Suwannee River Basin
Dissolved Oxygen TMDL Submittals

Submitted to:

U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:

Georgia Department of Natural Resources
Environmental Protection Department
Atlanta, Georgia

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TMDL Executive Summary

Basin Name: **Suwannee River**

Table 1: Listed Segments

Segment Number	Name	Priority Ranking	Use Classification	Size (miles)	Location
Segment #1	Alapha River	2	Fishing	29	U.S. Hwy. 280 to Sand Creek (Wilcox/BenHill/Turner/Irwin Co.)
Segment #2	Bear Creek	2	Fishing	7	Reedy Cr. to Indian Cr. near Berlin (Colquitt Co.)
Segment #3	Cane Creek	2	Fishing	6	Rooty Branch to Okeefenokee Swamp near Homerville (Clinch Co.)
Segment #4	Cat Creek	2	Fishing	8	Beaverdam Cr. downstream SR 37 to Withlacoochee River near Ray City (Berrien/Lowndes Co.)
Segment #5	Double Run Creek	2	Fishing	5	Upstream SR 90 to Alapaha River near Rebecca (Turner Co.)
Segment #6	Fivemile Creek	2	Fishing	10	Downstream Gaskins Pond to Big Cr. near Nashville (Berrien/Lanier Co.)
Segment #7	Greasy Branch	2	Fishing	10	U.S. Hwy. 84/SR38 to Okeefenokee Swamp (Ware Co.)
Segment #8	Indian Creek	2	Fishing	4	Upstream Little River near Berlin (Colquitt Co.)
Segment #9	Little River	2	Fishing	4	Newell Branch, d/s Hwy. 32 to Ashburn Branch, W. of Sycamore (Turner Co.)
Segment #10	Mill Creek	2	Fishing	3	Reynolds Cr. to Alapaha River (Wilcox Co.)
Segment #11	Mule Creek	2	Fishing	8	Headwaters to Reedy Cr. near Pavo (Thomas/Brooks Co.)
Segment #12	New River	2	Fishing	5	Westside Branch to Gum Cr. downstream Tifton (Tift Co.)
Segment #13	Piscola River	2	Fishing	25	Downstream Whitlock Branch @ Ozell Road to Okapilco Creek near Boston (Thomas/Brooks Co.)
Segment #14	Suwanee Creek	2	Fishing	16	Headwaters to Little Suwannee Cr. near Manor (Clinch/Ware Co.)
Segment #15	Suwannochee Creek	2	Fishing	30	Bear Branch to Lees Bay (Clinch Co.)
Segment #16	Suwannochee Creek	2	Fishing	11	Lees Bay to Suwannee River (Clinch Co.)
Segment #17	Tatum Creek	2	Fishing	9	Tower Rd. to Jones Cr. (Clinch Co.)
Segment #18	Tenmile Creek	2	Fishing	9	Averys Millpond to Big Cr. near Nashville (Berrien/Lanier Co.)
Segment #19	Toms Creek	2	Fishing	23	Headwaters to Stateline (Echols Co.)
Segment #20	Ty Ty Creek	2	Fishing	9	Tucker Cr. to Warrior Cr. near Omega (Colquitt Co.)
Segment #21	Warrior Creek	2	Fishing	8	Rock Cr. to Ty Ty Cr. near Norman Park (Colquitt Co.)
Segment #22	West Fork Deep Creek	2	Fishing	1	Downstream SR S1798 to downstream SR 159 N. of Ashburn (Turner Co.)
Segment #23	Withlacoochee River	2	Fishing	17	Headwaters (Hardy Mill Creek) to New River (Berrien Co.)
Segment #24	Alapaha River	2	Fishing	16	Sand Creek to U.S. Hwy. 129/Ga. Hwy. 11 (Irwin/Tift/Berrien Co.)
Segment #25	Bear Creek	2	Fishing	4	City of Adel Lake to Withlacoochee River (Cook Co.)

Segment #26	Big Creek	2	Fishing	9	SR107 to Alapaha River near Irwinville (Irwin Co.)
Segment #27	Cow Creek	2	Fishing	14	Headwaters to Alapaha River (Clinch/Lanier/Echols Co.)
Segment #28	Deep Creek	2	Fishing	9	W. Fork Deep Cr. to Lake Cr., E. of Ashburn (Turner Co.)
Segment #29	Franks Creek	2	Fishing	9	St. Rt. S1780 to Little River near Hahira (Lowndes Co.)
Segment #30	Giddens Mills Creek	2	Fishing	1	U/S U.S. Hwy. 41/SR 7 to Bear Cr., Adel (Cook Co.)
Segment #31	Hardy Mill Creek	2	Fishing	17	U.S. Hwy. 319, S. of Tifton to Withlacoochee River (Tift/Berrien Co.)
Segment #32	Horse Creek	2	Fishing	13	Headwaters near Sylvester to Warrior Cr. (Worth Co.)
Segment #33	Little Brushy Creek	2	Fishing	4	Stump Cr. to Reedy Cr. S. of Ocilla (Irwin Co.)
Segment #34	Little River	2	Fishing	41	Ashburn Branch, W. of Sycamore to Warrior Cr. (Turner/Tift/Colquitt Co.)
Segment #35	Negro Branch	2	Fishing	9	Headwaters to Piscola Cr., Quitman (Brooks Co.)
Segment #36	New River	2	Fishing	7	Reedy Cr. to Gum Branch near Lenox (Cook Co.)
Segment #37	New River	2	Fishing	4	Brushy Cr. to Withlacoochee River, E. of Sparks (Berrien/Cook Co.)
Segment #38	Okapilco Creek	2	Fishing	10	Upstream SR S1540 to U.S. Hwy. 319, Moultrie (Colquitt Co.)
Segment #39	Okapilco Creek	2	Fishing	10	SR 37 to Hog Cr., S. of Moultrie (Colquitt Co.)
Segment #40	Okapilco Creek	2	Fishing	5	SR 76, Quitman to Withlacoochee River (Brooks Co.)
Segment #41	Reedy Creek	2	Fishing	10	Little Creek (upstream U.S. Hwy. 319/SR 35) to Little Brushy Cr., S. of Ocilla (Irwin Co.)
Segment #42	Sand Creek	2	Fishing	14	Headwaters E. of Sycamore to Alapaha River (Turner/Irwin Co.)
Segment #43	Town Creek	2	Fishing	9	Headwaters to Warrior Cr. near Sylvester (Worth Co.)
Segment #44	Tributary to Withlacoochee	2	Fishing	2	Upstream Morris Pond, Nashville (Berrien Co.)
Segment #45	Ty Ty Creek	2	Fishing	10	Little Cr. near Ty Ty to Tucker Cr. near Omega (Worth/Tift Co.)
Segment #46	Warrior Creek	2	Fishing	10	Horse Cr. to Rock Cr. near Norman Park (Worth/Colquitt Co.)
Segment #47	Willacoochee River	2	Fishing	13	Turkey Branch, upstream SR90/U.S. Hwy. 319 N. of Ocilla to SR 90, S.E. of Ocilla (Irwin Co.)
Segment #48	Willacoochee River	2	Fishing	11	SR 158 to Alapaha River (Berrien Co.)
Segment #49	Morrison Creek	2	Fishing	--	Near Adel, Georgia

Summary of TMDL Analysis and the TMDLs for Listed Segments

The TMDL analysis includes an evaluation of the relationship between the sources and the impact on the receiving water. Due to the many factors that dynamically influence in-stream dissolved oxygen concentrations, this relationship was developed using a complex model linkage. Impaired waterbodies were modeled using both a dynamic receiving water model and a dynamic watershed model. The linkage of these models permitted representation of major processes associated with dissolved oxygen concentration variability. By developing a linked watershed-receiving water model, the impacts of various factors (including all nonpoint and point source loads) on in-stream dissolved oxygen were evaluated. Ultimately, the loading capacity of the waterbody for each critical pollutant affecting the dissolved oxygen concentration was determined. The required source-based loading reduction required to meet the in-stream standard was also calculated. This approach permitted assessment of point source and nonpoint source contributions (including both watershed and leaf litterfall, etc.).

Applicable Water Quality Standards

The applicable dissolved oxygen water quality criteria for waters in the Satilla River Basin is as follows:

> *Numeric.* A daily average of 5.0 mg/l and no less than 4.0 mg/l at all times for waters supporting warm water species of fish. 391-3-6-.03 (c) (l)
>
> *Natural Water Quality - GAEPD.* It is recognized that certain natural waters of the State may have a quality that will not be within the general or specific requirements contained herein. This is especially the case for the criteria for dissolved oxygen, temperature, pH and fecal coliform. NPDES permits and best management practices will be the primary mechanisms for ensuring that the discharges will not create a harmful situation. 391-3-6-.03(7)
>
> *Natural Water Quality - EPA.* "Where natural conditions alone create dissolved oxygen concentrations less than 110 percent of the applicable criteria means or minima or both, the minimum acceptable concentration is 90 percent of the natural concentration." Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Freshwater). EPA440/5-86-003

Critical Condition: June – July, 1998 (low flow and high temperature).

MOS: Implicit; conservative assumptions include 1) running dynamic model; 2) permitted point sources are loaded into model for allocation runs (average monthly permit values); 3) running model with real flow and temperature during summer instead of 7Q10 and 75% temperature; 4) assumed 41% saturation for upstream DO (Meyer, 1992).

Seasonality: Evaluated for all seasons, including high flow winter and low flow summer conditions.

Monitoring: Follow-up monitoring according to 5-year River Basin Planning cycle (Georgia EPD, 1996).

Approach: NPDES for point sources; Best management practices for nonpoint sources.

Date Submitted: Draft - June 2000, Final – December 2001.

Table 2: Summary of TMDLs for Listed Segments

Listed Segments	TMDL – TOC (lbs/yr)	TMDL – TN (lbs/yr)	TMDL – TP (lbs/yr)
Alapaha Creek - Segment #1	29,675,612	1,062,816	131,954
Bear Creek - Segment #2	3,675,805	92,548	13,434
Cane Creek - Segment #3	5,089,829	93,207	5,795
Cat Creek - Segment#4	5,365,126	150,357	23,859
Double Run Creek- Segemnt#5	2,982,882	99,205	11,534
Fivemile Creek - Segment #6	4,532,300	140,125	13,182
Greasy Branch - Segment #7	4,637,054	61,090	5,349
Indian Creek - Segment#8	7,929,460	200,146	29,735
Little River - Segment#9	1,603,658	57,067	6,323
Mill Creek - Segment#10	2,028,305	53,900	14,781
Mule Creek Segment#11	1,696,257	44,692	7,351
New River - Segment #12	2,682,646	67,545	9,017
Piscola River - Segment #13	11,998,002	408,412	61,408
Suwannee Creek -Segment#14	2,571,327	43,520	3,784
Suwannoochee Creek - Segment#15	18,653,555	549,373	37,759
Suwannoochee Creek - Segment#16	27,708,823	708,374	50,486
Tatum Creek - Segment# 17	13,584,289	278,582	23,106
Tenmile Creek - Segment#18	3,111,107	73,293	8,749
Toms Creek Segment #19	8,087,197	407,550	19,439
Ty Ty Creek - Segment #20	7,518,520	213,039	28,668
Warrior Creek - Segment #21	14,703,389	449,224	53,008
West Fork Deep Creek - Segment #22	5,182,209	157,248	19,960
Withlacoochee River - Segment#23	10,823,557	291,935	38,545
Alapaha River- Segment#24	43,782,072	1,651,316	202,625
Bear Creek Segment #25	4,632,470	259,169	34,668
Big Creek - Segment#26	2,387,832	72,266	10,118
Cow Creek - Segment #27	3,725,616	65,206	5,866
Deep Creek -Segment #28	13,511,573	506,453	63,521
Franks Creek - Segment#29	5,062,584	126,552	26,132
Giddens Mills Creek - Segment#30	3,892,131	63,200	9,741
Hardy Mill Creek - Segment#31	5,245,746	134,578	18,169
Horse Creek Segment #32	2,537,177	80,332	8,429
Little Brushy Creek- Segment#33	2,896,552	93,520	12,740
Little River - Segment#34	15,758,116	454,325	57,977
Negro Branch Segment #35	2,182,159	70,597	9,621
New River - Segment #36	13,998,770	925,518	223,383
New River - Segment #37	18,221,206	1,030,510	239,585
Okapilco Creek-Segment#38	3,622,475	107,764	12,990
Okapilco Creek - Segment#39	5,395,811	146,171	19,355
Okapilco Creek- Segment#40	26,845,935	793,837	122,708
Reedy Creek - Segment #41	4,227,020	128,002	18,544
Sand Creek - Segment #42	3,210,191	96,914	11,684
Town Creek - Segment #43	1,531,910	48,433	4,522
Tributary to Withlacoocheee -Segment #44	415,501	58,336	7,912
Ty Ty Creek - Segment #45	6,180,578	177,972	23,586
Warrior Creek - Segment #46	12,815,030	394,225	45,549
Willacoochee River - Segment #47	5,627,463	199,007	24,502
Willacoochee River - Segment #48	16,129,068	511,052	69,693
Morrison Creek - Segment #49	3,181,053	92,642	16,077

Appendix D presents the Waste Load Allocations (WLAs) and the Load Allocations (LAs) as annual loads for the loads contributing to the dissolved oxygen in the impaired segments in the Suwannee River Basin.

1.0 Introduction

The State of Georgia is required to develop total maximum daily loads (TMDLs) for waters not meeting water quality standards, in accordance with Section 303(d) of the Clean Water Act and the U. S. Environmental Protection Agency (EPA) Water Quality Planning and Management Regulations (40 CFR Part 130). Water quality data collected in 1998 indicate that a number of waterbodies in the Suwannee River Basin did not achieve water quality standards for dissolved oxygen. The low dissolved oxygen conditions may be due to naturally occurring conditions. These waterbodies were listed on the Georgia 2000-303(d) list. This document presents the dissolved oxygen TMDLs for the listed waterbodies in the Suwannee River Basin, which is located in southwest Georgia (Figure 1-1).

Four river basins, the Ochlockonee, Suwannee, Satilla, and the St. Marys are the focus of TMDL development in Georgia in 2000. The four river basins are shown in Figure 1-1.

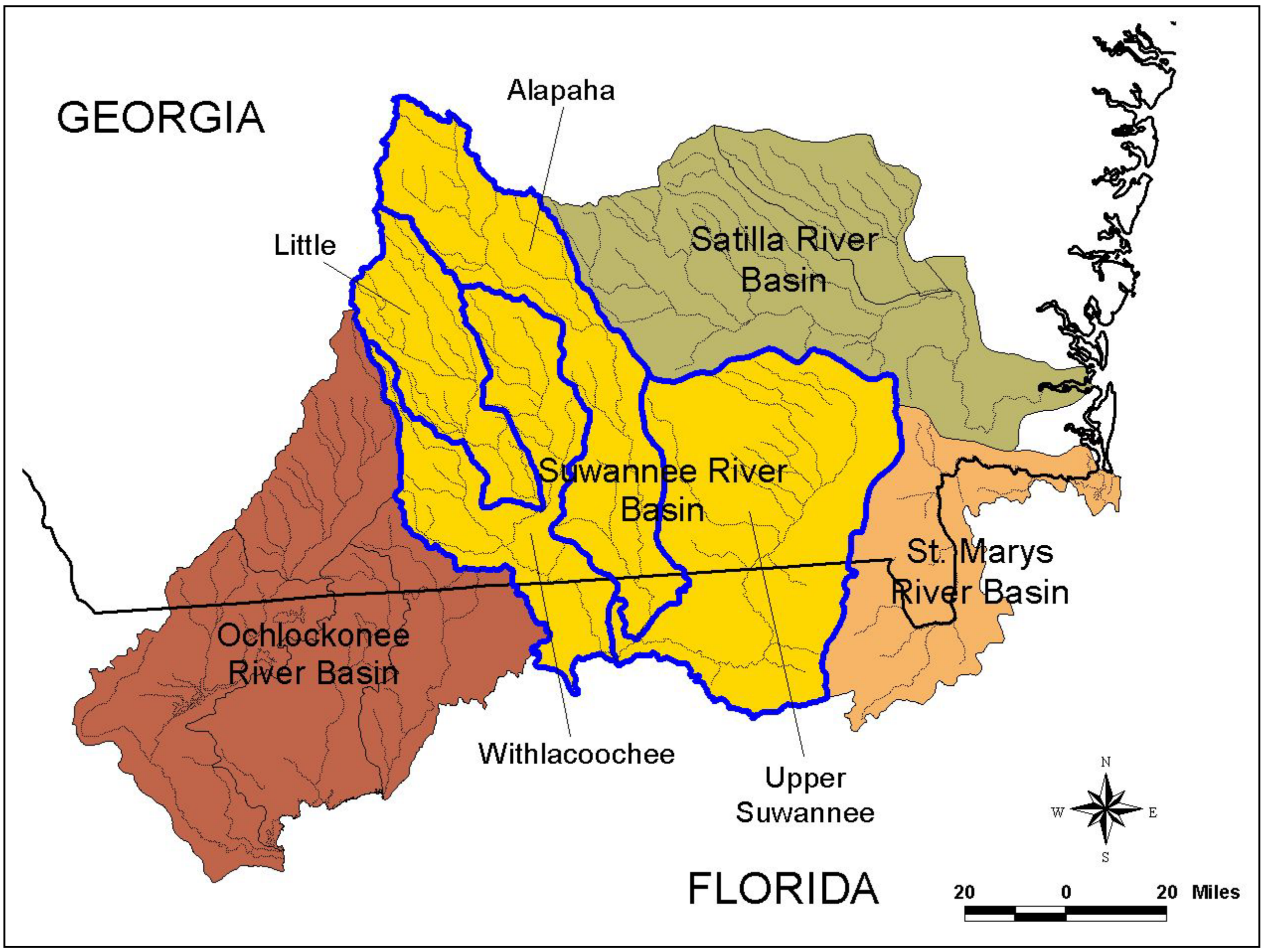

Figure 1-1. Southern Four Georgia Basins Requiring Dissolved Oxygen TMDL Development (Ochlockonee, Suwannee, Satilla, and St. Mary's River Basins)

2.0 Problem Understanding

The Suwannee River Basin, from the headwaters to the Gulf of Mexico, covers an area of approximately 2,785 mi^2. The headwaters of the Suwannee River are in the southeastern portion of the state in the Okefenokee National Wildlife Refuge, located south of Waycross, Georgia. The major Georgia cities in the Suwannee River Basin are Valdosta, Adel, Tifton, Norman Park, Arabi, and Fitzgerald shown in the location map in Figure 2-1. The Suwannee River flows south through Florida and eventually drains into the Gulf of Mexico through Apalachee Bay. For the purpose of developing TMDLs in southern Georgia for the low dissolved oxygen segments, the Suwannee River Basin will refer to portions of the river basins that are located within the Georgia state border.

