College of Agricultural and Environmental Sciences, at the University of Georgia was contracted to update the GIS-based platform that would allow for similar analyses of the original WCS and its Sediment Tool.

The GIS software platform chosen was ArcGIS. The GA EPD Watershed Characterization System (GAWCS) was developed to run in ArcMap 10.X and utilize widely available and regularly updated state-wide geospatial datasets. Within the ArcGIS toolbox, two source code scripts, written in the open-source Python coding language, generate required datasets based on DEM data, and evaluate a selected watershed utilizing a sediment budget model based on the Revised Universal Soil Loss Equation, Version 2 (RUSLE2).The sediment budget model provides the estimated annual average soil loss due to sheet and rill erosion. A tabular

summary of land cover, soil, stream, and demographic attributes of the selected watershed is provided to fully characterize a watershed, aid in water quality evaluation, and identify potential sources of impairment.

The DEM Process script utilizes the highest resolution DEM dataset available to generate three raster datasets that are subsequently used in the sediment budget calculation process. First, a state-wide slope angle raster data file is generated by calculating the slope angle from the raw DEM raster data. Following the generation of the slope angle raster, the DEM raster is hydrologically corrected such that modeled streamflow always flows along accurate stream paths to the edge of the DEM dataset. In this process, the streams from the USGS National Hydrography Dataset (NHD) NHD Flowline Feature Class are rasterized, snapped, and "burned" into the DEM. The "burn" process is essentially subtracting the stream pixels from the DEM, thus making an artificial gully and forcing the subsequently calculated flow accumulation and flow direction to follow the NHD streams. The DEM raster is then filled to remove any sinks. Finally, a state-wide flow direction raster and flow accumulation raster are generated, based on the edited DEM raster file. As higher resolution DEM datasets become available, the DEM processing script can be used to generate state-wide slope angle, flow direction, and flow accumulation raster datasets with a higher degree of accuracy.

The Watershed Characterization script evaluates a user-defined watershed that can either be based on a manual watershed delineation provided by the user or the script can delineate a watershed based on a user-selected pour point. Once the watershed is delineated, a variety of statistics describing land cover, population, and soil makeup are calculated and exported in tabular form.

Following the tabulation of watershed statistics, the Watershed Characterization script initiates the sediment erosion calculation process. A 30-meter by 30-meter grid is superimposed over the watershed to form the basic framework from which the sediment erosion estimate is calculated. This grid size represents the spatial resolution of the most land cover datasets, including the National Land Cover Dataset (NLCD) produced by USGS, and the Georgia Land Use Trends (GLUT) dataset produced by NARSAL. For each grid cell within the watershed, the Watershed Characterization script extracts or calculates the individual USLE factors based on the geospatial data provided through the ArcMap interface. Based on the specific cell characteristics and individual factors, the potential erosion for each grid cell is calculated using the USLE.

After the annual soil loss is computed for each grid cell in the watershed, areas of deposition and erosion are identified. Only areas of erosion are assumed to contribute to the total sediment yield of the watershed. Curvature of the watershed is computed along with a 3x3 focal mean slope. Areas of deposition are defined where slope is concave and less than ½ the mean slope. All other areas are defined as eroding. To compute the total sediment yield (tons/acre/year), a weighted flow accumulation is computed excluding the areas of deposition. The calculated sediment yields (tons/acre/year) are recalculated based on the actual watershed size to get an absolute sediment yield (tons/year).

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 water body without exceeding the applicable water quality criteria; in this case, the narrative water quality criteria for aquatic life. This TMDL determines the range of sediment loads that can enter the Chattahoochee River Basin watersheds not supporting their designated use without causing additional impairment to the stream. This range is based on the hypothesis that if a not supporting watershed has an annual average sediment loading rate similar to a watershed supporting its biology, then the receiving stream will remain stable and not be biologically impaired due to sediment. In the Chattahoochee River Basin, the average sediment yield in the watersheds supporting fish communities in the Piedmont ecoregion is 1.15 tons/acre/yr. The average sediment yield in the watersheds supporting macroinvertebrate communities in subecoregions 45a, 45b, and 65d are 1.07, 0.66, and 1.13 tons/acre/yr, respectively. This TMDL establishes allowable pollutant loadings, and thereby provides the basis to establish water quality based controls. For some pollutants, TMDLs are expressed on a mass loading basis.

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 criteria 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 (WLA) is the portion of the receiving water's loading capacity that is allocated to existing or future point sources including industrial facilities, municipal treatment plants, and private and institutional development (PID) facilities. WLAs are provided to the point sources from municipal and industrial wastewater treatment systems with NPDES effluent limits. The maximum allocated sediment load for these facilities is dependent on the discharge flow. The WLA given is a concentration or 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:

$$WLA = C_{permitted} * Q$$

Where:

WLA = Wasteload Allocation sediment load

$C_{permitted}$ = permitted concentration, in TSS (mg / L)

Q = permitted flow (where available) or design discharge flow

There are nine (9) permitted facilities in the Chattahoochee River Basin watersheds that discharge into a stream segment or upstream of a stream segment not supporting its designated use for biota. Table 23 provides the permitted WLAs for these facilities

Table 23. Permitted Waste Load Allocations for Facilities discharging to or upstream of not supporting segments

Facility	NPDES Permit No.	Facility Type	Receiving Water / Not Supporting Stream Segment	FLOW (MGD)		TSS (mg/L)	
				Monthly Average	Weekly Average	Monthly Average	Weekly Average
Buford (City of) Westside WPCP	GA0023175	Municipal	Richland Creek	0.25	0.31	20	30
Cobb County - Marietta Water Authority - James E. Quarles WTP	GAG640068	Municipal	Sope Creek	report	report	20	30
Gwinnett Co. - Lanier WTP	GAG640022	Municipal	Richland Creek	report	report	20	30
Facility	**NPDES Permit No.**	**Facility Type**	**Receiving Water / Not Supporting Stream Segment**	**FLOW (MGD)**		**TSS (mg/L)**	
				Daily Average	**Daily Max**	**Daily Average**	**Daily Max**
Argos Ready Mix, LLC - Alpharetta Concrete Plant	GA0047601	Industrial	Foe Killer Creek	report	report	10-20	20-40
Argos Ready Mix, LLC - Doraville	GA0046906	Industrial	North Fork Peachtree Creek	0.008	0.008	10-20	20-40
Colonial Pipeline, Atlanta Junction Facility	GA0048429	Industrial	Olley Creek	report	report	report	report
Kimberly Clark Corp	GA0046914	Industrial	Blue John Creek	report	report	report	report
Lockheed Martin Aeronautics Company	GA0001198	Industrial	Rottenwood Creek	report	report	10-20	20-40
Vulcan Construction Materials, LLC - Tucker Plant	GA0050216	Industrial	Burnt Fork Creek / South Fork Peachtree Creek	0.002	0.002	10-20	20-40

Note: Existing permitted facilities that discharge to the not supporting segments covered in this TMDL and that may have been erroneously omitted from this WLA table shall be given TSS limits that correspond to those similar to the omitted facility's type during permit reissuance.

It is recognized that effluent from biological treatment systems that have TSS limits of 20 mg/L or less are not expected to contribute to stream sedimentation. If there is available assimilative capacity, a new facility may be allowed, or for an existing facility may be able to expand. Any discharge into a stream without any assimilative capacity will be evaluated on a case-by-case basis and increases will be allowed, dependent on engineering and biological integrity study results.

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 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.

For stormwater permits, compliance with the terms and conditions of the permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP), and demonstrates consistency with the assumptions and requirements of the TMDL. EPD acknowledges that progress with the assumptions and requirements of the TMDL by stormwater permittees may take one or more permit iterations. Achieving the TMDL reductions may constitute compliance with a storm water management plan (SWMP) or a storm water pollution prevention plan (SWPPP), provided the MEP definition is met, even where the numeric percent reduction may not be achieved so long as reasonable progress is made toward attainment of water quality standards using an iterative BMP process.