The Suwannee River Basin contains 50 waterbody segments that are violating Georgia's dissolved oxygen standards of a daily average of 5.0 mg/l and no less than 4.0 mg/l (Figure 2-2 and see Listed Segments table on page 3). Each of these 50 listed segments contained at least one monitoring station in 1998 used for impairment listing purposes (Figure 2-2).

The GAEPD established water quality monitoring stations for the Ochlockonee, Suwannee, Satilla, and St. Marys River Basins as a part of the Georgia River Basin Planning Program (GAEPD, 1996). There were 138 stations established and sampled in the four river basins in 1998. Sixty-nine of the sampling stations were in the Suwannee River Basin. The monitoring work was conducted as a cooperative effort between the GAEPD and the United States Geologic Survey (USGS). The four river basins will be monitored again in 2003. It should be noted that core stations in the four basins are monitored each year. During 1998, the USGS measured gage height, water temperature, pH, and dissolved oxygen on-site and collected water samples for laboratory analyses. The laboratory water quality parameters included turbidity, five-day biological oxygen demand (BOD5), ammonia, nitrate-nitrite, total phosphorus, total organic carbon, and fecal coliform. In addition, samples for metals analyses were collected at each station. These data were used to assess compliance with water quality standards and the assessment results were used by the GAEPD in the development of the 2000-303(d) list.

The assessment indicated that 50 waterbody segments were not achieving compliance with water quality standards for dissolved oxygen (Figure 2-2 and see Listed Segments table on page 3). Low dissolved oxygen conditions in the Suwannee River basin may be in part due to naturally occurring conditions. Each of the 50 listed segments contained at least one monitoring site in 1998. The TMDLs for dissolved oxygen for the 50 listed segments were scheduled for development in 2000 and for presentation for public comment in June 2000. This report presents the TMDLS for dissolved oxygen for the listed segments in the Suwannee River Basin. A summary of selected water quality data and a map of station locations are presented in Appendix A.

Typical precipitation in this area is 47 inches per year based on examination of nearby precipitation stations in Doles, Valdosta, Pearson, Abbeville and Fargo, Georgia. A summary of the precipitation data and a map of stations in southern Georgia are included in this report in Appendix A.

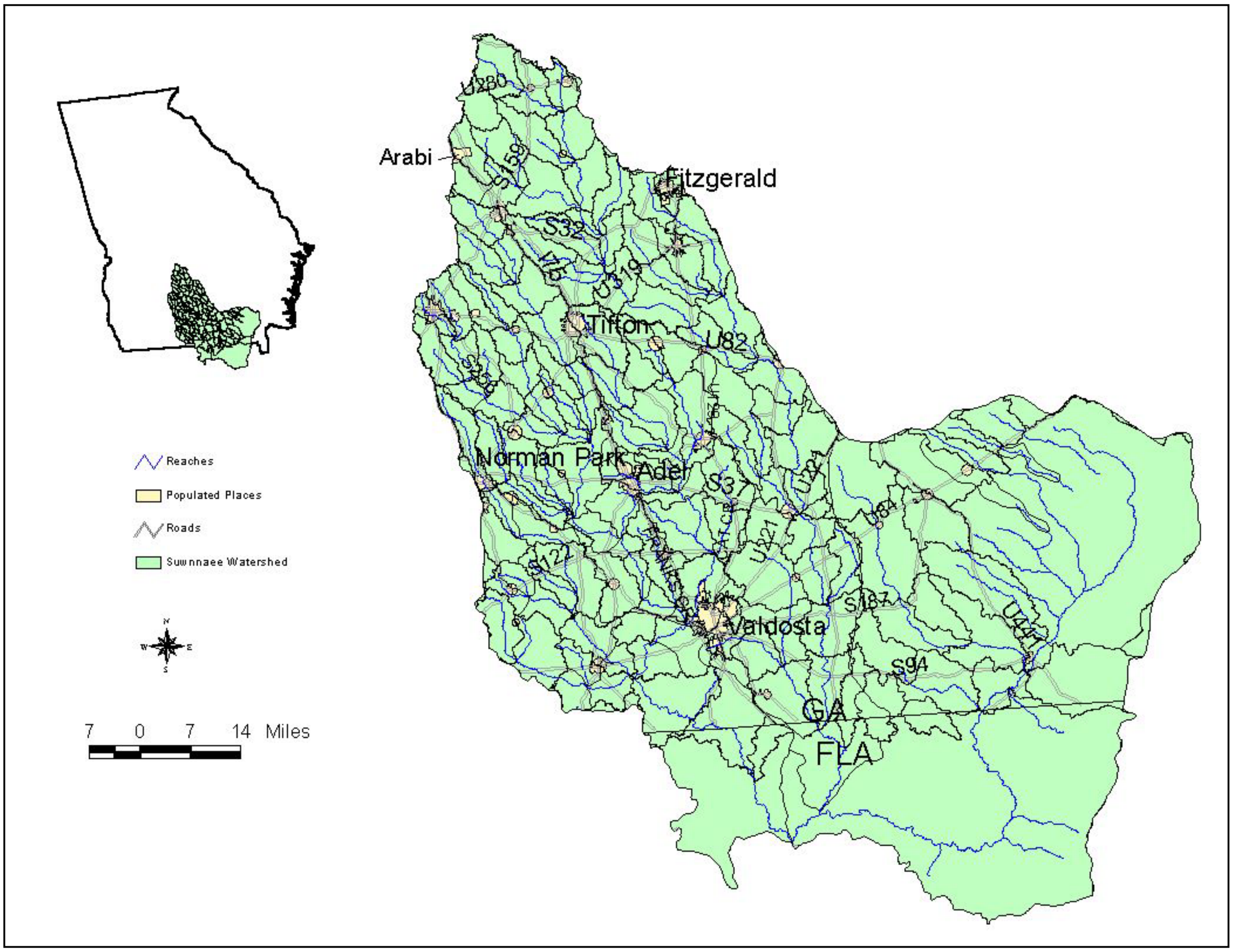

Figure 2-1. Location Map of the Suwannee River Basin

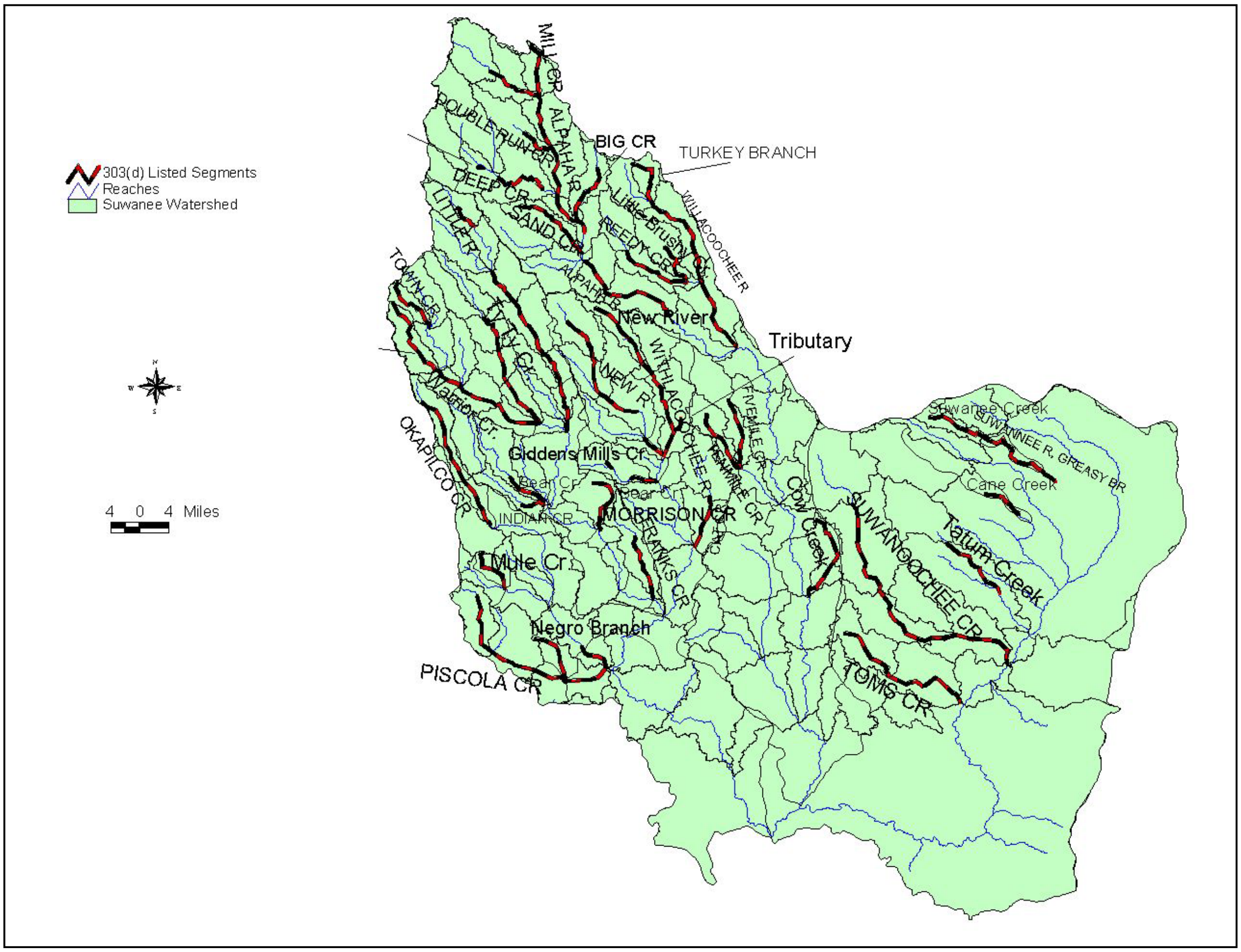

Figure 2-2. 303(d) Listed Segments for Dissolved Oxygen in the Suwannee River Basin

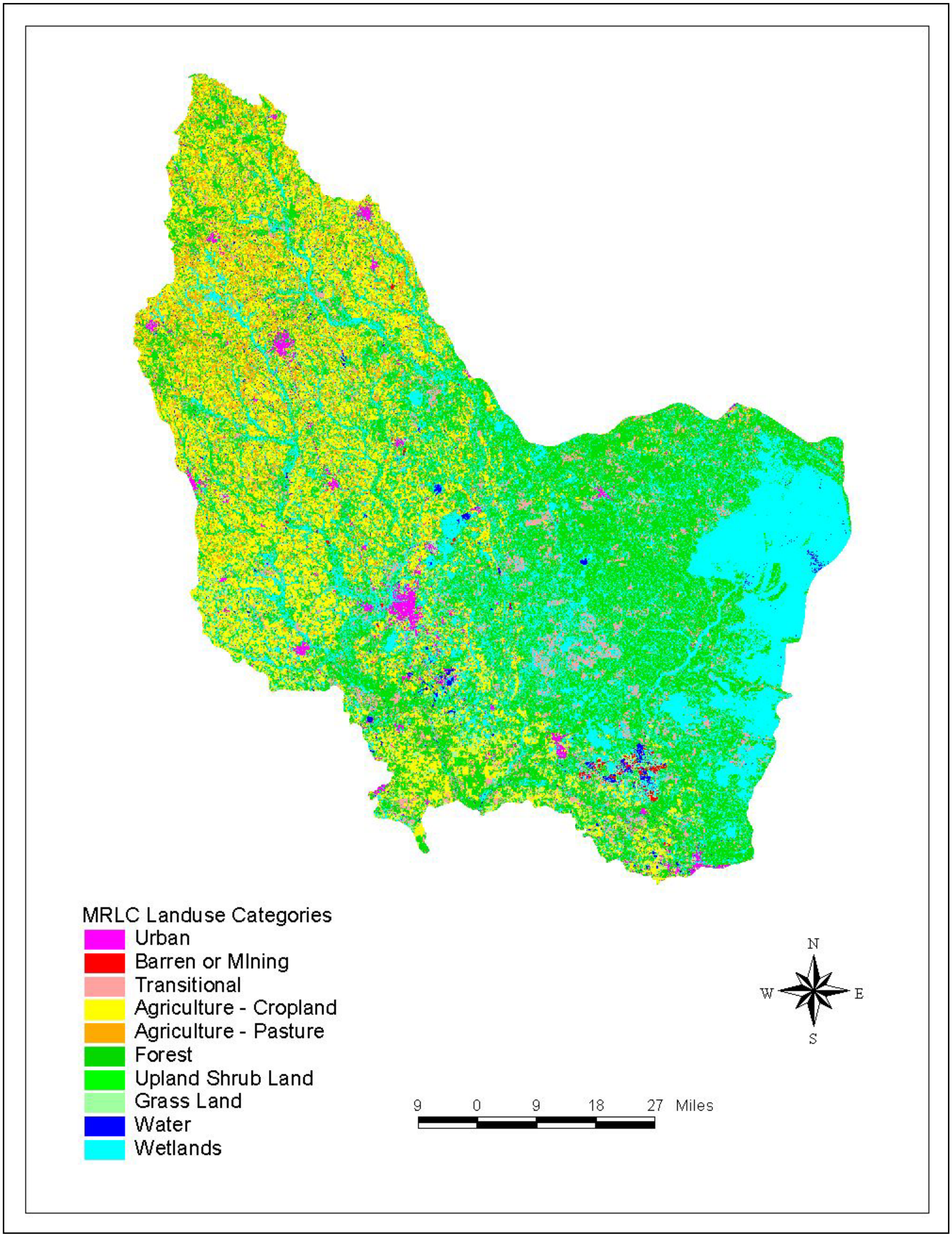

Figure 2-3. Land Use Representation in the Suwannee River Basin

3.0 Water Quality Standards

All dissolved oxygen impaired waterbodies in the Satilla River Basin are designated by the State of Georgia with a water use classification of fishing. Georgia Water Quality Standards (GAEPD, 1999) have defined water quality criteria for surface waters as those that are used, or have a high potential to be used, for fishing and primary contact recreation. Georgia's water quality standards state the following criteria for measurements of dissolved oxygen with a use classification of fishing:

> *Numeric.* A daily average of 5.0 mg/l and no less than 4.0 mg/l at all times for waters supporting warm water species of fish*. A daily average of 6.0 mg/l and no less than 5.0 mg/l at all times for waters designated as trout streams by the Wildlife Resource Division.

GAEPD, 1999
*Waterbodies in the Satilla River Basin are assumed to be classified as supporting warm water species of fish.

Certain waters of the state may have conditions where the dissolved oxygen is naturally lower than the recommended numeric dissolved oxygen criteria and cannot meet the numeric criteria unless reductions in the natural nutrient and carbon loads are obtained. This reduction in the natural forest or wetland contributions is not feasible, practicable or desirable, therefore the EPA Dissolved Oxygen Criteria was instituted and dissolved oxygen target limits were identified for TMDL development. The target limits were identified as 90% of the minimum naturally occurring concentration for impaired waterbodies.

> *Natural Water Quality*. "It is recognized that certain natural waters of the State may have a quality that will not be within the general or specific requirements contained herein. This is especially the case for the criteria for dissolved oxygen, temperature, pH and fecal coliform. NPDES permits and best management practices will be the primary mechanisms for ensuring that the discharges will not create a harmful situation." 391-3-6-.03(7)

GAEPD, 1999

U.S. EPA guidelines supplement the Georgia guidelines for naturally low dissolved oxygen conditions by providing numeric targets:

> "Where natural conditions alone create dissolved oxygen concentrations less than 110 percent of the applicable criteria means or minima or both, the minimum acceptable concentration is 90 percent of the natural concentration." Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Freshwater), EPA440/5-86-003, April 1986.

USEPA, 1986

Dissolved oxygen violation analyses were performed for all 69 water quality stations in the basin by comparing observation values to numeric water quality standards. The analyses confirmed that the water quality standards were violated for the listed segments.

4.0 Source Assessment

The 303(d) listing for the impaired segments identified nonpoint sources as the primary contributors to dissolved oxygen impairment. An examination of permits and land use information for the watershed was used to identify all potential sources of oxygen demanding substances in the basin. These sources (divided into Point and Nonpoint Sources) were considered in the source loading analysis and the subsequent TMDL.

Point Sources

Potential point sources affecting in-stream dissolved oxygen concentrations include wastewater treatment plants, industrial facilities (e.g., food processing facilities), combined sewer overflows, sanitary sewer overflows, and stormwater runoff. Point sources directly discharge organic and inorganic oxidizable substances into a waterbody, which ultimately affects dissolved oxygen concentrations. Pollutants that are typically monitored by facilities and should be considered in an evaluation of point source effects on in-stream dissolved oxygen concentrations include BOD, NH3, and TSS. Point sources contributing to the listed waters are listed in Table 4-1 and their corresponding discharge characteristics are listed in Table 4-2. The locations of the point sources are shown in Figure 4-1.