The waste load allocations from storm water discharges associated with MS4s (WLA_{sw}) are estimated based on the percentage of urban area in each watershed covered by the MS4 storm water permit. At this time, the portion of each watershed that goes directly to a permitted storm sewer and that which goes through non-permitted point sources, or is sheet flow or agricultural runoff, has not been clearly defined. Thus, it is assumed that approximately 70 percent of storm water runoff from the regulated urban area is collected by the municipal separate storm sewer systems.

The storm water discharges associated with industrial facilities that are not covered under individual NPDES permits are regulated by a Georgia NPDES General Permit No. GAR050000 for Storm Water Discharges Associated with Industrial Activities. The general permit requires that storm water discharges into an stream segment not supporting its designated use or within one linear mile upstream of and within the same watershed as any portion of an impaired stream segment identified as “not supporting” its designated use(s), must satisfy the requirements given in Appendix C of the permit if the impaired stream segment has been listed for criteria violated, “Bio F” (Impaired Fish Community) and/or “Bio M” (Impaired Macroinvertebrate Community). Tables 15 and 16 list the industrial facilities that are covered under Georgia NPDES General Permit for Storm Water Discharges Associated with Industrial Activity in the Chattahoochee River Basin, that are contained within watersheds of not supporting streams segments.

Georgia requires all construction sites over one acre to have a NPDES General Storm Water permit for construction activities. These General Permits 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 III through V of each permit. The conditions set forth in each of these permits were established to assure that the storm water runoff from these sites does not cause or contribute sediment to the stream. Each Georgia NPDES General Permit for Storm Water Associated with Construction Activities 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. The sediment load allocation from future construction sites within the watershed have to meet requirements outlined in the Georgia NPDES General Permit for Storm Water Associated with Construction Activities.

5.2 Load Allocations

The USLE was applied to those watersheds that have streams that are biologically impaired and to watersheds and corresponding streams considered least impacted to determine the current sediment loading rates to the streams. The annual sediment load in tons/year for fish community assessment not supporting and least impacted watersheds is reported in Table 24. The annual sediment load in tons/year for macroinvertebrate not supporting and least impacted watersheds is reported in Table 25.

The watersheds are grouped by those biologically impaired (not supporting designated uses), and those least impacted (supporting designated uses). For comparison purposes, the annual average sediment load per acre, or sediment yield, was calculated for each watershed and is also given in Tables 24 and 25. For streams sampled for fish community integrity, the average sediment yield of the Chattahoochee River Basin watersheds located in the Piedmont ecoregion not supporting their designated uses is 0.89 tons/acre/yr, while the average sediment yield of the supporting watersheds located within the Piedmont ecoregion is 1.15 tons/acre/yr. For streams sampled for benthic macroinvertebrate community integrity, the average sediment yield of the Chattahoochee River Basin watersheds located in subecoregions 45a, 45b and 65d not supporting their designated uses are 0.44, 0.19, and 0.84 tons/acre/yr, respectively, while the average sediment yield of the supporting watersheds located within the subecoregions 45a, 45b and 65d are 1.07, 0.66, and 1.13 tons/acre/yr, respectively.

Fish community assessment scores are based on a specific set of metrics for each ecoregion. A target sediment yield was established in each ecoregion by averaging the sediment yield of all watersheds where the associated stream integrity class was either “Good” or “Excellent”. The sediment yield per acre for each watershed was then compared with the average target sediment yield for the corresponding ecoregion. In cases where the not supporting yields exceeded the average target yield, the Total Allowable Sediment Load was calculated as a tons/year load based on the average target yield multiplied by the total acres for the not supporting watershed. Where the yields were less than the target yield, the Total Allowable Sediment Load was given as the current annual sediment load in tons/year.

Benthic macroinvertebrate community assessment scores are based on a specific set of metrics for each subecoregion. A target sediment yield was established in each subecoregion by averaging the sediment yield of all watersheds where the associated stream integrity class was either “Good” or “Very Good”. The sediment yield per acre for each not supporting watershed was then compared with the average target sediment yield for the corresponding ecoregion. In cases where the not supporting yields exceeded the average target yield, the Total Allowable Sediment Load was calculated as a tons/year load based on the average target yield multiplied by the total acres for the not supporting watershed. Where the yields were less than the target yield, the Total Allowable Sediment Load was given as the current annual sediment load in tons/year.

Table 24. Annual Sediment Yield for Fish Community Assessment Segments

Stream Segment	Station ID	Watershed Area (acres)	Total Sediment (tons/yr)	Road Sediment (tons/yr)	Total Sediment Yield (tons/acre/yr)
Piedmont Ecoregion (45) - Not Supporting - Fish Community Assessment					
Blue John Creek	WRD 226	6206.2	3980.9	407.4	0.64
Brushy Creek	WRD 1039	1547.6	1959.5	124.0	1.27
Cane Creek	WRD 701	4067.8	1335.2	142.8	0.33
Cauley Creek	WRD 1103	1035.7	551.4	11.6	0.53
Cavenders Creek	WRD 1211	2567.8	1288.6	90.8	0.50
Chattahoochee River	WRD 765	30374.0	13539.3	992.8	0.45
Crooked Creek	WRD 1038	5685.1	5479.8	419.2	0.96
Foe Killer Creek	WRD 1052	7537.2	2531.6	147.2	0.34
Haw Creek	WRD 607	2142.1	4007.4	335.0	1.87
Johns Creek	WRD 1051	8213.9	3682.8	271.5	0.45
Level Creek	WRD 1040	5242.1	4689.4	310.0	0.89
Little Tesnatee Creek	WRD 702	4999.7	3678.9	281.3	0.74
Marsh Creek (aka March Creek)	WRD 1101	3455.8	887.6	128.1	0.26
Richland Creek	WRD 1041	6032.9	25639.9	631.6	4.25
Sand Creek	WRD 1133	2227.3	748.6	26.6	0.34
Sope Creek	WRD 1109	22549.7	9962.4	1401.1	0.44
Soque River	WRD 764	35862.9	18750.1	1393.7	0.52
South Fork Peachtree Creek	WRD 689	17891.9	3383.9	572.0	0.19
Tate Creek	WRD 1210	3001.2	1709.5	241.2	0.57
Tributary #1 to the Chattahoochee River	WRD 1100	1037.0	472.8	42.6	0.46
Tributary #2 to the Chattahoochee River	WRD 1102	849.8	177.3	38.1	0.21
Tributary to Williams Creek	WRD 1130	998.8	1258.8	126.2	1.26
Williams Creek	WRD 1129	923.6	2817.5	250.9	3.05
Piedmont Ecoregion (45) - Supporting - Fish Community Assessment					
Gum Branch	WRD 198	912.5	839.5	15.1	0.92
Gum Creek	WRD 69	5031.2	6727.0	181.5	1.34
Hillabahatchee Creek	WRD 86	14571.8	16849.7	728.0	1.16
Mountain Creek	WRD 1037	9232.1	2776.8	283.4	0.30
Snake Creek	WRD 88	26092.3	45133.8	2470.4	1.73
Town Creek	WRD 87	6332.5	5289.2	304.0	0.84
Whooping Creek	WRD 89	16992.7	24006.2	1217.2	1.41
Whooping Creek	WRD 429	18013.1	26717.6	1391.1	1.48

Table 25. Annual Sediment Yield for Macroinvertebrate Community Assessment Segments

Stream Segment	Station ID	Watershed Area (acres)	Total Sediment (tons/yr)	Road Sediment (tons/yr)	Total Sediment Yield (tons/acre/yr)
Southern Inner Piedmont Subecoregion (45a) - Not Supporting - Macroinvertebrate Community Assessment					
Olley Creek	EPD 45a-61	8763.0	5935.0	642.9	0.68
Rottenwood Creek	EPD 45a-59	6216.4	1200.2	263.4	0.19
Southern Inner Piedmont Subecoregion (45a) - Supporting - Macroinvertebrate Community Assessment					
Davidson Creek	EPD 45a-3	7539.6	8024.6	514.7	1.06
Hillabahatchee Creek	EPD 45a-89	10638.3	13797.2	585.6	1.30
Middle Fork Broad River	EPD 45a03//	9116.4	10654.3	708.2	1.17
Town Creek	EPD HH16	2187.0	1602.1	66.5	0.73
Southern Outer Piedmont Subecoregion (45b) - Not Supporting - Macroinvertebrate Community Assessment					
North Fork Peachtree Creek	EPD 45b-202	21518.3	4189.5	830.9	0.19
South Fork Peachtree Creek	EPD 45b-203	17891.9	3383.9	572.0	0.19
Southern Outer Piedmont Subecoregion (45b) - Supporting - Macroinvertebrate Community Assessment					
Beaverdam Creek	EPD 45b-120	2725.0	974.6	58.0	0.36
Copeland Creek	EPD HH22	3255.2	3822.9	80.9	1.17
Little Falling Creek	EPD 45b-156	12166.6	6227.3	145.8	0.51
Rocky Creek	EPD 45b-258	16731.0	16579.0	1007.1	0.99
Tributary to Flint River	EPD 45b-357	3143.8	2310.9	90.5	0.74
Tributary to Murder Creek	EPD 45b-152	2086.5	420.8	39.4	0.20
Southern Hilly Gulf Coastal Plain (65d) - Not Supporting - Macroinvertebrate Community Assessment					
Pataula Creek	EPD 65d-22	5223.8	7272.6	316.1	1.39
Talipahoga Rum Creek	EPD 65d-17	3082.4	3028.8	251.6	0.98
Weracoba Creek	EPD 65d-1	4551.8	619.6	141.8	0.14
Southern Hilly Gulf Coastal Plain (65d) - Supporting - Macroinvertebrate Community Assessment					
Hollaca Creek	EPD 65d-3	14202.80	1223.09	131.285	0.09
Hannahatchee Creek	EPD 65d-14	4825.08	14322.6	941.357	2.97
Sally Branch	EPD 65d-4	3973.75	1342.36	171.953	0.34

Once the Total Allowable Sediment Load for each not supporting watershed is calculated, the nonpoint source loads (LA) for each watershed is calculated by subtracting the WLA and WLA_{sw} from the Total Allowable Sediment Load. It is recognized that there may be additional assimilative capacity in the cases where there is no required reduction in the sediment load and future dischargers (WLA) may be allowed. In the watersheds that have exceeded the total allowable sediment load, new dischargers (WLA) may be allowed if there is sufficient reduction in the nonpoint source loads (LA).

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 are usually evened out by the response of the biological community to habitat alteration, which is a long-term process. Therefore, the annual sediment load was determined to be appropriate for the TMDL.

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.

5.5 Total Sediment Load

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

The USLE method used calculates a total annual sediment load, as opposed to a daily load. The total allowable annual sediment load expressed in terms of tons per year is intended to prevent the cumulative impacts of excessive run-off related sediment in the watershed. The maximum daily allowable sediment load is a subcomponent of the allowable annual load. It is based upon the critical flow event that represents the maximum sediment load capacity for the stream. Research conducted by the ARS National Sedimentation Laboratory and USEPA Region 4 has determined that the bankfull flow is the critical flow that has the maximum daily sediment carrying capacity, and therefore has the maximum daily sediment loading capacity. Bankfull flow can be estimated using the one-day flow event that occurs once every one and a half years, 1Q1.5, determined by the Log Pearson recurrence interval statistical analysis.

The National Sedimentation Laboratory has correlated, by ecoregion, a relationship between the annual average sediment yield and the bankfull flow sediment yield for stable or unimpaired streams. Table 26 provides the mean bankfull flow (Q1.5) sediment yield expressed as tons per day per square kilometer for each ecoregion in the Chattahoochee River basin, compared to the mean annual average sediment yield discharged into a stable, unimpaired stream. The coefficient is the ratio of the maximum daily yield to the total annual yield. These relationships were used to transform total allowable sediment loads to daily maximum sediment loads (USDA-ARS, 2006).

Table 26. Suspended-Sediment Transport Rates Comparing Bankfull Flow Yield to Mean Annual Yield

Ecoregion	Sediment Yield at Q1.5 (Tons/d/km^2)	Mean Annual Sediment Yield (Tons/yr/km^2)	Annual to Daily Max Coefficient
Piedmont – 45	2.54	19.6	0.1296
Southeastern Plains – 65	0.228	8.64	0.0264

The total allowable sediment loads and daily maximum sediment loads for the not supporting watersheds are summarized in Table 26, along with any required sediment load reductions. The WLAs (WLA + WLA_{sw}) provided in Table 27 are for accounting purposes. A Summary Memorandum for each watershed is provided in Appendix A

Table 27. Total Allowable Sediment Loads and the Required Sediment Load Reductions

Stream Segment	Station ID	Current Load				TMDL		
		WLA (tons/yr)	WLA_{sw} (tons/yr)	LA (tons/yr)	Total Load (tons/yr)	Total Allowable Sediment Load (tons/yr)	Maximum Allowable Daily Load (tons/day)	Required % Reduction
Not Supporting Segments - Fish Community								
Blue John Creek	WRD 226		0.0	3980.9	3980.9	3980.9	515.9	0%
Brushy Creek	WRD 1039		976.7	798.3	1959.5	1775.0	230.0	9.4%
Cane Creek	WRD 701		0.0	1335.2	1335.2	1335.2	173.0	0%
Cauley Creek	WRD 1103		193.9	357.4	551.4	551.4	71.5	0%
Cavenders Creek	WRD 1211		0.0	1288.6	1288.6	1288.6	167.0	0%
Chattahoochee River	WRD 765		0.0	13539.3	13539.3	13539.3	1754.7	0%
Crooked Creek	WRD 1038		3187.6	2292.2	5479.8	5479.8	710.2	0%
Foe Killer Creek	WRD 1052	0.5	1321.4	1209.8	2532.1	2531.6	328.1	0%
Haw Creek	WRD 607		919.7	1537.1	4007.4	2456.8	318.4	38.7%
Johns Creek	WRD 1051		1909.5	1773.3	3682.8	3682.8	477.3	0%
Level Creek	WRD 1040		2040.2	2649.2	4689.4	4689.4	607.8	0%
Little Tesnatee Creek	WRD 702		0.0	3678.9	3678.9	3678.9	476.8	0%
Marsh Creek (aka March Creek)	WRD 1101		488.8	398.8	887.6	887.6	115.0	0%
Richland Creek	WRD 1041	11.4	2628.3	4279.4	25651.3	6919.1	896.7	73.0%
Sand Creek	WRD 1133		0.0	748.6	748.6	748.6	97.0	0%
Sope Creek	WRD 1109		5375.9	4586.6	9962.4	9962.4	1291.1	0%
Soque River	WRD 764		0.0	18750.1	18750.1	18750.1	2430.0	0%
South Fork Peachtree Creek	WRD 689	0.1	1628.4	1755.3	3384.0	3383.9	438.5	0%
Tate Creek	WRD 1210		0.0	1709.5	1709.5	1709.5	221.5	0%
Tributary #1 to the Chattahoochee River	WRD 1100		280.7	192.1	472.8	472.8	61.3	0%
Tributary #2 to the Chattahoochee River	WRD 1102		80.7	96.6	177.3	177.3	23.0	0%
Tributary to Williams Creek	WRD 1130		0.0	1145.5	1258.8	1145.5	148.5	9.0%
Williams Creek	WRD 1129		0.0	1059.3	2817.5	1059.3	137.3	62%
Not Supporting Segments - Macroinvertebrate Community								
North Fork Peachtree Creek	EPD 45b-202	0.5	1953.4	2235.7	4190.0	4189.5	543.0	0%