Table 4-1. Point Sources Contributing to Impaired Waterbodies in the Suwannee River Basin

PERMIT ID	Point Source	Receiving Water
GA0024244	Rochelle - Northwest WPCP	Mill Creek tributary
GA0024236	Rochelle - Southwest WPCP	Mill Creek tributary
GA0031151	Regency Inn - Budget Inn	Lime Creek
GA0023370	Knights Inn	unnamed tributary to Deep Creek
GA0025852	Ashburn WPCP	Hot Creek - Alapaha River – Suw
GA0022101	Ben Hill – Irwin Area Vo-Tech	Withlacoochee River
GA0024465	Red Carpet Inn	Middle Creek
GA0025500	Ty Ty WPCP	Ty Ty Creek
GA0048470	Tifton New River WPCP	New River tributary
GA0000124	Tifton Aluminum Company	Gum Creek
GA0033596	Alapaha Pond	Alapaha River
GA0033928	Magnolia Plantation	unnamed tributary of Cane Creek
GA0031950	Lenox Pond	unnamed tributary to Little Riv
GA0022071	DOT Safety Rest Area no. 6	Little River
GA0022063	DOT Safety Rest Area no. 5	Little River
GA0034738	Red Carpet Inn	Little River tributary
GA0000175	Premium Pork Inc.	Okapilco Creek
GA0002241	CSX Transportation	Waycross canal to Satilla River
GA0000183	Wells Aluminum Corp.	Okapilco Creek
GA0021563	Sparks WPCP	Bear Creek to Suwanee River
GA0000108	Aluminum Finishing of Georgia Corp.	Bear Creek
GA0025879	Moultrie - Spence Field WPCP	Little Indian Creek
GA0024911	Adel WPCP	Bear Creek
GA0049492	Okefenokee Swamp Park	Okefenokee Swamp

GA0021296	Lakeland Pond	Big Creek
GA0031828	Homerville WPCP	Gallows Bridge tributary
GA0037460	Homerville Industrial Park WPCP	drainage ditch to Tatum Creek
GA0022055	DOT Safety Rest Area no. 4	Franks Creek
GA0047228	Georgia Sheriffs Boys Ranch	
GA0022047	DOT Safety Rest Area no. 3	Franks Creek
GA0020001	USAF Moody AFB	Beatty Branch
GA0048909	Days Inn	oxidation pond
GA0031224	River Park Mobile Home Park	Withlacoochee River
GA0033235	Valdosta-Withlacoochee WPCP	Withlacoochee - Suwannee River
GA0020222	Valdosta - Mud Creek WPCP	Mud Creek to Suwanee River
GA0034274	Lowndes County - Twin Lakes WPCP no.	

Table 4-2. Point Sources in Watersheds Contributing to Impaired Segments

				Permitted (MAX / AVG)				
NPDES	HUC Label	Receiving Water	Season	DO (mg/L)	BOD-5	Flow (mgd)	NH3	TSS
GA0024244	3110202	Mill Creek tributary		2	45 / 30 mg/L	--	--	120 / 90 mg/L
GA0024236	3110202	Mill Creek tributary		2	45 / 30 mg/L	--	--	120 / 90 mg/L
GA0031151	3110202	Lime Creek		--	45 / 30 mg/L	-- / 0.02	--	45 / 30 mg/L
GA0023370	3110202	unnamed tributary to Deep Creek		--	45 / 30 mg/L	0.021 / 0.014	--	120 / 90 mg/L
GA0025852	3110202	Hot Creek - Alapaha River – Suw		5	37.5 / 25 mg/L	1.45 / 1.16	22.5 / 15 mg/L	45 / 30 mg/L
GA0022101	3110202	Withlacoochee River		--	45 / 30 mg/L	0.0137 / 0.0137	--	120 / 90 mg/L
GA0024465	3110202	Middle Creek		--	45 / 30 mg/L	0.024 / 0.016	--	120 / 90 mg/L
GA0025500	3110204	Ty Ty Creek		--	45 / 30 mg/L	0.098 / 0.078	--	120 / 90 mg/L
GA0048470	3110203	New River tributary	0	6	15 / 10 mg/L	--	15 / 10 mg/L	45 / 30 mg/L
			1	--	--	--	7.5 / 5 mg/L	--
			2	--	--	--	3 / 2 mg/L	--
			3	--	--	--	7.5 / 5 mg/L	--
GA0000124	3110203	Gum Creek		--	--	--	--	290 / 138 lbs/day
GA0033596	3110202	Alapaha River		--	45 / 30 mg/L	0.12 / 0.1	--	120 / 90 mg/L

GA0033928	3110204	unnamed tributary of Cane Creek		--	45 / 30 mg/L	0.035 / 0.035	--	120 / 90 mg/L
GA0031950	3110204	unnamed tributary to Little Riv		--	45 / 30 mg/L	0.21 / 0.17	--	120 / 90 mg/L
GA0022071	3110204	Little River		--	45 / 30 mg/L	0.013 / 0.01	--	45 / 30 mg/L
GA0022063	3110204	Little River		--	45 / 30 mg/L	0.013 / 0.01	--	45 / 30 mg/L
GA0034738	3110203	Little River tributary		--	45 / 30 mg/L	0.015 / 0.015	--	120 / 90 mg/L
GA0000175	3110203	Okapilco Creek		--	108 / 54 lbs/day	--	22 / 11 lbs/day	326 / 163 lbs/day
GA0002241	3110201	Waycross canal to Satilla River		--	45 / 30 mg/L	--	--	45 / 30 mg/L
GA0000183	3110204	Okapilco Creek		--	45 / 30 mg/L	--	--	60 / 30 lbs/day
GA0021563	3110203	Bear Creek to Suwanee River	0	6	22.5 / 15 mg/L	0.29 / 0.23	7.5 / 5 mg/L	45 / 30 mg/L
			1	5	37.5 / 25 mg/L	--	19.5 / 13 mg/L	--
			2	--	33 / 22 mg/L	--	18 / 12 mg/L	--
			3	--	24 / 16 mg/L	--	7.5 / 5 mg/L	--
			4	--	16.5 / 11 mg/L	--	3 / 2 mg/L	--
			5	--	-- / --	--	4.5 / 3 mg/L	--
GA0000108	3110203	Bear Creek		--	--	--	--	60 / 31 mg/L
GA0025879	3110204	Little Indian Creek		--	-- / 10 mg/L	--	-- / 2 mg/L	--
GA0024911	3110203	Bear Creek		2	45 / 30 mg/L	--	26.1 / 17.4 mg/L	120 / 90 mg/L
GA0049492	3110201	Okefenokee Swamp		--	45 / 30 mg/L	--	--	45 / 30 mg/L
GA0021296	3110202	Big Creek		--	45 / 30 mg/L	0.25 / 0.2	--	120 / 90 mg/L
GA0031828	3110201	Gallows Bridge tributary		2	45 / 30 mg/L	0.63 / 0.5	26.1 / 17.4 mg/L	45 / 30 mg/L
GA0037460	3110201	drainage ditch to Tatum Creek	0	--	45 / 30 mg/L	0.31 / 0.25	15 / 10 mg/L	45 / 30 mg/L
			1	--	30 / 20 mg/L	--	7.5 / 5 mg/L	--
GA0022055	3110204	Franks Creek		--	45 / 30 mg/L	0.013 / 0.01	--	45 / 30 mg/L

GA0047228	3110203			--	65 / 45 mg/L	0.037 / 0.025	--	120 / 90 mg/L
GA0022047	3110204	Franks Creek		--	45 / 30 mg/L	0.013 / 0.01	--	45 / 30 mg/L
GA0020001	3110203	Beatty Branch	0	6	22 / 15 mg/L	1.125 / 0.75	3 / 2 mg/L	45 / 30 mg/L
			1	--	--	--	6 / 4 mg/L	--
GA0048909	3110204	oxidation pond		--	45 / 30 mg/L	--	--	120 / 90 mg/L
GA0031224	3110203	Withlacoochee River		--	45 / 30 mg/L	--	--	120 / 90 mg/L
GA0033235	3110203	Withlacoochee - Suwannee River	0	5	22.5 / 15 mg/L	--	26.1 / 17.4 mg/L	45 / 30 mg/L
			1	6	45 / 30 mg/L	--	6.4 / 4.3 mg/L	45 / 30 mg/L
			2	7	18 / 12 mg/L	--	3 / 2 mg/L	45 / 30 mg/L
			3	--	10.5 / 7 mg/L	--	--	--
			4	--	15 / 10 mg/L	--	--	--
			5	--	6 / 4 mg/L	--	--	--
			6	--	10.5 / 7 mg/L	--	--	--
			7	--	15 / 10 mg/L	--	--	--
GA0020222	3110202	Mud Creek to Suwanee River		6	15 / 10 mg/L	4.03 / 3.22	2.25 / 1.5 mg/L	45 / 30 mg/L
GA0034274	3110202			6	15 / 10 mg/L	0.188 / 0.15	--	45 / 30 mg/L

Note: -- Denotes situations where permitted data are not available.

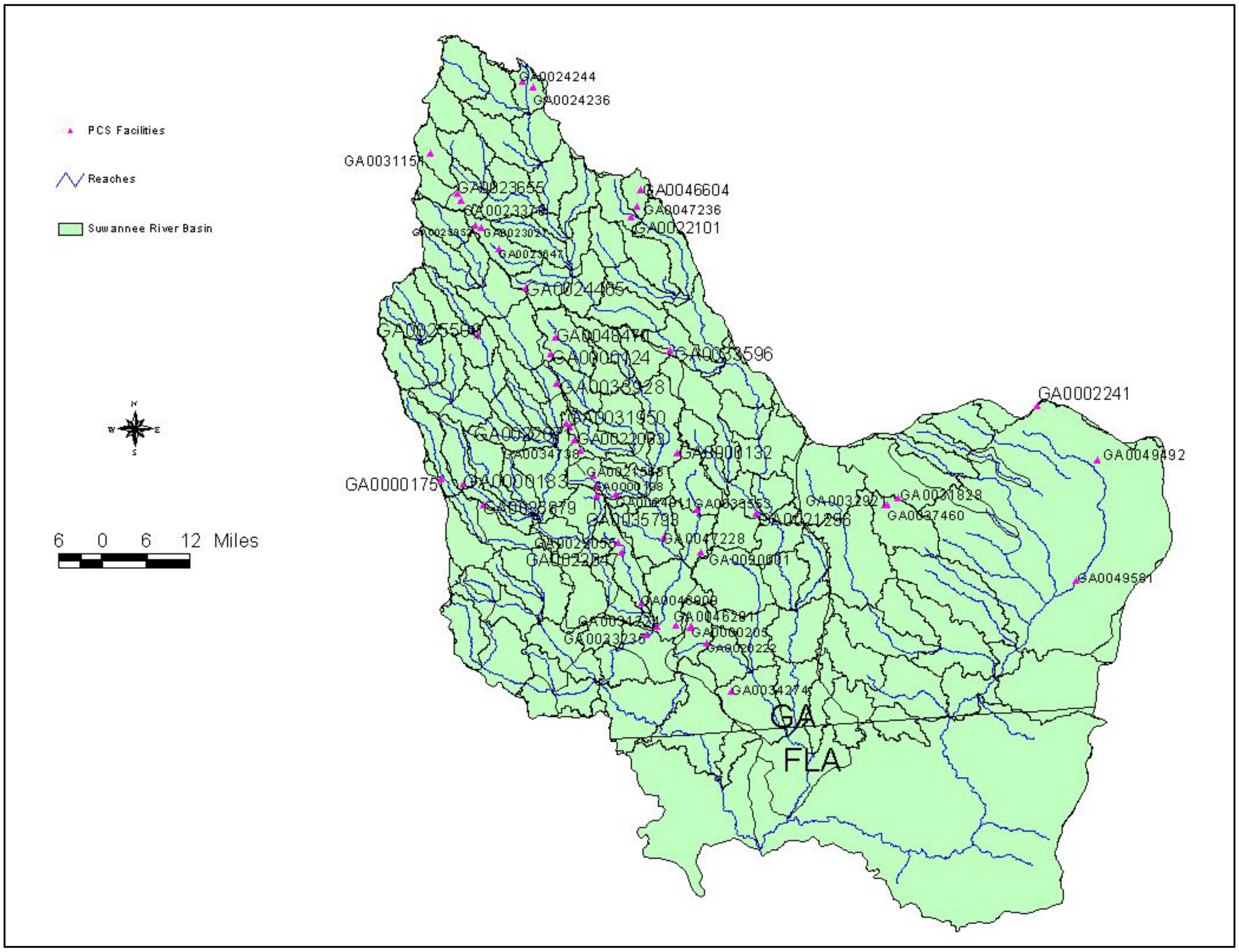

Figure 4-1. Point Sources in the Suwannee River Basin Contributing to Impaired Waterbodies

Nonpoint Sources

Nonpoint sources of oxygen demanding substances are typically separated into urban and rural components. In urban or suburban settings, important sources of loading are surface storm runoff, failing septic systems, and leakage and overflows from sanitary sewer systems. In rural areas, sources of oxygen demanding substances may include diffuse runoff of agricultural fertilizer and animal wastes (from manure application or grazing animals), erosion of sediments, and runoff from concentrated animal operations.

Based on a landuse assessment and review of the literature, nonpoint source contributions from urban, agriculture, and forested areas are all likely in the Suwannee River Basin. Croplands, pasture, forest, urban (or built-up) areas, and wetlands were all identified in the basin. The land use distribution for the Georgia 12-digit watersheds contributing to the impaired segments is displayed in Appendix A. Figure 2-3 graphically displays the land use distribution within the study area.

In addition to the aforementioned nonpoint sources of oxygen demanding substances, many southern Georgia streams receive significant contributions of oxygen demanding organic materials from local wetlands and forested stream corridors. In particular, the following sources of organic materials have been identified:

- adjacent wetland/swampy areas that have organically rich bottom sediments
- direct leaf litterfall onto the water surface from overhanging trees and vegetation
- lateral leaf litterfall that has fallen into the floodplains

Leaf litterfall plays a major role in the amount of carbon in the stream water column. The riparian areas of the watershed are the primary source of litterfall. At higher flows, the leaf litterfall in the floodplains are picked up and transported laterally into the stream. Many streams in southern Georgia are referred to as “blackwater” streams due to the humic substances leached from surrounding watersheds that impart color to the water (Meyer, 1992). Low dissolved oxygen in blackwater streams is common in the summer months when the temperatures are high and the flows are low.

5.0 Summary of the Technical Approach

The TMDL analysis includes an evaluation of the relationship between the sources and the impact on the receiving water. Due to the many factors that dynamically influence in-stream dissolved oxygen concentrations, this relationship was developed using a complex model linkage.

Impaired waterbodies were modeled using both a dynamic receiving water model and a dynamic watershed model. The linkage of these models permitted representation of major processes associated with dissolved oxygen concentration variability, including:

- Input and oxidation of carbonaceous waste material
- Input and oxidation of nitrogenous waste material
- Input and oxygen demand of sediments in the water body
- Use of oxygen through aquatic plant respiration
- Reaeration
- Oxygen production through photosynthesis

By developing a linked watershed-receiving water model, the impacts of various factors (including all nonpoint and point source loads) on in-stream dissolved oxygen were evaluated. Ultimately, the loading capacity of the waterbody for each critical pollutant affecting the dissolved oxygen concentration was determined. The required source-based loading reduction required to meet the in-stream standard was also calculated. This approach permitted assessment of point source and nonpoint source contributions (including both watershed and leaf litterfall, etc.).

The technical approach is summarized in the following sections:

- Model selection
- Source representation
- In-stream representation
- Model testing

Model Selection

The Hydrologic Simulation Program Fortran (HSPF), a dynamic watershed model capable of simulating a wide range of water quality parameters, was selected to represent nonpoint source pollutant contributions (and point source contributions as necessary) to the impaired waterbodies. The impaired waterbodies themselves were modeled using the Environmental Fluid Dynamics Code (EFDC), a 3-D hydrodynamic and water quality model capable of simulating dissolved oxygen and a full suite of dissolved oxygen interactions. Output from the HSPF was applied directly to the EFDC, in order to provide the linkage between source and waterbody response.

Source Representation

Nonpoint and point sources were both represented in the linked models. The watershed model was primarily implemented to represent upstream nonpoint source contributions to the impaired waterbody. Direct contributions of leaf litter (representation of organic materials contributed by overhanging trees and vegetation) to each impaired waterbody were represented in the receiving water model.

Point sources were represented in both the receiving water model and the watershed model. Facilities discharging within the same 12-digit subwatershed as a modeled impaired waterbody were represented in the receiving water model. Facilities discharging to unimpaired reach segments that affect impaired waterbodies, but were not explicitly modeled with the receiving water model, were represented in the watershed model.

Nonpoint Source Representation

Nonpoint source pollutants likely to impact dissolved oxygen include nutrients, BOD, and sediment. These pollutants have a direct impact on oxygen reducing procedures, including oxidation of carbonaceous and nitrogenous materials and exertion of oxygen demand by sediments. They also affect oxygen replenishment through plant respiration and photosynthesis production.

The watershed model represents the variability of nonpoint source contributions through dynamic representation of hydrology and land practices. In a number of situations, the watershed model additionally accounts for point source contributions (where point sources are located on major streams contributing to an impaired waterbody that are not represented explicitly in the receiving water model). Key components of the watershed model include:

- Watershed segmentation
- Meteorological data
- Simulation period
- Landuse representation
- Hydrologic representation
- Water quality representation

Watershed Segmentation

In order to evaluate the sources contributing to an impaired waterbody and to represent the spatial variability of these sources within the watershed model, the contributing drainage area was represented by a series of subwatersheds. These subwatersheds were represented using the Georgia 12-digit watershed data layer. In some situations, the 12-digit data layer required further subdivision for appropriate hydrologic connectivity and representation.

The watershed model was run for all subwatersheds contributing to each impaired waterbody. Figure 5-1 presents the subwatersheds used in the watershed modeling process. Table 5-1 presents the subwatersheds contributing to individual impaired waterbodies.