Stream Segment	Station ID	Current Load				TMDL		
		WLA (tons/yr)	WLA_{sw} (tons/yr)	LA (tons/yr)	Total Load (tons/yr)	Total Allowable Sediment Load (tons/yr)	Maximum Allowable Daily Load (tons/day)	Required % Reduction
Olley Creek	EPD 45a-61		2843.0	3092.0	5935.0	5935.0	769.2	0%
Pataula Creek	EPD 65d-22		0.0	5906.9	7272.6	5906.9	155.9	19%
Rottenwood Creek	EPD 45a-59		739.6	460.6	1200.2	1200.2	155.5	0%
South Fork Peachtree Creek	EPD 45b-203	0.1	1628.4	1755.3	3384.0	3383.9	438.5	0%
Talipahoga Rum Creek	EPD 65d-17		0.0	3028.8	3028.8	3028.8	80.0	0%
Weracoba Creek	EPD 65d-1		399.6	220.1	619.6	619.6	16.4	0%

Definitions:

Current Total Load - Sum of modeled sediment load and approved waste load allocations (WLA)
WLA - waste load allocation for discrete point sources
WLA_{sw} - waste load allocation associated with storm water discharges from a municipal separate storm sewer system (MS4)
LA - portion of the total allowable sediment load attributed to nonpoint sources and natural background sources of sediment
Total Allowable Sediment Load - allowable sediment load calculated using the target sediment yield and the stream's watershed area
Maximum Allowable Daily Load - total allowable sediment load (annual) converted to a daily figure based on the bankfull sediment transport relationship
Required % Reduction - percent reduction applied to current load in order to meet total allowable sediment load

6.0 RECOMMENDATIONS

The TMDL process consists of an evaluation of the sub-watersheds for each 303(d) listed stream segment to identify, as best as possible, the sources of sediment causing the stream to be impaired for the narrative criteria for aquatic life. The TMDL analysis was performed using the best available data to specify WLAs and LAs that will meet the narrative aquatic life criteria so as to support the use classification specified for the listed segment.

This TMDL represents part of a long-term process to reduce loading of sediment to meet water quality standards in the Chattahoochee River Basin. Implementation strategies will be reviewed and the TMDLs will be refined as necessary. The phased approach will support progress toward water quality standards attainment in the future. In accordance with USEPA TMDL guidance, these TMDLs may be revised based on the results of future monitoring and source characterization data efforts. The following recommendations emphasize further source identification and involve the collection of data to support the current allocations and subsequent source reductions.

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. Based on monitoring conducted by WRD and EPD in the Chattahoochee River Basin, these segments are listed as not supporting their designated use due to biological impairments. Additional monitoring sites are added as necessary.

In the case where a watershed-based plan has been developed for a listed stream segment, an appropriate water quality monitoring program will be outlined. The monitoring program will be developed to help identify the various sediment sources. The monitoring program may be used to verify the 303(d) stream segment listings. This will be especially valuable for those segments where limited data resulted in the listing.

6.2 Sediment Management Practices

The following management practices are recommended to reduce, or at a minimum, maintain the total allowable sediment loads at current levels.

- Compliance with NPDES (wastewater, construction, industrial stormwater, and/or MS4) permit limits and requirements;
- Implementation of recommended Water Quality management practices in the *Coosa-North Georgia Regional Water Plan* (GA EPD, 2017) and the *Middle Chattahoochee Regional Water Plan* (GA EPD, 2017) ;
- Implementation of required Action Items in the *Water Resource Management Plan* developed by the Metro-North Georgia Water Planning District (MNGWPD, 2017)
- Implementation of *Georgia's Best Management Practices for Forestry* (GFC, 2009);
- Implementation of *Best Management Practices for Georgia Agriculture* (GSWCC, 2013) and Adoption of National Resource Conservation Service (NRCS) Conservation Practices for agriculture;
- Adherence to the Surface Mining Land Use Plan prepared as part of the Surface Mining Permit Application;

- Implementation of the *Georgia Better Back Roads Field Manual* (GA RCDC, 2009) and adoption of additional practices for proper unpaved road maintenance;
- Implementation of individual Erosion and Sedimentation Control Plans for land disturbing activities; and application of the *Manual for Erosion and Sediment Control in Georgia* (GSWCC, 2016)
- Implementation of the *Georgia Stormwater Management Manual* (ARC, 2016) to facilitate prevention and mitigation of stream bank erosion due to increased stream flow and velocities caused by urban runoff through structural storm water BMP installation.
- Where applicable, implementation of the *Coastal Stormwater Supplement to the Georgia Stormwater Management Manual* (CCSMPC, 2009).

6.3 Reasonable Assurance

Permitted discharges will be regulated through the NPDES permitting process described in this report. An allocation to a point source discharger does not automatically result in a permit limit or monitoring requirement. Through its NPDES permitting process, GA EPD will determine whether a new or existing 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 USEPA 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 will be provided for this TMDL. During that time, the TMDL will be available on the GA EPD website, a copy of the TMDL will be provided upon request, and the public will be invited to provide comments on the TMDL.

7.0 INITIAL TMDL IMPLEMENTATION PLAN

This plan identifies applicable state-wide programs and activities that may be employed to manage point and nonpoint sources of sediment loads for twenty nine (29) segments in the Chattahoochee River Basin. Local watershed planning and management initiatives will be fostered, supported or developed through a variety of mechanisms. Implementation may be addressed by Watershed-Based Plans or other assessments funded by Section 319 (h) grants, the local development of watershed protection plans, or "Targeted Outreach" initiated by GA EPD. These initiatives will supplement or possibly replace this initial implementation plan. Implementation actions should also be guided by the recommended management practices and actions contained within each applicable Regional Water Plan developed as part of Georgia's Comprehensive State-wide Water Management Plan implementation (Georgia Water Council, 2008).

7.1 Not Supporting Segments

This initial plan is applicable to the following water bodies that were added to Georgia's 2014 Integrated 305(b)/303(d) list of not supporting waters in *Water Quality in Georgia 2012-2013* (GA EPD, 2014) available on the GA EPD website. The following tables summarize the descriptive information provided in the 303(d) list.

Stream Segments on the 2014 303(d) List as Biota Impacted - Fish Community

Stream Segment	Ecoregion	Location	Reach ID	Segment Length (mi)	Designated Use
Blue John Creek	Piedmont	Troup Branch to Long Cane Creek	GAR031300020910	3	Fishing
Brushy Creek	Piedmont	Headwaters to the Chattahoochee River	GAR031300010915	5	Fishing
Cane Creek	Piedmont	Tributary to Chestatee River near Dahlonega	GAR031300010604	8	Fishing
Cauley Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010914	2	Fishing
Cavenders Creek	Piedmont	Headwaters to Chestatee River	GAR031300010605	2	Fishing
Chattahoochee River	Piedmont	Ga. Hwy. 17, Helen to SR255	GAR031300010107	8	Recreation
Crooked Creek	Piedmont	Tributary to Chattahoochee River	GAR031300010909	2	Fishing
Foe Killer Creek	Piedmont	Headwaters to Big Creek	GAR031300011003	7	Fishing
Haw Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010901	3	Fishing
Johns Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010903	4	Fishing
Level Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010904	5	Fishing
Little Tesnatee Creek	Piedmont	Freeman Creek to upstream Hwy. 129	GAR031300010501	3	Fishing
Marsh Creek (aka March Creek)	Piedmont	Headwaters to Chattahoochee River	GAR031300011102	4	Fishing

Stream Segment	Ecoregion	Location	Reach ID	Segment Length (mi)	Designated Use
Richland Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300010906	5	Fishing
Sand Creek	Piedmont	Headwaters to House Creek	GAR031300021018	9	Fishing
Sope Creek	Piedmont	Headwaters to Chattahoochee River	GAR031300011105	11	Fishing
Soque River	Piedmont	Goshen Creek to SR 17, Clarkesville	GAR031300010202	29	Fishing, Drinking Water
South Fork Peachtree Creek	Piedmont	Headwaters to Peachtree Creek, Atlanta	GAR031300011207	15	Fishing
Tate Creek	Piedmont	Headwaters to Chestatee River	GAR031300010512	4	Fishing
Tributary #1 to the Chattahoochee River	Piedmont	Headwaters to the Chattahoochee River	GAR031300010917	3	Fishing
Tributary #2 to the Chattahoochee River	Piedmont	Headwaters to the Chattahoochee River	GAR031300011117	2	Fishing
Tributary to Williams Creek	Piedmont	Headwaters to Williams Creek	GAR031300021207	2	Fishing
Williams Creek	Piedmont	Headwaters to Mulberry Creek	GAR031300021212	4	Fishing