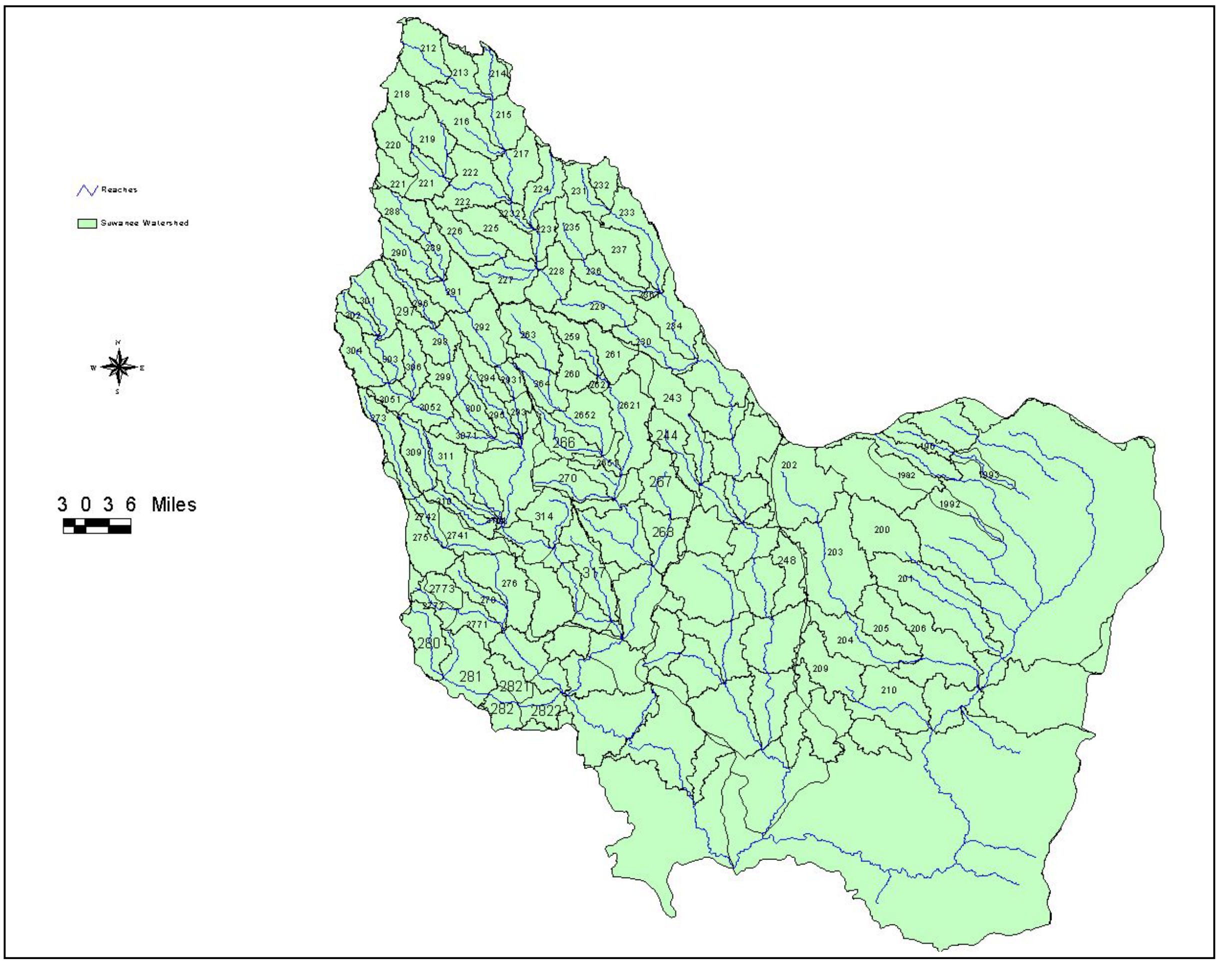

Figure 5-1. Subwatersheds Used in the Watershed Modeling Process (Contributing to Listed Waterbodies)
Note: Subwatersheds are labeled by their model Ids - refer to Table 5-1 for corresponding 12-digit Ids. Some subwatersheds were further divided to support proper hydrologic representation.

Table 5-1. Subwatersheds Contributing to Impaired Waterbodies

Name	Contributing Subwatersheds (GA 12-Digit)	Corresponding Watershed Model IDs
Alpaha River Segment #1	212, 213, 214, 215, 216, 217, 218, 219, 220, 221-1, 221-2, 222, 223-1, 223-2, 224, 225	031102020101, 031102020102, 031102020103, 031102020104, 031102020105, 031102020106, 031102020201, 031102020202, 031102020203, 031102020204(a), 031102020204(b), 031102020205, 031102020301(a), 031102020301(b), 031102020302, 031102020303
Bear Creek Segment #2	311	031102040404
Cane Creek Segment #3	198-2, 199-2	031102010104(b), 031102010105(b)
Cat Creek Segment #4	267, 268	031102030301, 031102030302
Double Run Creek Segment #5	216	031102020105
Fivemile Creek Segment #6	243	031102020801
Greasy Branch Segment #7	196, 199-3	031102010102, 031102010105(c)
Indian Creek Segment #8	309, 310, 310-1, 311	031102040402, 031102040403, 031102040403(a), 031102040404
Little River Segment #9	288	031102040101
Mill Creek Segment #10	214	031102020103
Mule Creek Segment #11	277-3	031102030601(c)
New River Segment #12	259	031102030101
Piscola River Segment #13	280, 281, 282, 282-2	031102030701, 031102030702, 031102030703, 031102030703(a)
Suwanee Creek Segment #14	196	031102010102
Suwanochee Creek Segment #15	202. 203, 204	031102010301, 031102010302, 031102010303
Suwanochee Creek Segment #16	202, 203, 204, 205, 206	031102010301, 031102010302, 031102010303, 031102010304, 031102010305
Tatum Creek Segment #17	200, 201	031102010201, 031102010202
Tenmile Creek Segment #18	244	031102020802
Toms Creek Segment #19	209, 210	031102010502, 031102010503
Ty Ty Creek Segment #20	296, 297, 298, 299, 300	031102040201, 031102040202, 031102040203, 031102040204, 031102040205
Warrior Creek Segment #21	301, 302, 303, 304, 305-1, 305-2, 306, 307-1	031102040301, 031102040302, 031102040303, 031102040304, 031102040305(a), 031102040305(b), 031102040306, 031102040307(a)
West Fork Deep Creek Segment #22	220, 221-1, 221-2	031102020203, 031102020204(a), 031102020204(b)
Withlacoochee River Segment #23	259, 260, 261, 262-1, 262-2	031102030101, 031102030102, 031102030103, 031102030104(a), 031102030104(b)

Alapaha River Segment #24	212, 213, 214, 215, 216, 217, 218, 219, 220, 221-1, 221-2, 222, 223-1, 223-2, 224, 225, 226, 227, 228, 229	031102020101, 031102020102, 031102020103, 031102020104, 031102020105, 031102020106, 031102020201, 031102020202, 031102020203, 031102020204(a), 031102020204(b), 031102020205, 031102020301(a), 031102020301(b), 031102020302, 031102020303, 031102020304, 031102020305, 031102020401, 031102020402
Bear Creek Segment #25	270, 270-1, 270-2	031102030402, 031102030402(a), 031102030402(b)
Big Creek Segment #26	224	031102020302
Cow Creek Segment #27	248	031102020903
Deep Creek Segment #28	218, 219, 220, 221-1, 221-2, 222	031102020201, 031102020202, 031102020203, 031102020204(a), 031102020204(b), 031102020205
Franks Creek Segment #29	317	031102040505
Giddens Mills Creek Segment #30	270-2	031102030402(b)
Hardy Mill Creek Segment #31	259, 260, 262-2	031102030101, 031102030102, 031102030104(b)
Horse Creek Segment #32	304	031102040304
Little Brushy Creek Segment #33	237	031102020603
Little River Segment #34	288, 289, 290, 291, 292, 293, 293-1, 293-2, 294, 295	031102040101, 031102040102, 031102040103, 031102040104, 031102040105, 031102040106, 031102040106(a), 031102040106(b), 031102040107, 031102040108
Negro Branch Segment #35	282-1	031102030703(a)
New River Segment #36	263, 264, 265-2	031102030201, 031102030202, 031102030203(b)
New River Segment #37	263, 264, 265-1, 265-2, 266	031102030201, 031102030202, 031102030203(a), 031102030203(b), 031102030204
Okapilco Creek Segment #38	273	031102030501
Okapilco Creek Segment #39	273, 274-2	031102030501, 031102030502
Okapilco Creek Segment #40	273, 274-1, 274-2, 275, 276, 277, 277-1, 277-2, 278, 279-1, 279-2	031102030501, 031102030502(a), 031102030502(b), 031102030503, 031102030504, 031102030601, 031102030601(a), 031102030601(b), 031102030602, 031102030603(a), 031102030603(b)
Reedy Creek Segment #41	235, 236	031102020601, 031102020602
Sand Creek Segment #42	225	031102020303
Town Creek Segment #43	302	031102040302
Tributary to Withlacoochee Segment #44	262-3	031102030104(c)
Ty Ty Creek Segment #45	296, 297, 298, 299	031102040201, 031102040202, 031102040203, 031102040204
Warrior Creek Segment #46	301, 302, 303, 304, 305-1, 305-2, 306	031102040301, 031102040302, 031102040303, 031102040304, 031102040305(a), 031102040305(b), 031102040306

Willacoochee River Segment #47	231, 232, 233	031102020501, 031102020502, 031102020503
Willacoochee River Segment #48	231, 232, 233, 234, 235, 236, 236-1, 237	031102020501, 031102020502, 031102020503, 031102020504, 031102020601, 031102020602, 031102020602(a), 031102020603
Morrison Creek Segment #49	314	031102040502

Note: Contributing Subwatersheds (GA 12-digit) and Corresponding Watershed Model Ids are listed in the same order for each segment. Model Ids are presented for the purpose of visually displaying the subwatersheds in Figure 5-1.

Meteorological Data

Nonpoint source loadings and hydrologic conditions are dependent on weather conditions. Weather parameters required to simulate various components of hydrology and water quality include precipitation, air temperature, dew point, wind speed, solar radiation, and percent cloud cover. Hourly data from weather stations within the boundaries of or in close proximity to the subwatersheds being modeled, were applied to the watershed model.

Weather stations used to represent the Suwannee River Basin include Doles (GA2728), Pearson (GA6879), Abbeville 4 S (GA0010), Fargo (GA3312), and Valdosta 4 NW (GA8974). Appendix A presents the locations of the weather stations with respect to the modeled subwatersheds.

Examination of the precipitation at these stations shows that the wettest months are typically January, February, March, and July. The driest month is typically October. Monthly and annual patterns are similar for all stations. Appendix A presents rainfall characteristics, including monthly mean and annual total precipitation for each station.

Simulation Period

Selection of an appropriate simulation period is important in nonpoint source modeling due to the variability of hydrologic and source loading conditions over time. The year 1998 was selected as the simulation period. This time period was selected due to its coverage of a wide range of hydrologic conditions, including heavy rainfall and drought conditions. Additionally, this period contained the most extensive monitoring data, which is necessary for model calibration.

The HSPF model was run for 10 years to examine the watershed water quality loading over an extended period of time. The 1998 watershed load was also compared directly to the 1997 loading year to see if there were any anomalies in the loading rates. For some cases, particularly for subwatershed 031200020101 (model ID 322), the 1997 load was double the 1998 load. In this case, the in-stream model was run during 1997 through 1998 to account for any build-up in the sediment oxygen demand from the higher 1997 loads.

Land Use Representation

The watershed model uses land use data as the basis for representing hydrology and nonpoint source loading. Land use categories for modeling were selected based on the USGS Multi-Resolution Land Classification (MRLC) data set, and included built-up, forest, cropland, pasture, and wetlands. The USGS data represents conditions in the early to middle 1990's. The modeling categories and their corresponding USGS classifications are presented in Table 5-2. The land use representation for the Georgia 12-digit watersheds used in modeling are presented in Appendix A.

Table 5-2. Land Use Representation

Land Categories Represented in the Model	MRLC Land Use Code	MRLC Land Use Classes	% Impervious
Built-up	21	Low Intensity Residential	19
	22	High Intensity Residential	65
	23	High Intensity Comm./Ind./Trans.	80
	33	Transitional	10
Forest	31	Bare Rock/Sand/Clay	0
	32	Quarries/Strip Mines/Gravel Pits	0
	41	Deciduous Forest	0
	42	Evergreen Forest	0
	43	Mixed Forest	0
	51	Deciduous Shrubland	0
	52	Evergreen Shrubland	0
	53	Mixed Shrubland	0
	71	Grassland/Herbaceous	0
	85	Other Grasses	0
Wetland	91	Woody Wetlands	0
	92	Emergent Herbaceous Wetlands	0
Cropland	61	Planted/Cultivated	0
	82	Row Crops	0
	83	Small Grains	0
	84	Bare Soil	0
Pasture	81	Pasture/Hay	0

The HSPF model requires division of land uses in each subwatershed into separate pervious and impervious land units. For each land use, this division can be made based on typical imperviousness percentages from individual land use categories, such as those used in the Soil Conservation Service's TR-55 method. For modeling purposes, the percent imperviousness of a give land category can be calculated as an area-weighted average of land use classes encompassing the modeling land category.

Hydrologic Representation

Watershed hydrology plays an important role in the determination of nonpoint source flow and ultimately nonpoint source loadings to a waterbody. The watershed model must appropriately represent the spatial and temporal variability of hydrologic characteristics within a watershed. Key hydrologic characteristics include interception storage capacities, infiltration properties, evaporation and transpiration rates, and watershed slope and roughness. The HSPF modules used to represent watershed hydrology for TMDL development include PWATER (water budget simulation for pervious land units) and IWATER (water budget simulation for impervious land units). A detailed description of relevant hydrologic algorithms is presented in the HSPF User's Manual.

Water Quality Representation

A total of four water quality parameters were simulated using the watershed model: biochemical oxygen demand (BOD,) total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). These parameters (either directly or indirectly) constitute the primary nonpoint sources contributing to dissolved oxygen depletion and/or replenishment. The buildup and washoff of these pollutants were represented using the PQUAL (simulation of quality constituents for pervious land segments) and IQUAL (simulation of quality constituents for impervious land segments) modules in HSPF. Different buildup and washoff rates were used to represent the different land categories (e.g. fertilizer and manure application generally result in a higher nutrient buildup and washoff from cropland than from urban lands). Upon application to the receiving water model, many of parameters simulated in the watershed model were converted into more applicable constituents for in-stream modeling.

Leaf Litterfall Representation

Loadings of leaf litterfall were assumed to be consistent with a study performed on the Ogeechee River in southern Georgia (Meyer et al. 1997). The direct leaf litterfall was reported as 843 $g/m^2/yr$ and lateral leaf litterfall was reported as 3,520 $g/m^2/yr$. The surface area of the stream channel was used to derive loading rates into the model. The lateral leaf litterfall was flow dependent to simulate the loading increase when the flows are large enough to inundate the floodplains. During the higher flows, the organic material deposited in the floodplain is picked up and transported into the stream.

The leaf litterfall loading was only applied to the receiving water model grid segments (during simulation of each impaired river segment). Loadings from the HSPF model (particularly BOD, which was ultimately converted to TOC) were assumed to account for residual leaf litterfall from upstream segments (transported to the impaired segment). The majority of leaf litter was assumed to be deposited on the stream bottom within each segment, thus forming an organic-enriched bed.

Point Source Representation

After identifying all point source facility locations in the subwatersheds contributing to the impaired waterbodies, appropriate facilities were represented in the linked models. Depending on location, point sources were either represented in the watershed model or the receiving water model. Facilities discharging within a Georgia 12-digit subwatershed containing an impaired waterbody were represented as direct inputs into the receiving water model. Facilities discharging within a subwatershed representing an unimpaired waterbody were represented in the watershed model.

In the later case, the facilities discharge into waterbodies that eventually feed into an impaired waterbody, and thus must be considered in the source representation. Due to their indirect impact on the impaired waterbody, however, their contributions are subject to fate and transport in the watershed model through a stream system leading to the impaired waterbody.

Point source facilities were represented in both the watershed and receiving water models using a constant flow and pollutant loading. DMR data (flow and pollutant concentrations or loads) were represented in the models to simulate existing conditions – for calibration. Permitted flows and loads were used to represent initial conditions for TMDL development. The monthly average permitted conditions were loaded into the in-stream model for the allocation runs. For example, where BOD5 is permitted at a maximum of 45 mg/L and an average of 30 mg/L, the average of 30 mg/L would be multiplied by the average daily, permitted flow to produce a daily mass loading (lbs/day). The monthly average permitted values, versus the monthly maximum, are more representative in determining assimilative capacity in the system. In special circumstances, such as a major point source discharge, a step-function would be implemented so that the waterbody would receive a maximum daily load during the month, but still maintain the permitted monthly average. Water quality constituents represented include BOD, TN, TSS, and TP. BOD and TSS values were represented using DMR and permitted values. TN values were based on monitored NH3 values for the facilities. TP values were assumed to be 5 mg/L for municipal facilities (due to the absence of DMR data and permitted values). Refer to Table 4-1 for point source flows and loads used in the modeling process.

In-stream Representation

The receiving water model, EFDC, was used to simulate all in-stream dissolved oxygen processes for the impaired waterbodies. Impaired waterbodies received flow and water quality output from the corresponding HSPF model (which represented watershed contributions). Unimpaired waterbodies located in stream networks contributing to impaired waterbodies were not represented explicitly using EFDC, but instead were represented using HSPF in-stream algorithms. Key components of the in-stream representation include:

- Hydrodynamic representation
- Water quality configuration
- Unimpaired waterbody representation

Hydrodynamic Representation

Independent grid systems were developed to represent impaired waterbodies using EFDC, except in the case where multiple impaired waterbodies were connected. In these situations extended grids representing the entire impaired system were developed. The longitudinal extent of each waterbody impairment, as defined in the Georgia 303(d) list, was used to determine the grid coverage. In general, the grid for each impairment was extended to the waterbody's intersection with the nearest up- and down-stream Georgia 12-digit subwatershed boundary. This standardized the grid development processes, as well as the watershed model-receiving water model linkage. Under this configuration, the entire extent of each impairment was fully represented.

The extent of impairments in the Suwannee River Basin ranged from 2 miles to over 30 miles (when considering connected impairments). Due to the variability in impairment length, each grid was configured using a different number of cells and different cell dimensions. Each cell was rectangular and represented a single vertical water layer (one dimension). Cells were typically on the order of 1 km (0.62 mi) to 3.22 km (2 mi) in length. Lateral dimensions were derived from USGS cross-sectional data obtained from USGS monitoring stations located on each of the impaired segments.

Tributary inflows, point sources, and nonpoint source contributions were applied directly to applicable cells in the grid. For impaired headwaters, the total flow from the contributing 12-digit subwatershed was divided into two portions. The first portion (typically 20% of the flow) was applied directly into the most upstream cell, while the remaining portion (typically 80%) was divided equally among the remaining cells to represent nonpoint source inflows.

For downstream impairments, upstream inflows (represented in the watershed model) were applied directly to the most upstream cell in the grid. Flow from the 12-digit subwatershed(s) in immediate vicinity of the impaired waterbody (also represented in the watershed model) were distributed evenly among the cells. Flow from incoming tributaries (represented as stream networks in the watershed model) and point sources were applied directly to the most appropriate cell in the configuration. Figure 5-2 presents an example of the in-stream configuration for an impaired headwater and its linkage to the watershed model.

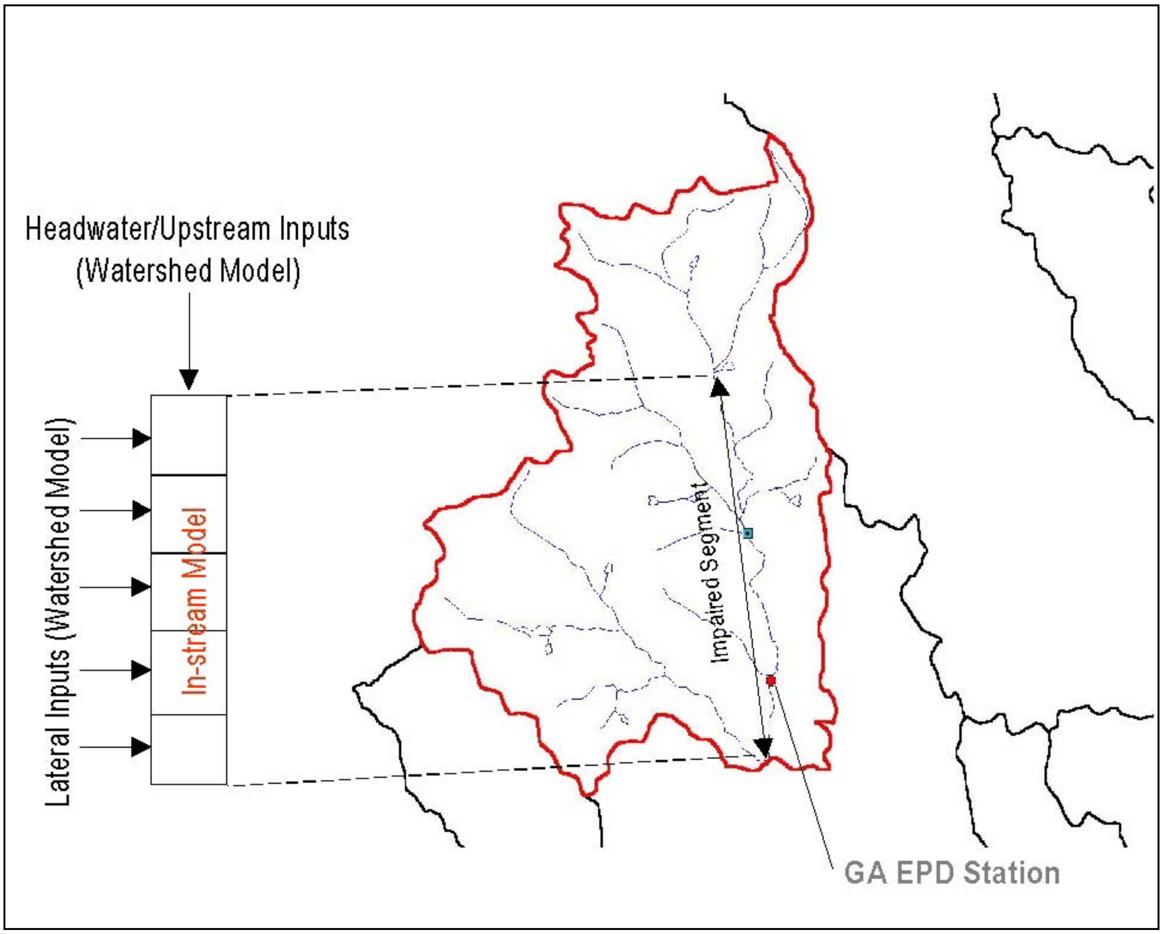

Figure 5-2. Diagram of In-stream Model Configuration

The hydrodynamic portion of the EFDC model is designed to solve three-dimensional, vertically hydrostatic, free surface, turbulent averaged equations of motion for a variable-density fluid. The model uses stretched or sigma vertical coordinates and Cartesian or curvilinear, orthogonal horizontal coordinates. Dynamically-coupled transport equations for turbulent kinetic energy, turbulent length scale, salinity and temperature are also solved. The two turbulence parameter transport equations implement the Mellor-Yamada level 2.5 turbulence closure scheme (Mellor & Yamada, 1982) as modified by Galperin et al (1988). The EFDC model also simultaneously solves an arbitrary number of Eulerian transport-transformation equations for dissolved and suspended materials. The EFDC model allows for drying and wetting in shallow areas by a mass conservation scheme. A number of alternatives are in place in the model to simulate general discharge control structures such as weirs, spillways and culverts. The theoretical and computational basis for the model is documented in Hamrick (1992a).

Water Quality Configuration

Simulation of dissolved oxygen in the receiving water model considered a large suite of model state variables and kinetic processes. The EFDC model simulates the interactions between up to 21 state variables including dissolved oxygen, suspended algae (3 groups), various components of carbon, nitrogen, phosphorus and silica cycles, and fecal coliform bacteria. The kinetic processes included in this model use the Chesapeake Bay three-dimensional water quality model, CE-QUAL.ICM (Cevco & Cole, 1994). Figure 5-3 is a schematic diagram of the EFDC water column water quality model.

The primary sources and sinks of oxygen represented in the EFDC model are:
- algal photosynthesis and respiration
- nitrification
- heterotrophic respiration of dissolved organic carbon
- oxidation of chemical oxygen demand
- surface reaeration
- sediment oxygen demand
- external loads

Refer to *A Three-Dimensional Hydrodynamic-Eutrophication Model (HEM-3D): Description of Water Quality and Sediment Process Submodels (EFDC Water Quality Model)* for a full description of relevant equations and formulations.

In order to represent all sources and sinks of dissolved oxygen, the water quality model required temperature representation and inputs of water quality parameters from the watershed model and point source discharges. For calibration purposes, in-situ temperature data measured concurrently with dissolved oxygen was input into the model. For the allocation model runs, a representative, seasonal distribution of temperature was created for the entire southern four basins. The data used to create the seasonal pattern in the model was collected by the USGS at the 5 monitoring sites in Georgia. The monitoring site that was the closest to the southern four basins in Georgia was at USGS02213700 on the Ocmulgee River near Warner Robbins, Georgia. A sinsusoidal function was fit to the daily maximum and minimum from the Ocmulgee River station to create the representative temperature for the allocation runs.

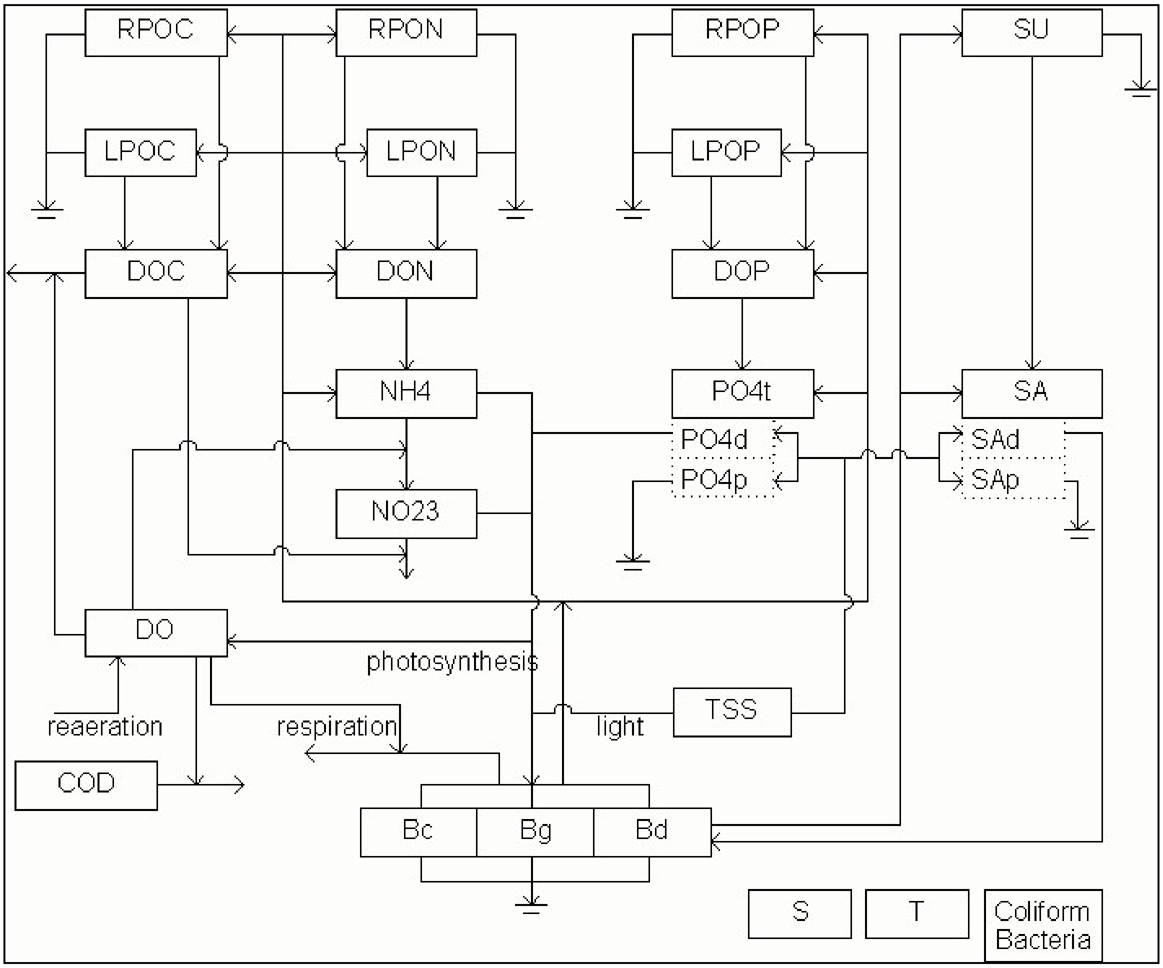

Figure 5-3. EFDC water column water quality model schematics diagram

Water quality parameters were input to cells in the grid using the same procedure as for flow. All upstream inputs, tributary inputs, point sources, and nonpoint source contributions in immediate vicinity of the impaired waterbody were accounted for. Specific parameters transferred from the watershed model (and point sources) to the receiving water model included TSS, BOD, TN, and TP.

BOD5 to Total Organic Carbon

The HSPF subwatershed model runs were calibrated primarily to 5-day biochemical oxygen demand (BOD5) and total suspended solids (TSS). Due to the inherent solutions of the water quality models, it was necessary to convert the BOD5 from the point and nonpoint sources to TOC. The watershed loads simulated by HSPF are with respect to BOD5, TN, TP, and TSS. EFDC is a carbon-based water quality model, and therefore, the model simulates organic matter as carbon rather than BOD. Therefore, to put the watershed loads into the in-stream model, BOD5 had to be converted to TOC. By breaking the ratio down into a BODU/BOD5 and TOC/BODU components, the multiplier was justified by a typical in-stream f-ratio (ratio of ultimate BOD to a 5-day BOD) of 4.0 and literature value for converting ultimate BOD to TOC of 2.7 (Thomann and Mueller, 1987). Therefore, an 11.0 (sensitivity ranged from 10.8 to 11.2) multiplier was initially used to convert BOD5 to TOC.

Two cases were initially setup for the in-stream water quality calibrations. A human-impacted subwatershed and a natural subwatershed were selected to be the range of conditions found in the 4 basins, excluding the effect of point sources. The human-impacted subwatershed selected was the headwater of the Ochlockonee River (SWSID 322). This watershed had almost 70% agricultural land uses, a small urban component, no point sources, and exhibited low flow due its headwater location in the watershed. The natural subwatershed was on the Suwannoochee River (SWSID 203) in the Suwannee River Basin. This subwatershed had over 90% forested and wetland areas and no point sources. The EFDC model was setup for both segments and an attempt was made to create one common input file containing load multipliers, kinetic rates, and coefficients that could be used for all subwatershed types that were within the range that was established for SWSIDs 322 and 203. It became apparent that the two subwatersheds exhibited completely different characteristics of organic loading into the system. From examining measured data for BOD5 and TOC, it became obvious the differences between a carbon load in a watershed with primarily agricultural contributions versus one with primarily forest or wetland contributions. The TOC measured data were an in-stream value that would include all of the contributions of oxygen consuming material, point and nonpoint sources. From examination of the data by predominant landuse, a landuse-based multiplier was derived for each landuse type. The multipliers are listed in Table 5-3.

Table 5-3. Landuse-based Multipliers to Convert BOD5 to TOC.

Landuse	TOC/BOD5
Forest/Wetland	20
Agriculture	7.5
Urban	2.3

Unimpaired Waterbody Representation

Unimpaired waterbodies contributing to impaired segments were represented as a component of the watershed model. The RCHRES and GQUAL HSPF modules were used to simulate in-stream flow and general water quality. Flow determination using HSPF required development of rating curves for each stream modeled. Rating curves were developed for streams using cross-sectional dimensions estimated from regional watershed area-bankfull channel dimension curves (Rosgen, 1996). No explicit water quality interactions were represented using the GQUAL module. General first-order decay was used to represent all processes typically influencing the fate of water quality parameters, e.g. transformation, settling, etc.

Model Testing

After developing the watershed and receiving water models to represent source contributions and in-stream response, the models were tested for validity. This testing is typically referred to as model calibration, and it involves the comparison of simulated results to observed data and the subsequent adjustment of model parameter values. Calibration of the linked models was performed for the year 1998, due to the availability of monitoring data. Hydrology and water quality were first calibrated for the watershed model. Once the preliminary calibration results from the watershed model were applied to the receiving water model, calibration of the receiving water model ensued. Calibration of the receiving water model additionally required further calibration of the watershed model, and thus an iterative approach to calibration was taken.

Watershed Model Hydrology Calibration

Hydrologic calibration involved an adjustment of parameters related to all components of the hydrologic cycle including overland flow, infiltration, groundwater flow, and evapotranspiration. Adjustments were made during a comparison of in-stream flow monitoring data to modeled in-stream flow at a representative location for the region. The location selected was Little Satilla River near Offerman, GA (USGS02227500). The entire drainage area contributing to flow at this station was modeled and results were compared to the monitoring data. After making appropriate adjustments, the model results showed a good correlation with the observed values. The resulting hydrology parameters were validated at two additional stations in the region; Withlacoochee River at McMillan Road near Bemiss, Georgia and Okapilco Creek at Route 33 near Quitman, Georgia. A summary of calibration and validation results for these locations are presented in Appendix B. Once hydrologic parameters were calibrated and validated, the values were applied to the remaining subwatersheds in the basin.

Watershed Model Water Quality Calibration

Once hydrology was calibrated and validated for the watershed model, calibration of water quality parameters was necessary. Water quality calibration consisted of adjusting TSS, BOD, TN, and TP buildup and washoff parameters within a reasonable range to achieve a good match between model output and in-stream water quality observations. Key considerations in the water quality calibration for the watershed model were baseflow concentrations, background concentrations, seasonal variations, and stormflow concentrations.

Initial buildup and washoff parameters were based on past studies in the southeast, including the *Nonpoint Source Pollutant Loading Evaluation - ACT and ACF Water Allocation Formula - Environmental Impact Statements* and *Water-Quality Improvements in the Lower Mississippi River Valley – Analysis of Nutrient Loadings in the Yazoo River Basin*. Each landuse category was represented by a different buildup and washoff rate, in order to simulate the variability between load contributions from different sources. The parameters were adjusted through a comparison of model output to typical loading rates from various landuses and monitoring data at the 18 water quality monitoring stations. As with the hydrology parameters, water quality parameter values were additionally applied to the remaining subwatersheds in the basin.

Receiving Water Model Calibration

Calibration of the receiving water model focused on adjustment of kinetic parameters during a comparison of model output and monitoring data for 1998. Preliminary calibration was performed at station USGS02314600 – Suwannoochee Creek (US 84) at Dupont, GA, and the resulting parameter values were applied to the remaining impaired waterbodies. In some situations the preliminary calibrated parameters required further change. Calibration results for dissolved oxygen at station USGS02314600 are presented in Appendix C. The remaining modeled waterbodies exhibited similar results.

Kinetic parameters that required adjustment included reaeration formula, ratios for nutrient splits, leaf litterfall nutrient split, and density of periphyton. For the in-stream, EFDC model runs, the primary water quality parameters for evaluating a calibrated model were dissolved oxygen and TOC. Secondary parameters include ammonia, nitrate-nitrite, total nitrogen, and total phosphorus. SOD and COD benthic flux were also examined to see how much oxygen demand was derived by the sediment. In addition to the water quality calibration, flow, velocity, and depth were examined to ensure proper calibration of the hydrodynamics.

6.0 Loading Capacity

The tested model was ultimately used to identify the allowable loading capacity for the listed segments. The first step in the process was to determine naturally occurring dissolved oxygen concentrations for the impaired waterbodies. By doing so, the applicable water quality standard used for TMDL development was identified.

To determine the naturally occurring dissolved oxygen concentrations, the in-stream models were run using watershed model input representing pristine conditions (entirely forest and wetland contributions) and leaf litterfall. The resultant in-stream dissolved oxygen concentrations represented natural conditions. The range of values was representative of naturally low dissolved oxygen concentrations and was below 110% of the state water quality standard, therefore the EPA criteria was instituted and dissolved oxygen target limits were identified for TMDL development. The target limits were identified as 90% of the minimum naturally occurring concentration for impaired waterbodies.

After identifying the dissolved oxygen target limits, the models were run to determine the loading capacity of the waterbody. This was done through a series of simulations aimed at meeting the dissolved oxygen target limit by varying source contributions. The final acceptable scenario represented the TMDL (and loading capacity of the waterbody). Subsequent sections of this report present components of the TMDL.

Confirmation of Waterbodies Reaching Dry Conditions

An analysis of USGS daily discharge data at selected gaging stations located throughout the southern four Georgia basins suggests that many streams in the region actually exhibit no-flow conditions for extended periods of time. Several of the impaired waterbodies dry for significant periods of time throughout the year. Analysis of water quality is virtually impossible during no-flow conditions and situations where streams contain no flow or pooled non flowing water. Seven stations were selected for the analysis. Each station is located on a unique waterbody representing a drainage area between 139 and 1,260 mi^2 (Table 6-1).