Stream Segments on the 2014 303(d) List as Biota Impacted - Macroinvertebrate Community

Stream Segment	Sub-ecoregion	Location	Reach ID	Segment Length (mi)	Designated Use
North Fork Peachtree Creek	45b	Headwaters to Peachtree Creek	GAR031300011204	14	Fishing
Olley Creek	45a	Headwaters to Sweetwater Creek	GAR031300020204	11	Fishing
Pataula Creek	65d	Headwaters to Clear Creek	GAR031300031502	9	Fishing
Rottenwood Creek	45a	Headwaters to Chattahoochee River	GAR031300011103	9	Fishing
South Fork Peachtree Creek	45b	Headwaters to Peachtree Creek, Atlanta	GAR031300011207	15	Fishing
Talipahoga Rum Creek	65d	Headwaters to Bradley Lake Tributary	GAR031300030903	4	Fishing
Weracoba Creek	65d	Columbus (upstream of Bull Creek)	GAR031300030104	6	Fishing

The GA EPD developed TMDLs in 2017 for sediment in the Chattahoochee River Basin due to a "Bio F" or "Bio M" criteria violation on Georgia's 2014 Integrated 305(b)/303(d) List. These streams have shown a degradation of the biological community, which is generally caused by habitat loss due to stream sedimentation. The purpose of the narrative sediment criteria is to prevent objectionable conditions that are harmful to humans, animals or aquatic life, as stated in Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(5)(e):

> "*All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life*."

7.2 Potential Sources

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 settles to 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 sediment sources in the watershed. The general sediment sources are point and nonpoint. NPDES permittees discharging treated wastewater are the primary point sources of sediment as TSS. It is recognized that effluent from biological treatment systems that have TSS limits of 20 mg/L or less are not expected to contribute to stream sedimentation. 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.

Prior to the implementation of this plan, a detailed assessment of the potential sources should be carried out. This will better determine what best management practices are needed and where they should be installed. A watershed assessment will also help when requesting funding assistance for the implementation of this plan. GA EPD is available to provide assistance in completing a watershed survey of the potential sources of impairment.

Through water quality modeling, it has been determined that the sediment loading found in six (6) of the twenty nine (29) segments needs to be reduced. This sediment may be due to land disturbing activities including, but not limited to land development, agriculture, impervious surfaces, commercial forestry, and others. It is believed that, if sediment loads are not reduced, these streams will continue to degrade over time. Remedies exist for addressing excess sediment, from both point and non-point sources, in streams. They will be discussed in this plan.

Based on modeling, some segments have been found to need 0% reductions in sediments loads. This occurs if the estimated sediment yield (tons/acre/year) for these not supporting segments is below the average sediment yield for the least impacted stream segments within the Chattahoochee River Basin. It is likely that the impairment in these segments is due to past land use practices and is referred to as "legacy" sediment. It is believed that these streams will repair themselves over time if sediment loads are maintained at current levels.

7.3 Sediment Controls

It has been determined that most of the sediment found in the Chattahoochee 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 not supporting 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. Setting a numeric TMDL may be ineffective given the difficulty in measuring it. In addition, habitat and aquatic communities can be slow to respond to changes in sediment loading. Thus, this TMDL recommends compliance with NPDES permits and implementation of Best Management Practices (BMPs) to control sediment produced from non-point sources such as the erosion of stream banks, paved surfaces, roofs, and others sources, which are not regulated or subjected to most enforcement actions. BMPs may be used to help reduce average annual sediment loads and achieve water quality criteria, and improve the over aquatic health of the system. 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.

The table below lists examples of BMPs that address excess sediment. This is not a complete list and additional management measures may be proposed that will be considered as implementing non-point source controls consistent with this plan.

Examples of BMPs for Use in Controlling Sediment from Non-Point Sources

Name of BMP	Type (Ag., Forestry, Urban, Other.)
Filter Strips	Agriculture
Reduced Tillage System	Agriculture
Exclusion	Agriculture
Timber Bridges	Forestry
Revegetation	Forestry
Sediment Basin	Urban
Porous Pavement	Urban
Wet Detention Pond	Urban
Organic Filter	Urban
Streambank Protection and Restoration	Ag, Forestry, Urban, Other
Stream Buffers	Ag, Forestry, Urban, Other
Additional Ordinances	Ag, Forestry, Urban, Other

The GA EPD Non-Point Source Program should be consulted when selecting appropriate management practices for addressing the TMDL, particularly when determining the best practices for specific watersheds.

7.3.1 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 developing 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 at all times.

It is recommended that there be no authorized increase in the concentration of TSS above that identified in the TMDL. However, if there is available assimilative capacity, new discharges may be allowed based on engineering evaluations 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 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.

GA EPD has developed a Georgia NPDES General Permit for Storm Water Associated with Construction Activities. Coverage under a General Permit is required for all construction sites disturbing one or more acres. General permits have been created to cover construction projects that fall into three distinct categories; stand-alone construction projects (General Permit No. GAR100001), infrastructure construction projects (General Permit No. GAR100002), and construction that occurs under a common plan of development where the primary permittee chooses to use secondary permittees for land disturbance activities (General Permit No. GAR100003). Regardless of the type of construction project, all sites required to have a coverage 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 III through V of each NPDES General Permit for Storm Water Associated with Construction Activities. The permit requires all sites to have an Erosion and Sedimentation Control Plan; to implement, inspect and maintain BMPs; and to monitor storm water for turbidity. Georgia's General Storm Water 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.

The NPDES General Storm Water Permits for Construction Activity also require that storm water discharges into a stream segment not supporting its designated use or a stream segment within one linear mile upstream of and within the same watershed as, any portion of an stream segment not supporting its designated use, must address any site-specific condition or requirement in a TMDL implementation plan and must include at least four additional BMPs from a list provided in Part III. C. of the Permit. This condition only applies to streams with impairments for "Bio F" (fish community) and /or "Bio M" (macroinvertebrate community), and with the listed potential cause of either "NP" (nonpoint source) or "UR" (urban runoff).

For stormwater permits, compliance with the terms and conditions of the permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP), and demonstrates consistency with the assumptions and requirements of the TMDL. EPD acknowledges that progress with the assumptions and requirements of the TMDL by stormwater permittees may take one or more permit iterations. Achieving the TMDL reductions may constitute compliance with a storm water management plan (SWMP) or a storm water pollution prevention plan (SWPPP), provided the MEP definition is met, even where the numeric percent reduction may

not be achieved so long as reasonable progress is made toward attainment of water quality standards using an iterative BMP process.

7.3.2 Nonpoint Source Land Use Approaches

GA EPD is the lead agency for implementing the state's Nonpoint Source Management Program, as described in Georgia's *Statewide Nonpoint Source Management Plan* (GA EPD, 2014). The *Statewide Nonpoint Source Management Plan* combines regulatory and non-regulatory approaches, in cooperation with other state and Federal agencies, local and regional governments, state colleges and universities, businesses and industries, nonprofit organizations, and individual citizens. The 2014 document represents a revision of the *Statewide Nonpoint Source Management Plan* last updated in 2000. This revision provides an update to reflect new priorities and practices of nonpoint source pollution control in Georgia. It represents Georgia's plan for making progress toward meeting the ultimate goal of the Clean Water Act of achievement of water quality standards for fishable and swimmable waters. Regulatory responsibilities include establishing water quality criteria 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.

7.3.2.1 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 (FNSPTTF) to assess the extent of water pollution caused by forestry practices, and to develop recommendations for reducing or eliminating 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. This comprehensive BMP manual, *Georgia's Best Management Practices for Forestry* was released in January 1999. Additional guidance has been developed by the FNSPTTF since 1999. The current version of Georgia's forestry BMP manual, *Georgia's Best Management Practices for Forestry,* was developed and released in May 2009 (GFC, 2009).

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 program coordinator and the four regional specialists conduct educational programs across the state. The regional specialists 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's 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. Since publication of the first BMP manual in 1981, the GFC has given 2,672 BMP talks to over 86,500 persons and participated in 492 field demonstrations of BMPs (through June 2013). The education process is ongoing, with workshops routinely provided for foresters, timber buyers and loggers through the Sustainable Forestry Initiative® (SFI®) Program in Georgia.

To determine if educational efforts have been successful and if the BMPs are effective at minimizing erosion and sedimentation, the GFC conducted BMP Implementation and Compliance Surveys in 1991, 1992, 1998, 2002, 2004, 2007, 2009, 2011, and 2013. In 1997, the Southern Group of State Foresters (SGSF) Task Force completed a newly developed and more rigorous survey protocol document titled *Silviculture Best Management Practices Implementation Monitoring – A Framework for State Forestry Agencies*. In 2002, this document was revised and re-published. Starting with the 1998 BMP implementation survey and every one thereafter, surveys were conducted using this protocol recommended by the 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 statewide average BMP implementation has ranged from 65 percent in 1991 to the current rate of 90 percent. In 1991, approximately 86 percent of the acres evaluated were in compliance. This total acreage percentage increased to 92 percent compliance in 1992, 98 percent compliance in 1998, and over 99 percent compliance in 2013.

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.

7.3.2.2 Agricultural Land

There are a number of agricultural organizations that work to support Georgia's more than 40,000 farms. 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).To incorporate advances in BMP technology and include estimates of BMP effectiveness and cost, the GSWCC compiled and published a new BMP document in 2007 titled, *Best Management Practices for Georgia Agriculture*. In 2013, GSWCC published the 2nd edition of *Best Management Practices for Georgia Agriculture* (GSWCC, 2013), which included an expanded section on nutrient management planning.

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 (FOTG); 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 not supporting 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 from 3.1 billion tons per year in 1982 to 1.9 billion tons per year in 1997, a reduction of 38 percent (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://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/

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.

7.3.2.3 Mine Sites

Surface mining and mineral processing present two threats to surface waters. The first threat is the wastewater produced 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 Surface Mining Land Use Plan, reclamation strategies, and surety bond requirements to guarantee proper management and reclamation of surface mined areas. The Surface Mining 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 not supporting 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.

7.3.2.4 Roads

Unpaved roads can be a major contributor of sediment to our waterways if not properly managed. Under the Georgia Better Back Roads Program, the Georgia Resource Conservation and Development Council (GARC&D) led a partnership of natural resource agencies and County Administrators that developed the *Georgia Better Back Roads Field Manual* in 2009 (GA RCDC, 2009). In addition to publishing Georgia's first unpaved road improvement field manual with the goal of improving water quality through the identification of cost-effective techniques/materials for stabilizing road surfaces and ditches, the Georgia Better Back Roads Program has worked to establish statewide demonstration sites, and provides statewide training opportunities for public works officials responsible for maintaining unpaved roads. USEPA has also distributed *Recommended Practices Manual, A Guideline for Maintenance and Service of Unpaved Roads* (Choctawhatchee, et. al, 2000) as guidance for the maintenance and service of unpaved roadways, drainage ditches, and culverts to be used to minimize roadway erosion.

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.

7.3.2.5 Urban Development

The Erosion and Sedimentation Act, established in 1975, provides the mechanism for controlling erosion and sedimentation from land-disturbing activities. This Act establishes a permitting process for land-disturbing activities. Many local governments and counties have adopted erosion and sedimentation ordinances and have been given authority to issue and enforce permits for land-disturbing activities. Approximately 113 counties and 227 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 *Manual for Erosion and Sediment Control in Georgia*, developed by the Georgia Soil and Water Conservation Commission, may be used as a guide to develop erosion and sedimentation control plans (GSWCC, 2016)

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 following planning and management documents. Up-to-date versions of these documents may be found online.

- *Georgia Stormwater Management Manual* (the "Blue Book") (ARC, 2016), the development of the Blue Book was facilitated by the Atlanta Regional Commission in 2001 for use as a multi-volume document designed to provide guidance on stormwater management policy, technical design standards and pollution prevention. The Blue Book was thoroughly revised in 2016.
- *Coastal Stormwater Supplement to the Georgia Stormwater Management Manual* (CCSMPC, 2009), the development of the CSS was facilitated by the Chatham County-Savannah Metropolitan Planning Commission for use in the 24-county coastal region of Georgia. It provides comprehensive guidance on an integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design that can be used by Georgia's coastal communities.
- Georgia's Coastal Regional Commission developed *Green Growth Guidelines* (Coastal Georgia RDC, 2005), which outlines the environmental, social, and economic benefits from use of low impact development (LID) strategies when compared to today's conventional development approach.
- *Land Development Provisions to Protect Georgia Water Quality* (GA EPD, 1997).

Compliance with NPDES permits, the Erosion and Sedimentation Control Act, and local ordinances related to land disturbing activities will contribute to controlling sediment delivery from regulated activities and may help to achieve the reductions necessary to meet the TMDL. Using federal, state, and local laws, enforcement actions are available as a remedy for excess sediment coming from regulated sources. These may include land clearing for non-agricultural use, construction, wastewater discharges, and excessive sediment run-off from other land disturbing activities. The local issuing authority typically enforces these laws. However, the enforcement may be deferred to GA EPD if the local city or county government is not the issuing authority or further and action is needed.

7.4 Public Education

Public education efforts target individual stakeholders to provide information regarding the use of BMPs to protect water quality. GA EPD will continue efforts to increase awareness and educate the public about the impact of human activities on water quality.

7.5 Monitoring

Monitoring of sediment through the measurement of total settable solids or TSS may be carried out through GA EPD's Adopt-A-Stream program. Additional opportunities for monitoring aquatic

habitat through macro-invertebrate assessments may be available in the future. If it is determined through stakeholder involvement that either of these types of monitoring should take place, GA EPD will work with the entity that assumes responsibility for monitoring activities by providing the necessary training and taking the needed steps to establish a well-organized monitoring program.

7.6 Future Action

This Initial TMDL Implementation Plan includes a general approach to pollutant source identification as well as management practices to address pollutants. In the future, GA EPD will continue to determine and assess the appropriate point and non-point source management measures needed to achieve the TMDLs and also to protect and restore water quality in not supporting water bodies.

For point sources, any wasteload allocations for wastewater treatment plant facilities will be implemented in the form of water-quality based effluent limitations in NPDES permits. Any wasteload allocations for regulated storm water will be implemented in the form of best management practices in the NPDES permits. Contributions of sediment from regulated communities may also be managed using permit requirements such as watershed assessments, watershed protection plans, and long term monitoring. These measures will be directed through current point source management programs.

GA EPD will work to support watershed restoration, improvement and protection projects that address non-point source pollution. This is a process whereby GA EPD and/or Regional Commissions or other agencies or local governments, under a contract with GA EPD, will develop a watershed management plan intended to address water quality at the small watershed level (HUC 10 or smaller).These plans will be developed as resources and willing partners become available. The development of these plans may be funded via several grant sources including but not limited to Clean Water Act Section 319(h), Section 604(b), and/or Section 106 grant funds. These plans are intended for implementation upon completion.