Table 6-1. USGS Gaging Stations and Characteristics

USGS Gaging Station ID	Drainage Area (mi^2)	Waterbody	Basin	Period of Record
02227000	139	Hurricane Creek	Satilla	10/1/51 - 10/8/71
02227500	646	Little Satilla River	Satilla	1/27/51 - 9/30/98
02314500	1,260	Suwannee River	Suwannee	4/20/37 - 9/30/98
02316000	663	Alapaha River	Suwannee	4/26/37 - 9/30/76
02317755	537	Withlacoochee River	Suwannee	10/20/76 - 1/4/90
02318000	577	Little River	Suwannee	6/12/40 - 9/30/71
02318700	269	Okapilco Creek	Suwannee	12/21/79 - 9/30/98

The three stations representing the smallest drainage areas (02227000, 02317755, and 02318700) had no-flow days more than 9% of the time. The remaining stations, representing larger watersheds, exhibited no-flow conditions less than 1% of the time. Although the timing of no-flow conditions varied from one waterbody to the next, the most common months exhibiting no-flow conditions were October, November, and June. Precipitation data for the basin supports these trends in that October and November are typically the driest months, and June often exhibits lower rainfall totals (compared to other months). Refer to Appendix A for detailed information regarding precipitation at appropriate weather stations in the basin. Table 6-2 presents information, by station, related to no-flow time periods.

Table 6-2. No-Flow Characteristics for Selected USGS Gaging Stations

USGS Gaging Station ID	Days with No Flow	Total Days	% of Days with No Flow	Month with Most No-Flow Days
02227000	745	7306	10.20	June
02227500	50	17414	0.29	October
02314500	74	22,444	0.33	November
02316000	106	14403	0.74	October
02317755	142	1233	11.52	November
02318000	17	11433	0.15	June
02318700	683	6859	9.96	October

Under no-flow conditions, the development or determination of an appropriate naturally occurring dissolved oxygen water quality standard is not possible or appropriate. Therefore, when using the models to identify minimum dissolved oxygen concentrations under natural conditions, no-flow periods were not considered. The minimum dissolved oxygen concentrations and related loadings were identified only during periods when there was flow in the stream.

7.0 Waste Load and Load Allocations

Two critical components of the TMDL are the Waste Load Allocations (WLAs) and the Load Allocations (LAs). The WLAs represent the load allocations to point source facilities contributing to impaired waterbodies, while the LAs represent load allocations to the nonpoint source contributions. LAs are assumed to represent all watershed and leaf litterfall loads to the impaired waterbody. The LAs are divided into subwatersheds (representing all subwatersheds contributing to an impaired waterbody).

The WLAs and LAs presented in Appendix D represent successful allocation scenarios (in which the dissolved oxygen target limit is met). WLAs and LAs sum to represent the entire TMDL, because MOS is implicitly considered through model assumptions.

The partitioning of allocations between point (WLA) and nonpoint (LA) sources was based on modeling results and professional judgment to meet the TMDL. The WLAs may be modified by GAEPD during the NPDES permitting process. The TMDLs will be used to assess the permit renewals in the impaired segments.

The WLA and LAs presented in Appendix D represent allocation scenarios in which the dissolved oxygen standard is met. The analysis on one segment of Turkey Branch indicates that NPDES permit limits for the existing discharge are not stringent enough to ensure compliance with the dissolved oxygen standard. As the draft TMDL for dissolved oxygen for the segment of the Turkey Branch did not provide a WLA for the point source, a separate TMDL for the Turkey Branch segment will be developed and public noticed. All other point sources in the Suwannee River Basin are addressed in Appendix D.

8.0 Margin of Safety

The margin of safety (MOS) is part of the TMDL development process. There are two basic methods for incorporating the MOS (USEPA, 1991):

- Implicitly incorporate the MOS using conservative model assumptions to develop allocations, and
- Explicitly specify a portion of the total TMDL as the MOS; use the remainder for allocations.

The MOS was considered implicitly in the TMDL development process. Conservative modeling assumptions include:

- Running dynamic model,
- Permitted point sources are loaded into model for allocation runs (average monthly permit values), taking into account the daily maximum loads,
- Running model with actual flow and temperature during one or more annual cycles including a critical summer period, and
- 41% saturation for upstream dissolved oxygen (Meyer, 1992).

9.0 Seasonal Variation

The Statute and regulations require that a TMDL be established with consideration of seasonal variations. Seasonal variation was considered through dynamic representation of a full calendar year. The model simulations included a wide range of hydrologic and pollutant loading scenarios and led to development of a TMDL corresponding to these scenarios.

10.0 Monitoring Plan

The GAEPD has adopted a basin approach to water quality management; an approach that divides Georgia's major river basins into five groups. Each year the GAEPD water quality monitoring resources are concentrated in one of the basin groups. One goal is to continue to monitor 303(d) listed waters. This monitoring will occur in the next monitoring cycle for the Suwannee in 2003 and will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed.

11.0 Point and Nonpoint Source Approaches

Permitted discharges will be regulated through the NPDES permitting process described in this report. The total organic carbon nonpoint source loading to the streams in the Suwannee River is made up of a combination of naturally occuring leaf litter and anthropogenic non-point source loads. Because most, if not all, total organic carbon loading to streams in the Suwannee River Basin is the result of nonpoint sources, the implementation goal for nonpoint sources will be to reduce the total organic carbon loading from anthropogenic non-point source loads. The reduction in anthropogenic non-point source loading should lead to the attainment of water quality standards. To ensure that anthropogenic non-point source load reductions occur in the Suwannee River Basin, Georgia EPD will work with the Natural Resource Conservation Service (NRCS), the Georgia Soil and Water Conservation Commission (GSWCC), and the Georgia Forestry Commission to implement best management practices (BMPs) to reduce anthropogenic nonpoint source loading of total organic carbon. Implementation of BMPs to reduce anthropogenic non-point source loading of total organic carbon is expected to lead to the attainment of water quality standards.

12.0 Public Participation

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

13.0 References

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Appendix A

Data Used in TMDL Analyses

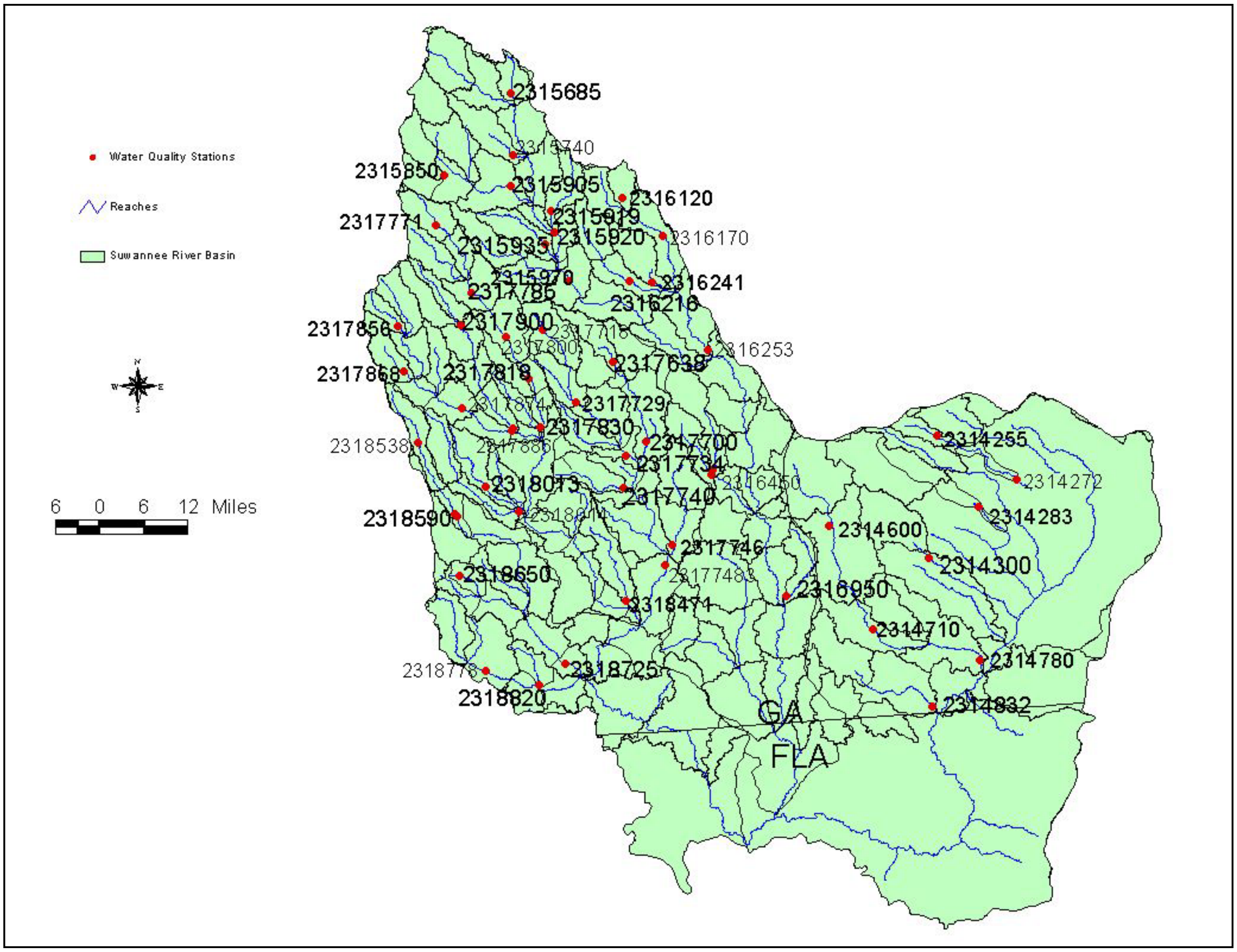


Figure A-1. Water Quality Stations in the Suwannee River Basin

Table A-1. Summary of Dissolved Oxygen Data from Monitoring Stations for 1998

USGS ID NO	Station Description	USGS 8-digit HUC	Dissolved Oxygen (mg/L)			No of Meas.
			min	max	mean	
02314255	SUWANNEE CREEK (US 84) NEAR MANOR, GA.	03110201	2.2	7.8	4.8	19
02314272	GREASY BRANCH (CR 473) NEAR WAYCROSS, GA.	03110201	0.2	6.5	3.4	19
02314283	CANE CREEK (CR 149) NEAR HOMERVILLE, GA.	03110201	0.8	7.7	5.1	19
02314300	TATUM CREEK (US HWY 441) NR HOMERVILLE, GEORGIA	03110201	0.9	9.1	4.0	20
02314500	SUWANNEE RIVER AT FARGO, GA.	03110201	3.2	8.4	6.2	20
02314600	SUWANNOOCHEE CREEK (US 84) AT DUPONT, GEORGIA	03110201	0.4	6.7	3.3	20
02314710	SUWANNOOCHEE CREEK (CR 47) NEAR FARGO, GA.	03110201	0.3	8.4	4.0	20
02314780	SUWANNOOCHEE CREEK (SR 94) NEAR FARGO, GEORGIA	03110201	1.5	9.0	4.3	20
02314832	TOMS CREEK (CR 36) NEAR NEEDMORE, GA.	03110201	0.6	9.1	4.3	20
02314500	SUWANNEE RIVER AT FARGO, GA.	03110201	0.3	12.9	5.1	20
02315685	MILL CREEK (SR 112) NEAR ROCHELLE, GA.	03110202	0.9	11.8	4.4	18
02315740	DOUBLE RUN CREEK (CR 250) NESR REBECCA, GA	03110201	1.0	9.6	5.6	20
02315850	WEST FORK DEEP CREEK (SR 159) NR AMBOY, GA.	03110202	1.4	10.0	5.7	18
02315905	DEEP CREEK (CR 250) NEAR REBECCA, GA.	03110202	2.8	9.2	6.1	20
02315919	BIG CREEK (CR 258) NR IRWINVILLE, GA.	03110202	3.2	10.9	6.7	18
02315920	ALAPAHA RIVER NEAR IRWINVILLE, GA	03110202	2.0	8.9	5.3	19
02315935	SAND CREEK (SR 125) NR IRWINVILLE, GA.	03110202	2.8	9.4	5.8	18
02315965	HAT CREEK (SR 125) NEAR IRWINVILLE, GA.	03110202	2.3	9.7	6.4	20

02315970	ALAPAHA RIVER (GA HWY 35) NEAR TIFTON, GEORGIA	03110202	3.1	9.3	5.8	20
02316000	ALAPAHA RIVER NEAR ALAPAHA, GA.	03110202	1.5	8.7	6.2	20
02316120	TURKEY BRANCH NR FITZGERALD,GA.	03110202	0.2	4	2.3	20
02316170	WILLACOOCHEE RIVER (SR 32) NEAR OCILLA, GA	03110202	2.4	8.8	5.8	20
02316216	REEDY CREEK (CR 57) NEAR OCILLA, GA.	03110202	0.2	10.5	6.1	19
02316241	LITTLE BRUSHY CREEK (CR 63) NEAR OCILLA, GA.	03110202	2.3	8.6	5.6	19
02316253	WILLACOOCHEE R (US HWY 82) NR WILLACOOCHEE, GA.	03110202	1.3	8.6	5.7	20
02316320	ALAPAHA RIVER (GA HWYS 168&64) NR NASHVILLE, GA.	03110202	4	9.4	6.6	19
02316450	TENMILE CREEK (SR 64) NEAR LAKELAND, GA.	03110202	0.3	9.4	3.1	20
02316490	FIVEMILE CREEK (SR 64) NEAR LAKELAND, GA.	03110202	0.8	9.1	3.5	20
02316750	ALAPAHA RIVER (US HWY 84) NEAR NAYLOR, GEORGIA	03110202	4.6	9.4	6.9	20
02316950	COW CREEK (SR 11) NEAR STOCKTON, GA.	03110202	2.8	9.9	5.7	20
02317500	ALAPAHA RIVER AT STATENVILLE, GA.	03110202	5.7	9.2	7.2	20
02317550	GRAND BAY CREEK (GA HWY 94) NR STATENVILLE, GA.	03110202	3.4	9.7	5.9	20
02317590	Mud Creek near Valdosta, Ga	03110202	4.7	12	6.9	21
02317608	ALAPAHOOCHEE RIVER (SR 135) NR STATENVILLE, GA.	03110202	5.8	18.1	8.1	20
02317638	HARDY MILL CREEK (CR 230) NEAR ENIGMA, GA.	03110203	3.3	8.6	5.8	20
02317700	WITHLACOOCHEE RIVER NEAR NASHVILLE, GA.	03110203	1.1	9.7	4.4	19
02317718	NEW RIVER AT U.S. 82 NR TIFTON,GA.	03110203	5.7	9.4	7.5	20
02317729	NEW RIVER (CR 252) NEAR LENOX, GA.	03110203	3.1	10.3	6.2	20
02317734	NEW RIVER AT STATE ROUTE 76 NEAR NASHVILLE, GA.	03110203	1.6	10.1	5.6	19
02317740	BEAR CREEK (CR 32) NEAR ADEL, GA.	03110203	1.5	9.5	5.9	19
02317746	CAT CREEK (CR 777) NEAR BARRETTS, GA.	03110203	0.9	10	4.7	20
23177483	WITHLACOOCHEE RIVER AT MCMILLAN RD NEAR BEMISS, GA	03110203	2	9.5	6.3	19
02317757	WITHLACOOCHEE RIVER NEAR VALDOSTA, GA.	03110203	4	10.2	6.2	21
02317771	LITTLE RIVER AT ST RT 112 NEAR ASHBURN, GA.	03110204	0.4	9.5	5.7	19
02317785	LITTLE RIVER NEAR CHULA, GEORGIA	03110204	0.8	9.5	5.7	19
02317800	LITTLE RIVER AT U.S. 82 NR TIFTON,GA.	03110204	1	9.4	5.8	19
02317818	LITTLE RIVER (CR 424) NEAR OMEGA, GA.	03110204	3.2	10.1	6.2	20
02317830	LITTLE RIVER NEAR LENOX, GA.	03110204	2.2	9.8	5.4	20
02317856	TOWN CREEK (CR 169) NEAR SYLVESTER, GA.	03110204	1.2	8.8	5.5	20
02317868	HORSE CREEK (CR 178) NEAR GORDY, GA.	03110204	2.1	9.4	6.4	19
02317874	WARRIOR CREEK (SR 256) NEAR NORMAN PARK, GA.	03110204	0.3	9.8	6.0	19
02317886	WARRIOR CREEK (CR 486) NEAR ELLENTON, GA.	03110204	0.8	9.8	5.5	20
02317900	TY TY CREEK AT TY TY, GA.	03110204	3.1	9	6.2	18
02317920	TY TY CREEK (CR 486) NEAR ELLENTON, GA.	03110204	0.5	7	2.9	20
02318013	BEAR CREEK (CR 170) NEAR MOULTRIE, GA.	03110203	0.9	9.7	4.5	20
02318014	INDIAN CREEK NEAR BERLIN, GA.	03110204	2.3	9.9	5.3	20
02318355	MORRISON CREEK (CR 243) NEAR ADEL, GA.	03110204	1.3	9.2	6.2	20
02318390	LITTLE RIVER (S1780) NEAR HAHIRA, GEORGIA	03110204	4.1	10.8	6.6	20
02318471	FRANKS CREEK (CR 775) NEAR VALDOSTA, GA.	03110204	2.4	11.5	6.0	21
02318500	WITHLACOOCHEE RIVER AT US 84 NEAR QUITMAN, GA	03110203	5.6	9.5	7.6	20
02318538	OKAPILCO CREEK (CR 182) NEAR MOULTRIE, GA.	03110203	2	9.8	6.4	19
02318590	OKAPILCO CREEK BELOW MOULTRIE, GA.	03110203	No Data			
02318591	OKAPILCO CREEK (CR 121) NEAR MOULTRIE, GA.	03110203	1.1	10.2	6.0	20
02318650	MULE CREEK (CR 274) NEAR BARWICK, GA.	03110203	0.3	8.7	3.2	19
02318725	OKAPILCO CREEK AT US RT 84 AT QUITMAN, GA.	03110203	2.4	9.8	5.7	20
02318778	PISCOLA CREEK (SR 38) NEAR DIXIE, GA.	03110203	0.6	8.6	3.1	20
02318820	NEGRO BRANCH (CR 125) NEAR QUITMAN, GA.	03110203	0.7	10.6	5.9	20
02318870	PISCOLA CREEK (SR 33) BELOW QUITMAN, GA	03110203	0.7	10.7	4.9	20
02318960	WITHLACOOCHEE R AT SR 31 NR CLYATTSVILLE, GA.	03110203	3.8	9.1	5.6	25