Any watershed management plan that specifically address water bodies contained within this TMDL will supersede the Initial TMDL Implementation Plan for that water body, once GA EPD accepts and/or approves the plan. Watershed management plans intended to address this TMDL and other water quality concerns, written by GA EPD and for which GA EPD and/or the GA EPD Contractor are responsible, will contain at a minimum the USEPA's 9-Key Elements of Watershed Planning :

1) An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load allocations or achieve water quality criteria. Sources should be identified at the subcategory level (with estimates of the extent to which they are present in the watershed (e.g., X numbers of cattle feedlots needing upgrading, Y acres of row crops needing improved sediment control, or Z linear miles of eroded streambank needing remediation);

2) An estimate of the load reductions expected for the management measures;

3) A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality criteria;

4) An estimate of the sources of funding needed, and/or authorities that will be relied upon, to implement the plan;

5) An information/education component that will be used to enhance public understanding of and participation in implementing the plan;

6) A schedule for implementing the management measures that is reasonably expeditious;

7) A description of interim, measurable milestones (e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

8) A set of criteria that can be used to determine whether substantial progress is being made towards attaining water quality criteria and, if not, the criteria for determining whether the plan needs to be revised; and;

9) A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (8).

The public will be provided an opportunity to participate in the development of watershed management plans that address water bodies not supporting their designated uses that are listed in this TMDL and to comment on them before they are finalized.

GA EPD will continue to offer technical and financial assistance (when and where available) to complete watershed management plans that address the water bodies not supporting their designated uses listed in this and other TMDL documents. Assistance may include but will not be limited to:

- Assessments of pollutant sources within watersheds;
- Determinations of appropriate management practices to address impairments;
- Identification of potential stakeholders and other partners;
- Developing a plan for outreach to the general public and other groups;
- Assessing the resources needed to implement the plan upon completion; and
- Other needs determined by the lead organization responsible for plan development.

GA EPD will also make this same assistance available, if needed, to proactively address water quality concerns. This assistance may be in the way of financial, technical, or other aid and may be requested and provided outside of the TMDL process or schedule.

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APPENDIX A

Total Allowable Sediment Load
Summary Memorandum

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Blue John Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Troup**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130002**
Waterbody Name:	**Blue John Creek**
Location:	**Troup Branch to Long Cane Creek**
Stream Length:	**3 miles**
Watershed Area:	**9.6 square miles**
Reach ID:	**GAR031300020910**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**3980.9 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**3980.9 tons/yr**
Maximum Allowable Daily Load:	**515.9 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Brushy Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Brushy Creek**
Location:	**Headwaters to Chattahoochee River**
Stream Length:	**5 miles**
Watershed Area:	**2.4 square miles**
Reach ID:	**GAR031300010915**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**976.7 tons/yr**
Load Allocation (LA) :	**798.3 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1775.0 tons/yr**
Maximum Allowable Daily Load:	**230.0 tons/day**
% Reduction:	**9.4%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Cane Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Lumpkin**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Cane Creek**
Location:	**Tributary to Chestatee River near Dahlonega**
Stream Length:	**8 miles**
Watershed Area:	**6.4 square miles**
Reach ID:	**GAR031300010604**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing, Primary and Secondary Trout (not supporting designated use)**

Applicable Water Quality Criteria:

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):	
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**1335.2 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1335.2 tons/yr**
Maximum Allowable Daily Load:	**173.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Cauley Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Cauley Creek**
Location:	**Tributary to Chattahoochee River**
Stream Length:	**2 miles**
Watershed Area:	**1.6 square miles**
Reach ID:	**GAR031300010914**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**193.9 tons/yr**
Load Allocation (LA) :	**357.4 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**551.4 tons/yr**
Maximum Allowable Daily Load:	**71.5 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Cavenders Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Lumpkin**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Cavenders Creek**
Location:	**Headwaters to Chestatee River**
Stream Length:	**2 miles**
Watershed Area:	**4 square miles**
Reach ID:	**GAR031300010605**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing, Primary Trout (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**1288.6 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1288.6 tons/yr**
Maximum Allowable Daily Load:	**167.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Chattahoochee River

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**White, Habersham**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Chattahoochee River**
Location:	**Ga. Hwy. 17, Helen to SR255**
Stream Length:	**8 miles**
Watershed Area:	**47.4 square miles**
Reach ID:	**GAR031300010107**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing, Primary Trout (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**13539.3 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**13539.3 tons/yr**
Maximum Allowable Daily Load:	**1754.7 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Crooked Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Crooked Creek**
Location:	**Tributary to Chattahoochee River**
Stream Length:	**2 miles**
Watershed Area:	**8.9 square miles**
Reach ID:	**GAR031300010909**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**3187.6 tons/yr**
Load Allocation (LA) :	**2292.2 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**5479.8 tons/yr**
Maximum Allowable Daily Load:	**710.2 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Foe Killer Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Foe Killer Creek**
Location:	**Headwaters to Big Creek**
Stream Length:	**7 miles**
Watershed Area:	**11.8 square miles**
Reach ID:	**GAR031300011003**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	**0.5 Tons/yr**
Argos Ready Mix - Alpharetta Concrete Plant (GA0047601):	**Daily Avg: 10-20 mg/L, Daily Max: 20-40 mg/L**
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**1321.4**
Load Allocation (LA) :	**1209.8 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**2531.6 tons/yr**
Maximum Allowable Daily Load:	**328.1 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Haw Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Forsyth**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Haw Creek**
Location:	**Headwatrters to Chattahoochee River**
Stream Length:	**3 miles**
Watershed Area:	**3.3 square miles**
Reach ID:	**GAR031300010901**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**919.7 tons/yr**
Load Allocation (LA) :	**1537.1 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**2456.8 tons/yr**
Maximum Allowable Daily Load:	**318..4 tons/day**
% Reduction:	**37.8%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Johns Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Johns Creek**
Location:	**Headwatrters to Chattahoochee River**
Stream Length:	**4 miles**
Watershed Area:	**12.8 square miles**
Reach ID:	**GAR031300010903**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**1909.5 tons/yr**
Load Allocation (LA) :	**1773.3 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**3682.8 tons/yr**
Maximum Allowable Daily Load:	**477.3 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Level Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Level Creek**
Location:	**Headwatrters to Chattahoochee River**
Stream Length:	**5 miles**
Watershed Area:	**8.2 square miles**
Reach ID:	**GAR031300010904**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**2040.2 tons/yr**
Load Allocation (LA) :	**2649.2 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**4689.4 tons/yr**
Maximum Allowable Daily Load:	**607.8 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Little Tesnatee Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**White, Habersham**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03070103**
Waterbody Name:	**Little Tesnatee Creek**
Location:	**Freeman Creek to upstream Hwy. 129**
Stream Length:	**3 miles**
Watershed Area:	**7.8 square miles**
Reach ID:	**GAR031300010501**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing, Secondary Trout (not supporting designated use)**

Applicable Water Quality Criteria:

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):	
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**3678.9 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**3678.9 tons/yr**
Maximum Allowable Daily Load:	**476.8 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Marsh Creek (aka March Creek)

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Marsh Creek (aka March Creek)**
Location:	**Headwaters to Chattahoochee River**
Stream Length:	**4 miles**
Watershed Area:	**5.4 square miles**
Reach ID:	**GAR031300011102**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**488.8**
Load Allocation (LA) :	**398.8 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**887.6 tons/yr**
Maximum Allowable Daily Load:	**115.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Richland Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Richland Creek**
Location:	**Headwaters to Chattahoochee River**
Stream Length:	**5 miles**
Watershed Area:	**9.4 square miles**
Reach ID:	**GAR031300010906**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	**11.4 tons/yr**
City of Buford Westside WPCP (GA0023175)	**Monthly avg: 20 mg/L, Weekly Avg: 30 mg/L**
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**2628.3 tons/yr**
Load Allocation (LA) :	**4279.4 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**6919.1 tons/yr**
Maximum Allowable Daily Load:	**896.7 tons/day**
% Reduction:	**73.0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Sand Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Troup, Harris**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130002**
Waterbody Name:	**Sand Creek**
Location:	**Headwaters to House Creek**
Stream Length:	**9 miles**
Watershed Area:	**3.5 square miles**
Reach ID:	**GAR031300021018**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**748.6 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**748.6 tons/yr**
Maximum Allowable Daily Load:	**97.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Sope Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Cobb**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Sope Creek**
Location:	**Headwaters to Chattahoochee River**
Stream Length:	**11 miles**
Watershed Area:	**35.2 square miles**
Reach ID:	**GAR031300011105**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**5375.9 tons/yr**
Load Allocation (LA) :	**4586.6 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**9962.4 tons/yr**
Maximum Allowable Daily Load:	**1291.1tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Soque River

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Habersham**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Soque River**
Location:	**Goshen Creek to SR 17, Clarkesville**
Stream Length:	**29 miles**
Watershed Area:	**56 square miles**
Reach ID:	**GAR031300010202**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing, primary and Secondary Trout (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**18750.1 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**18750.1 tons/yr**
Maximum Allowable Daily Load:	**2430.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
South Fork Peachtree Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**DeKalb, Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**South Fork Peachtree Creek**
Location:	**Headwaters to Peachtree Creek, Atlanta**
Stream Length:	**15 miles**
Watershed Area:	**18.9 square miles**
Reach ID:	**GAR031300011207**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	**0.1 tons/yr**
Vulcan Construction Materials Tucker Plant (GA0050216)	**Daily Avg: 10-20 mg/L, Daily Max: 20-40 mg/L**
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**1628.4 tons/yr**
Load Allocation (LA) :	**1755.3 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**3383.9 tons/yr**
Maximum Allowable Daily Load:	**438.5 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Tate Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Lumpkin**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Tate Creek**
Location:	**Headwaters to Chestatee River**
Stream Length:	**4 miles**
Watershed Area:	**4.7 square miles**
Reach ID:	**GAR031300010512**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing, Primary Trout (not supporting designated use)**

Applicable Water Quality Criteria:

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):	
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**1709.5 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1709.5 tons/yr**
Maximum Allowable Daily Load:	**221.5 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Tributary #1 to the Chattahoochee River

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Tributary #1 to the Chattahoochee River**
Location:	**Headwaters to the Chattahoochee River**
Stream Length:	**3 miles**
Watershed Area:	**1.6 square miles**
Reach ID:	**GAR031300010917**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**280.7 tons/yr**
Load Allocation (LA) :	**192.1 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**472.8 tons/yr**
Maximum Allowable Daily Load:	**61.3 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Tributary #2 to the Chattahoochee River

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Tributary #2 to the Chattahoochee River**
Location:	**Headwaters to the Chattahoochee River**
Stream Length:	**2 miles**
Watershed Area:	**1.3 square miles**
Reach ID:	**GAR031300011117**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**80.7 tons/yr**
Load Allocation (LA) :	**96.6 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**177.3 tons/yr**
Maximum Allowable Daily Load:	**23.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Tributary to Williams Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Harris**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130002**
Waterbody Name:	**Tributary to Williams Creek**
Location:	**Headwaters to Williams Creek**
Stream Length:	**2 miles**
Watershed Area:	**1.6 square miles**
Reach ID:	**GAR031300021207**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**1145.5 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1145.5 tons/yr**
Maximum Allowable Daily Load:	**148.5 tons/day**
% Reduction:	**9.0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Williams Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Harris**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130002**
Waterbody Name:	**Williams Creek**
Location:	**Headwaters to Mulberry Creek**
Stream Length:	**4 miles**
Watershed Area:	**1.4 square miles**
Reach ID:	**GAR031300021212**
Ecoregion:	**Piedmont**
Violation:	**Bio F**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**1059.3 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1059.3 tons/yr**
Maximum Allowable Daily Load:	**137.3 tons/day**
% Reduction:	**62%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
North Fork Peachtree Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Gwinnett, DeKalb, Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**North Fork Peachtree Creek**
Location:	**Headwaters to Peachtree Creek**
Stream Length:	**14 miles**
Watershed Area:	**33.5 square miles**
Reach ID:	**GAR031300011204**
Ecoregion:	**Piedmont**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	**0.5 tons/year**
Argos Ready Mix - Doraville: (GA0046906)	**Daily Avg: 10-20 mg/L, Daily Max: 20-40 mg/L**
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**1953.4 tons/yr**
Load Allocation (LA) :	**2235.7 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**4189.5 tons/yr**
Maximum Allowable Daily Load:	**543.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Olley Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Cobb**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130002**
Waterbody Name:	**Olley Creek**
Location:	**Headwaters to Sweetwater Creek**
Stream Length:	**11 miles**
Watershed Area:	**13.5 square miles**
Reach ID:	**GAR031300020204**
Ecoregion:	**Piedmont**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**2843.0 tons/yr**
Load Allocation (LA) :	**3092.0 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**5935.0 tons/yr**
Maximum Allowable Daily Load:	**769.2 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Pataula Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Stewart**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130003**
Waterbody Name:	**Pataula Creek**
Location:	**Headwaters to Clear Creek**
Stream Length:	**9 miles**
Watershed Area:	**8.4 square miles**
Reach ID:	**GAR031300031502**
Ecoregion:	**Southeastern Plains**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**5906.9 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**5906.9 tons/yr**
Maximum Allowable Daily Load:	**155.9 tons/day**
% Reduction:	**19%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Rottenwood Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Cobb**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**Rottenwood Creek**
Location:	**Headwaters to Chattahoochee River**
Stream Length:	**9 miles**
Watershed Area:	**9.6 square miles**
Reach ID:	**GAR031300011103**
Ecoregion:	**Piedmont**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Lockheed Martin Aeronautics Company (GA0001198)	**Daily Avg: 10-20 mg/L, Daily Max: 20-40 mg/L**
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**739.6 tons/yr**
Load Allocation (LA) :	**460.6 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**1200.2 tons/yr**
Maximum Allowable Daily Load:	**155.5 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
South Fork Peachtree Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**DeKalb, Fulton**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130001**
Waterbody Name:	**South Fork Peachtree Creek**
Location:	**Headwaters to Peachtree Creek, Atlanta**
Stream Length:	**15 miles**
Watershed Area:	**28.1 square miles**
Reach ID:	**GAR031300011207**
Ecoregion:	**Piedmont**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):	**0.1 tons/yr**
Vulcan Construction Materials Tucker Plant (GA0050216)	**Daily Avg: 10-20 mg/L, Daily Max: 20-40 mg/L**
Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**1628.4 tons/yr**
Load Allocation (LA) :	**1755.3 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**3383.9 tons/yr**
Maximum Allowable Daily Load:	**438.5 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Talipahoga Rum Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Stewart**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130003**
Waterbody Name:	**Talipahoga Rum Creek**
Location:	**Headwaters to Bradley Lake Tributary**
Stream Length:	**4 miles**
Watershed Area:	**5.9 square miles**
Reach ID:	**GAR031300030903**
Ecoregion:	**Southeastern Plains**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Load Allocation (LA) :	**3028.8 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**3028.8 tons/yr**
Maximum Allowable Daily Load:	**80.0 tons/day**
% Reduction:	**0%**

SUMMARY MEMORANDUM
Total Allowable Sediment Load
Weracoba Creek

1. 303(d) Listed Waterbody Information

State:	**Georgia**
County:	**Muscogee**
Major River Basin:	**Chattahoochee**
8-Digit Hydrologic Unit Code(s):	**03130003**
Waterbody Name:	**Weracoba Creek**
Location:	**Columbus (upstream of Bull Creek)**
Stream Length:	**6 miles**
Watershed Area:	**8.3 square miles**
Reach ID:	**GAR031300030104**
Ecoregion:	**Southeastern Plains**
Violation:	**Bio M**
Constituent(s) of Concern:	**Sediment**
Designated Use:	**Fishing (not supporting designated use)**

Applicable Water Quality Criteria:

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):

Industrial Sites:	**Meet requirements of NPDES General Industrial Storm Water Permit, Utilize BCT/BAT Controls**
Future Construction Sites	**Meet requirements of NPDES General Storm Water Permit**
Stormwater (WLAsw):	**399.6 tons/yr**
Load Allocation (LA) :	**220.1 tons/yr**
Margin of Safety (MOS):	**implicit**
Total Allowable Sediment Load:	**619.6 tons/yr**
Maximum Allowable Daily Load:	**16.4 tons/day**
% Reduction:	**0%**