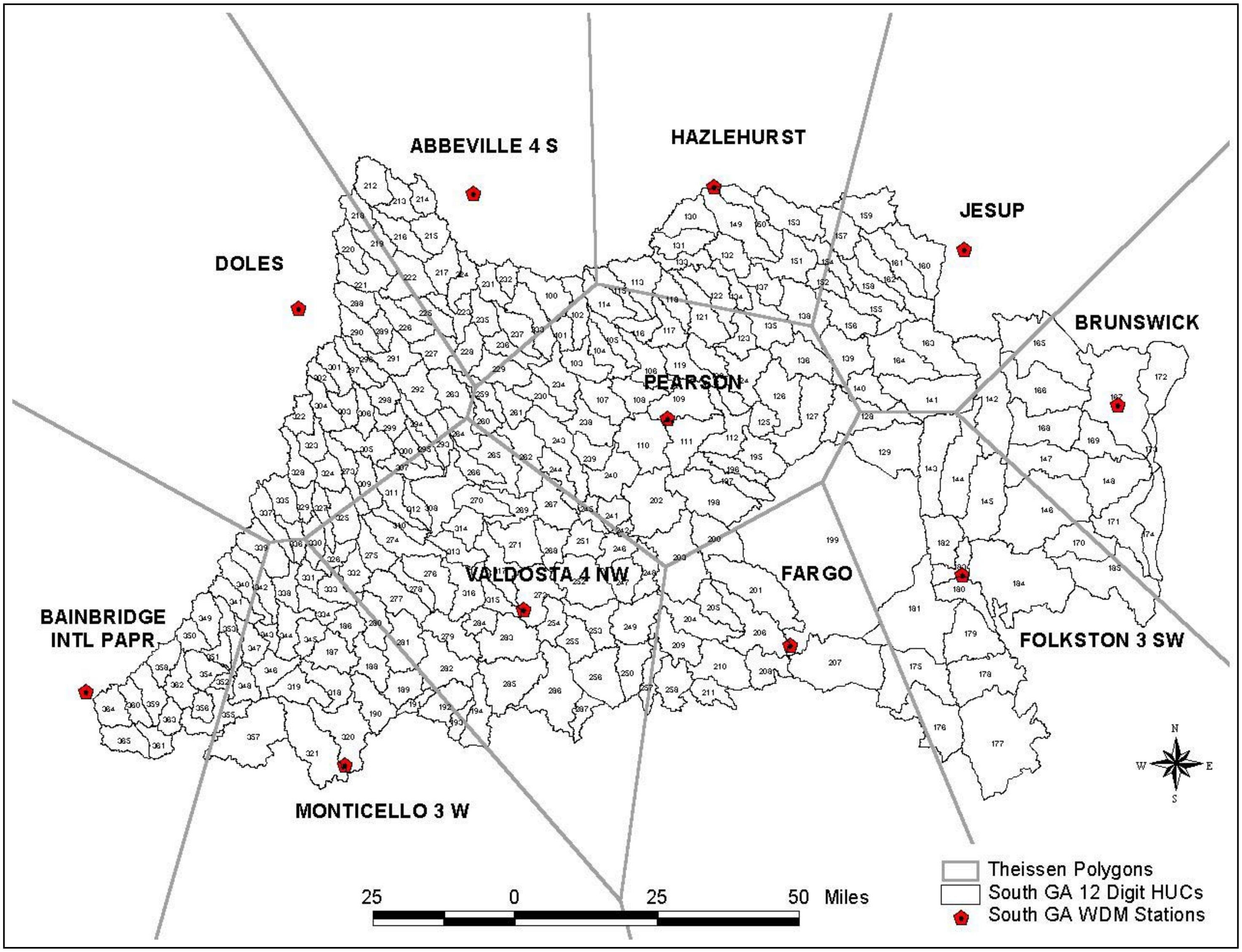


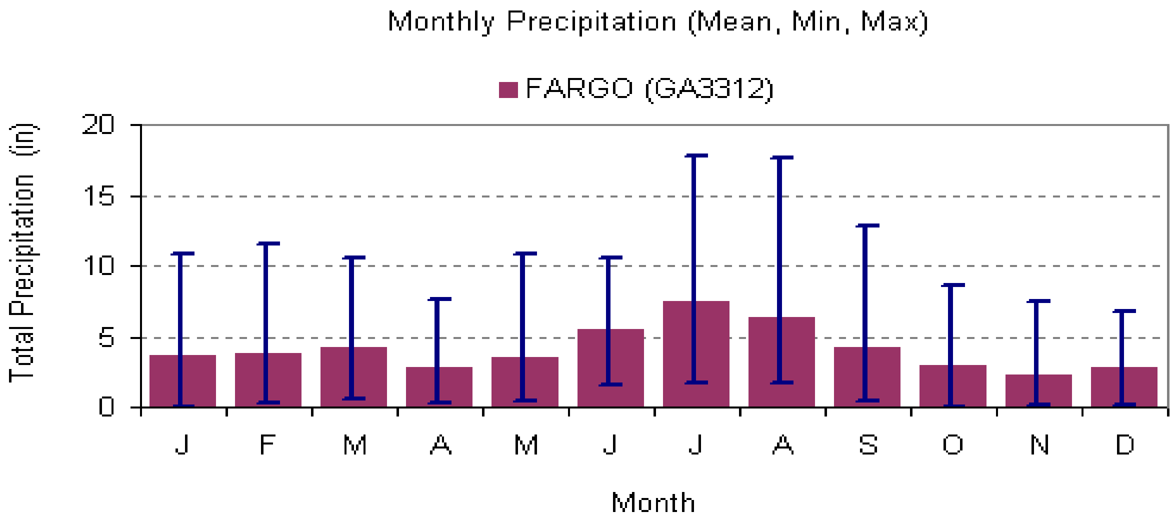
Figure A-2. Meteorological Stations for Southern 4 Basins Used in Watershed Model

TOTAL MONTLY PRECIPITATION (IN)

Station: FARGO (GA3312)

Analysis Period: 50 years (from June, 1948 to May, 1998)

Month	Count	Mean	Min	Max	St Dev	Median	25th	75th
January	50	3.68	0.03	10.89	2.46	3.30	1.73	5.15
February	50	3.77	0.30	11.54	2.31	3.46	2.00	5.08
March	50	4.29	0.59	10.59	2.69	4.06	2.35	5.92
April	50	2.87	0.34	7.60	2.03	2.37	1.20	4.17
May	50	3.45	0.40	10.80	2.31	3.01	1.55	4.63
June	50	5.51	1.60	10.63	2.16	5.46	4.06	6.40
July	50	7.52	1.70	17.80	3.48	6.36	4.92	9.37
August	50	6.39	1.70	17.62	3.17	6.20	3.86	8.02
September	50	4.19	0.47	12.76	2.87	3.52	2.01	5.68
October	50	2.89	0.00	8.60	2.40	1.98	1.22	5.02
November	50	2.31	0.11	7.50	1.67	1.75	0.98	3.22
December	50	2.89	0.09	6.75	1.68	2.79	1.43	3.78



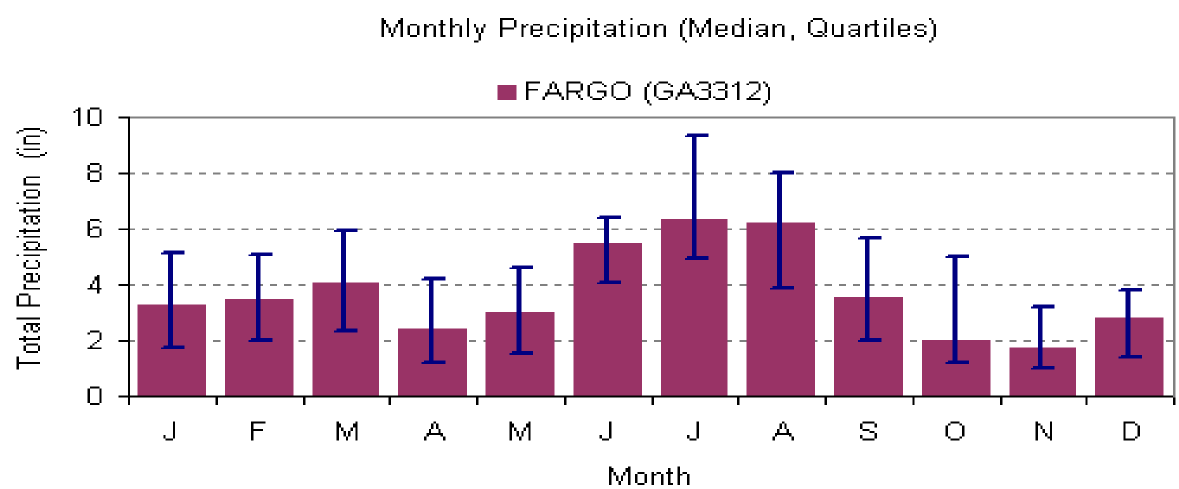


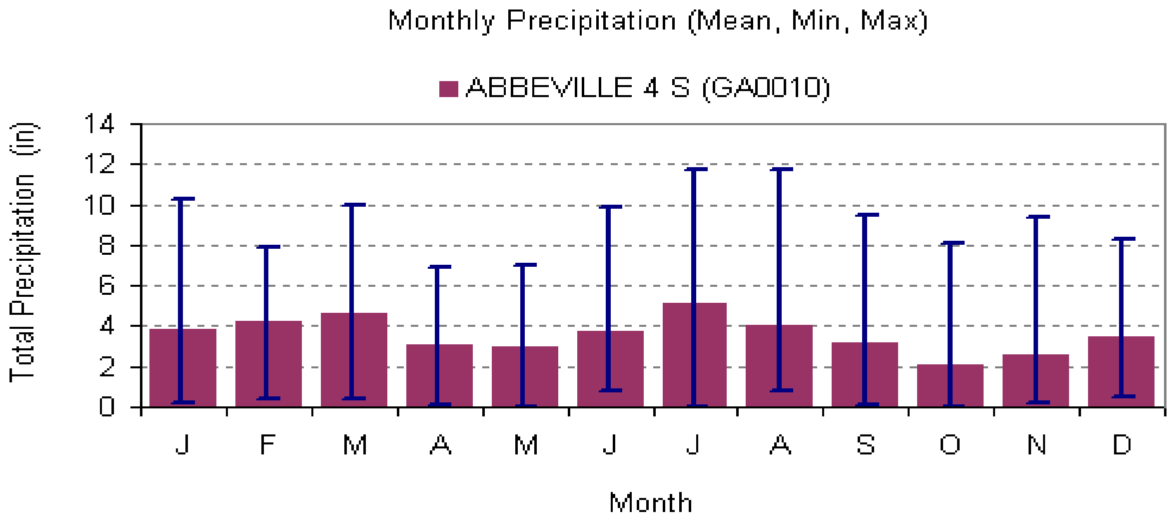
Figure A-3. Average Monthly Mean Precipitation for Fargo (GA3312)

TOTAL MONTLY PRECIPITATION (IN)

Station: ABBEVILLE 4 S (GA0010)

Analysis Period: 50 years (from June, 1948 to June, 1998)

Month	Count	Mean	Min	Max	St Dev	Median	25th	75th
January	50	3.85	0.20	10.30	2.46	3.44	1.91	5.28
February	50	4.20	0.40	7.84	2.06	4.05	2.76	5.90
March	50	4.59	0.35	9.91	2.28	4.67	2.85	6.21
April	50	3.05	0.10	6.86	2.02	2.79	1.15	4.28
May	50	2.91	0.00	7.03	1.94	2.39	1.61	3.59
June	51	3.78	0.82	9.90	1.78	3.44	2.50	4.90
July	50	5.16	0.00	11.76	2.85	4.87	2.82	6.70
August	50	4.03	0.81	11.77	2.38	3.92	2.24	5.11
September	50	3.11	0.10	9.50	2.19	2.51	1.39	4.38
October	50	2.10	0.00	8.13	1.96	1.65	0.61	2.99
November	50	2.55	0.15	9.34	2.14	2.08	0.76	3.41
December	49	3.42	0.46	8.25	1.67	2.95	2.33	4.45



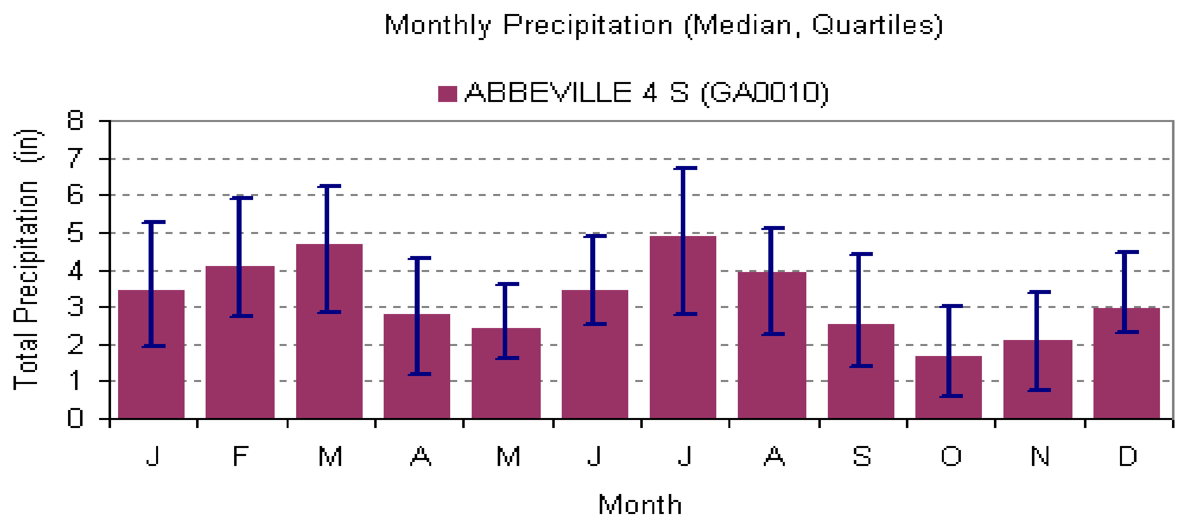


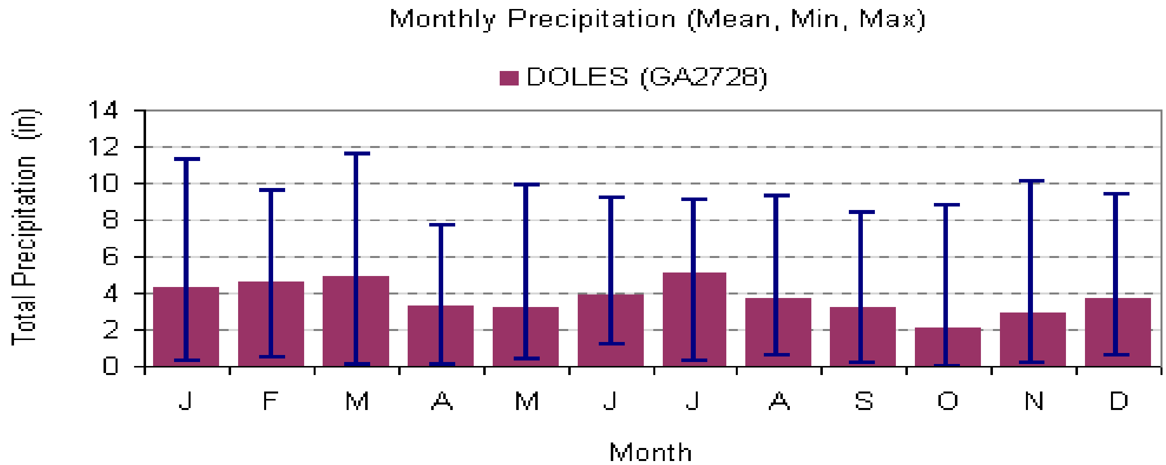
Figure A-4. Average Monthly Mean Precipitation for Abbeville (GA0010)

TOTAL MONTLY PRECIPITATION (IN)

Station: DOLES (GA2728)

Analysis Period: 50 years (from June, 1948 to May, 1998)

Month	Count	Mean	Min	Max	St Dev	Median	25th	75th
January	50	4.34	0.32	11.30	2.55	3.99	2.47	5.63
February	50	4.57	0.50	9.60	2.30	4.67	2.88	5.84
March	50	4.86	0.10	11.60	2.45	4.66	2.79	6.70
April	50	3.29	0.10	7.72	2.12	3.11	1.34	4.67
May	50	3.17	0.41	9.90	2.00	2.78	1.72	4.34
June	50	3.94	1.25	9.20	1.83	3.56	2.52	4.88
July	50	5.08	0.30	9.15	2.17	4.92	3.56	6.75
August	50	3.67	0.62	9.30	2.25	3.28	1.66	5.05
September	50	3.15	0.24	8.40	2.12	2.98	1.34	4.16
October	50	2.13	0.00	8.80	2.20	1.34	0.61	2.84
November	50	2.95	0.19	10.10	2.48	2.01	1.20	3.71
December	50	3.74	0.56	9.42	1.90	3.45	2.57	4.64



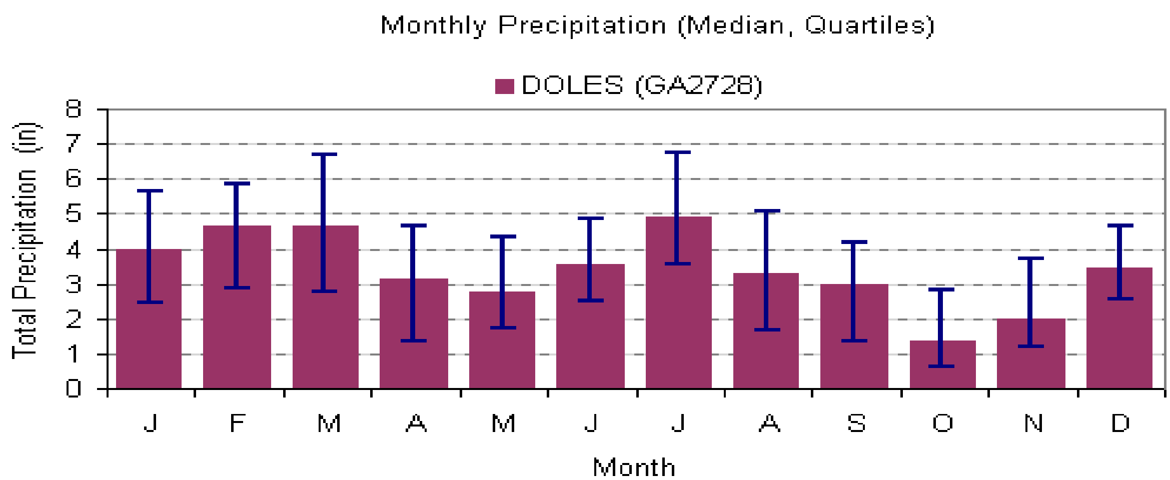


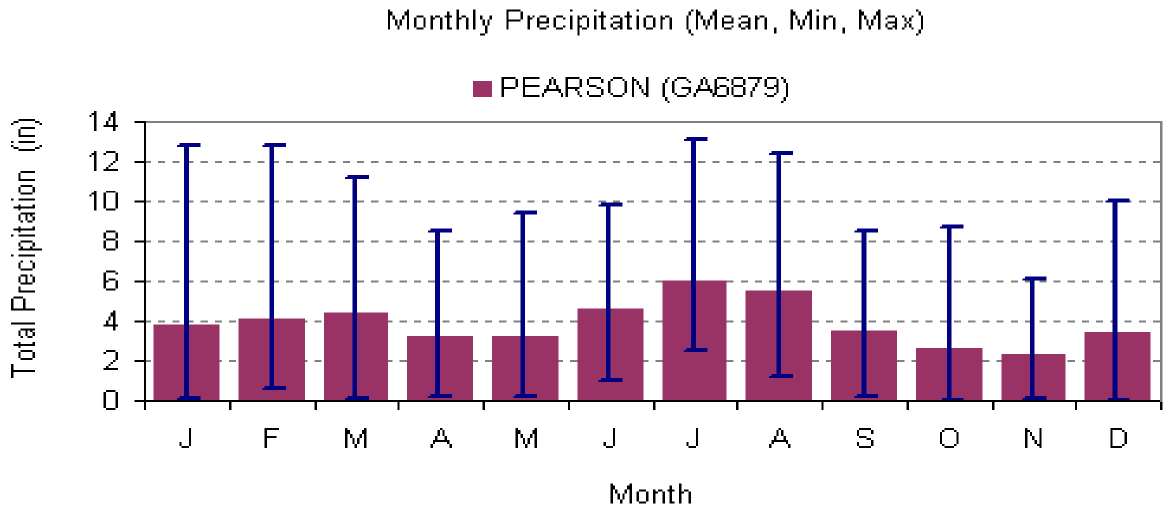
Figure A-5. Average Monthly Mean Precipitation for Doles (GA2728)

TOTAL MONTLY PRECIPITATION (IN)

Station: PEARSON (GA6879)

Analysis Period: 50 years (from June, 1948 to May, 1998)

Month	Count	Mean	Min	Max	St Dev	Median	25th	75th
January	50	3.78	0.14	12.84	2.42	3.65	1.90	5.28
February	50	4.12	0.60	12.80	2.26	4.05	2.25	5.48
March	50	4.40	0.14	11.20	2.52	3.80	2.52	5.62
April	50	3.21	0.20	8.50	2.31	2.80	1.40	4.78
May	50	3.22	0.21	9.37	2.06	2.76	1.80	4.48
June	50	4.61	1.02	9.80	2.12	4.41	2.87	5.52
July	50	6.04	2.46	13.10	2.08	5.95	4.74	7.28
August	50	5.52	1.18	12.40	3.00	4.43	3.34	6.85
September	50	3.49	0.20	8.51	2.10	3.27	2.03	4.98
October	50	2.60	0.00	8.70	2.19	1.86	1.06	3.51
November	50	2.25	0.10	6.10	1.60	1.87	0.93	3.33
December	50	3.41	0.00	10.00	2.09	2.85	2.03	4.57



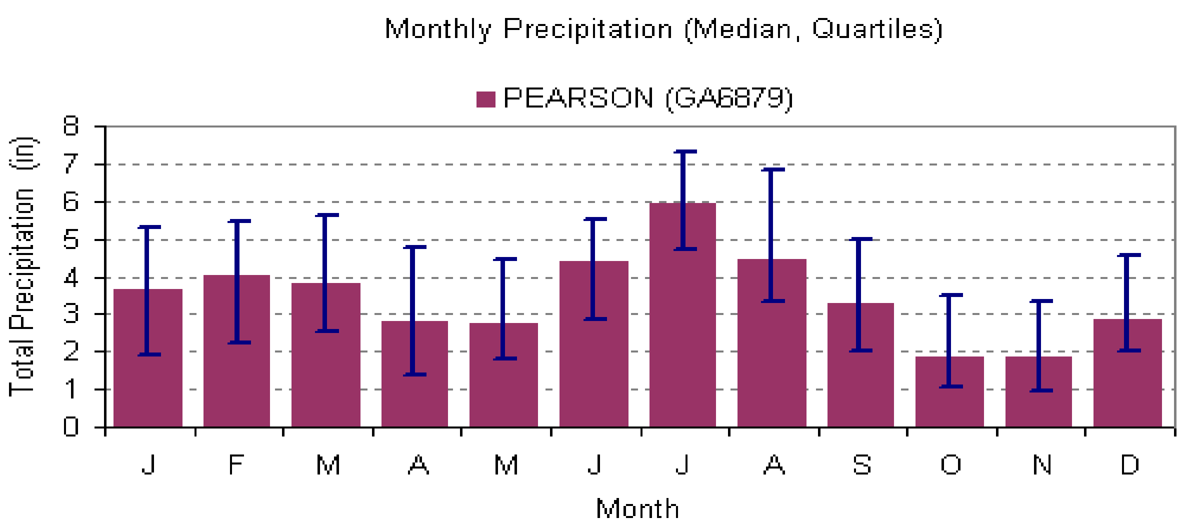


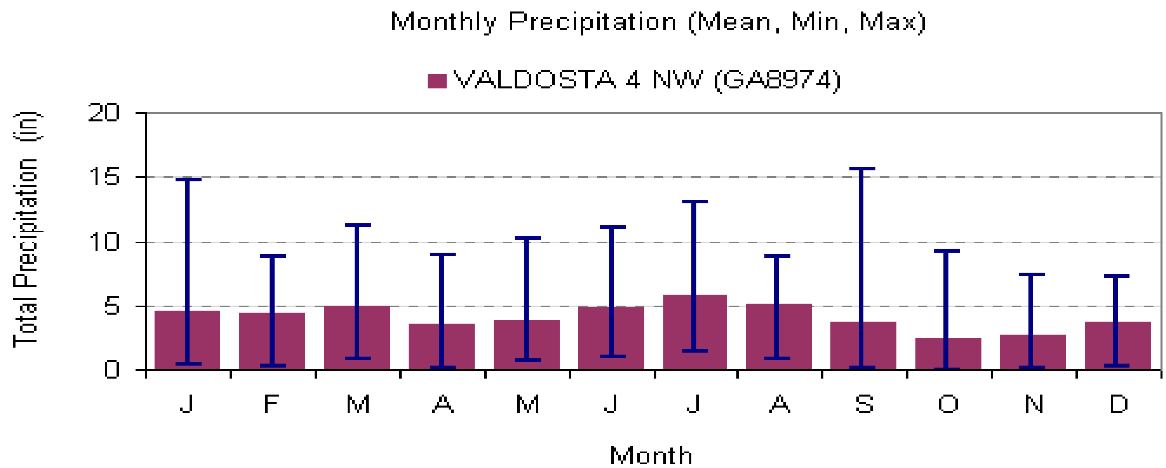
Figure A-6. Average Monthly Mean Precipitation for Pearson (GA6879)

TOTAL MONTLY PRECIPITATION (IN)

Station: VALDOSTA 4 NW (GA8974)

Analysis Period: 44 years (from October, 1954 to November, 1998)

Month	Count	Mean	Min	Max	St Dev	Median	25th	75th
January	44	4.61	0.40	14.70	2.81	4.26	2.75	5.94
February	44	4.43	0.30	8.80	2.06	4.19	2.68	5.95
March	44	4.99	0.84	11.25	2.57	4.59	3.27	6.45
April	44	3.59	0.20	9.00	2.45	3.41	1.68	5.06
May	44	3.76	0.74	10.23	2.30	3.35	1.90	4.78
June	44	4.85	0.96	11.10	2.59	4.29	2.70	6.87
July	44	5.81	1.40	13.10	2.34	5.70	4.36	7.15
August	44	5.16	0.80	8.80	2.11	5.50	3.64	6.99
September	44	3.68	0.16	15.63	3.07	3.05	1.77	4.48
October	45	2.37	0.00	9.20	2.27	1.40	0.90	3.30
November	45	2.66	0.16	7.40	1.85	2.00	1.26	3.78
December	44	3.73	0.30	7.20	1.87	3.51	2.17	5.20



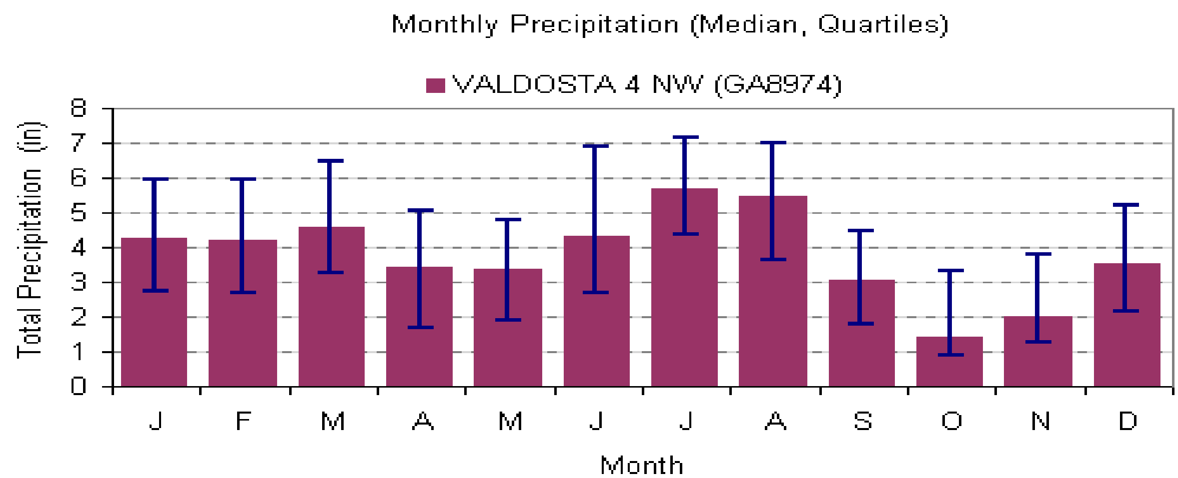


Figure A-7. Average Monthly Mean Precipitation for Valdosta (GA8974)

Table A-2: Land Use Distribution for Impaired Segments

GA 12-digit Watershed ID	Built-up Impervious (acres)	Built-up Pervious (acres)	Cropland (acres)	Forest (acres)	Pasture (acres)	Wetland (acres)	TOTAL (acres)
31102010102	133	1114	956	11006	430	2092	15731
31102010105	118	956	18	4723	7	3482	9304
31102010202	299	2669	42	46745	4	13913	63673
31102010302	611	5320	690	39508	160	19936	66224
31102010303	494	4428	88	15274	4	13716	34005
31102010305	228	1958	14	31422	4	13778	47403
31102010503	728	6419	46	20232	9	12512	39945
31102020102	147	1122	7500	7397	4408	1034	21608
31102020103	254	918	5476	4111	2637	520	13917
31102020105	240	2043	9742	7806	3571	1078	24479
31102020204	257	1541	10168	9004	4212	836	26018
31102020205	574	5117	24523	16948	9267	6923	63352
31102020301	158	1312	6975	3987	2379	3938	18749
31102020302	128	1115	9254	4570	2487	1775	19329
31102020303	158	1381	9210	4388	5528	1548	22214
31102020305	342	1827	6741	6917	3600	2834	22262
31102020401	234	2086	6167	6485	2551	3453	20976
31102020403	179	1187	5330	7960	1450	5462	21569
31102020502	1092	1603	4775	1740	1183	674	11067
31102020503	183	1497	11757	6038	5679	4812	29966
31102020504	135	1044	11751	7256	3354	5775	29316
31102020602	67	604	8832	3575	2315	3070	18462
31102020603	454	1382	11354	4449	3654	2024	23317
31102020703	94	786	4608	17700	1222	10075	34486
31102020801	431	3720	6151	16496	1842	9803	38443
31102020802	185	1448	4881	8189	1009	5364	21075
31102020902	397	3323	1296	9552	189	7544	22301
31102020903	173	1517	139	12589	40	5893	20352
31102020905	230	1919	3045	13341	208	8772	27514
31102021003	347	2873	3075	12845	113	9077	28329
31102021102	505	2711	4819	6234	928	7026	22223
31102021103	601	2956	9194	14658	619	12004	40032
31102030101	143	1043	7243	3476	2749	1536	16190
31102030104	640	2195	11495	14197	3291	6807	38625
31102030201	4070	7894	30678	21521	12979	7435	84576
31102030202	162	1010	6793	3233	3564	2797	17558
31102030203	183	1601	13738	10211	2565	5909	34206
31102030302	276	883	9019	5626	1567	3614	20985
31102030402	864	1603	8228	5431	2307	3672	22105
31102030404	2950	7986	7258	10016	934	9173	38317
31102030501	765	1479	10510	4525	3116	1776	22170
31102030502	393	1004	15450	7817	2819	3499	30982
31102030601	252	1606	16106	7762	1923	4944	32594
31102030603	460	2547	9766	9084	1167	6714	29739
31102030702	332	2667	17823	8871	1347	6805	37844

31102030703	597	2918	14097	14129	1286	8289	41315
31102030801	905	4655	6753	16624	997	13834	43768
31102030901	1215	7199	11186	26336	2172	9728	57836
31102040101	353	1464	6606	6740	3728	1280	20171
31102040104	150	964	9344	3307	5061	4579	23404
31102040105	1601	2301	9960	5909	4558	3716	28045
31102040106	226	797	5527	3848	2130	3110	15637
31102040203	146	779	5652	3505	4126	729	14937
31102040205	92	444	5379	2223	2149	2205	12492
31102040302	586	1168	2962	3451	1500	229	9897
31102040304	210	1881	6493	8869	3036	443	20932
31102040305	184	1653	8923	7827	3727	3429	25743
31102040307	138	1114	6211	5234	1536	3817	18049
31102040403	85	392	6068	3825	1538	1253	13160
31102040404	153	1128	9868	6773	3640	2328	23889
31102040502	245	670	10383	4373	1772	2744	20187
31102040503	210	1062	2713	7356	567	7364	19271
31102040505	569	1402	9537	9757	2840	5695	29799

Source: USGS MRLC – 1990's
Note: Built-up includes low and high residential, high and low commercial and barren land uses.

Appendix B

Hydrology Calibration and Validations

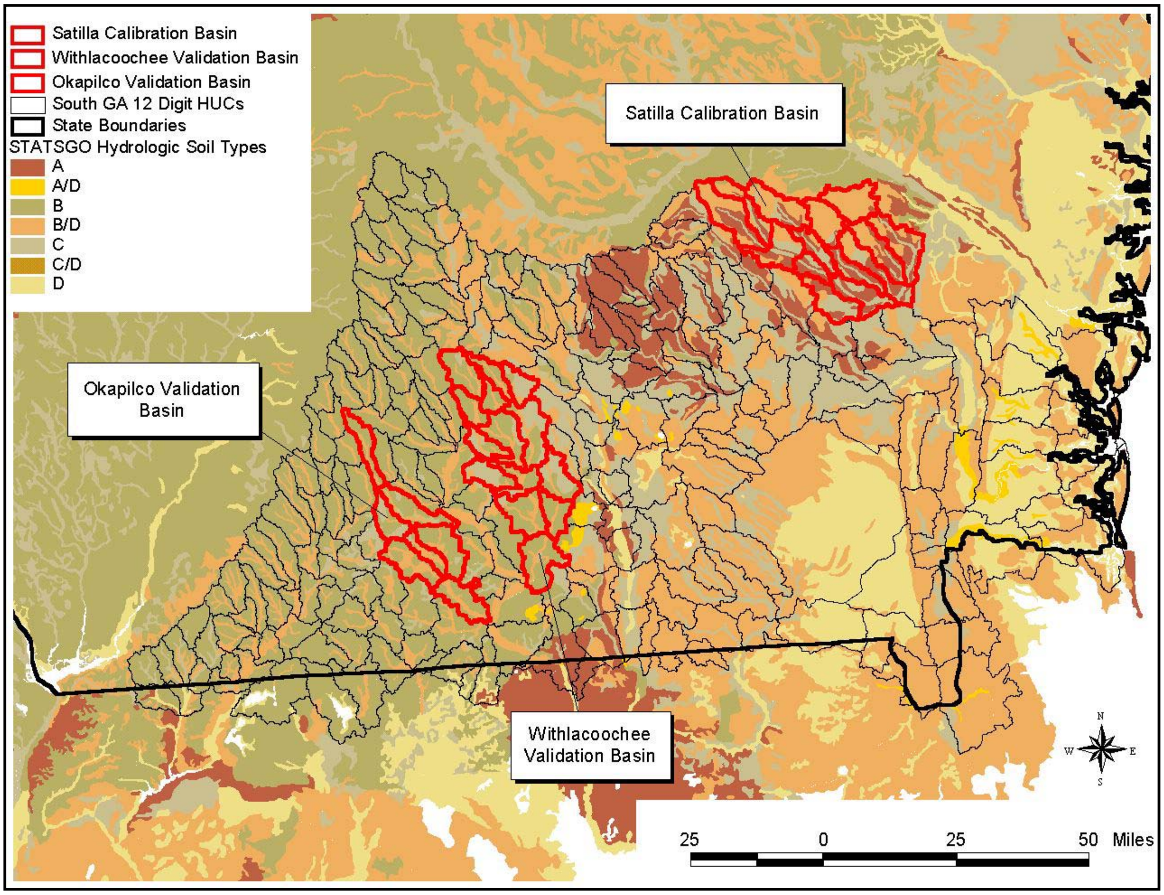


Figure B-1. Location of hydrology calibration and validation basins.

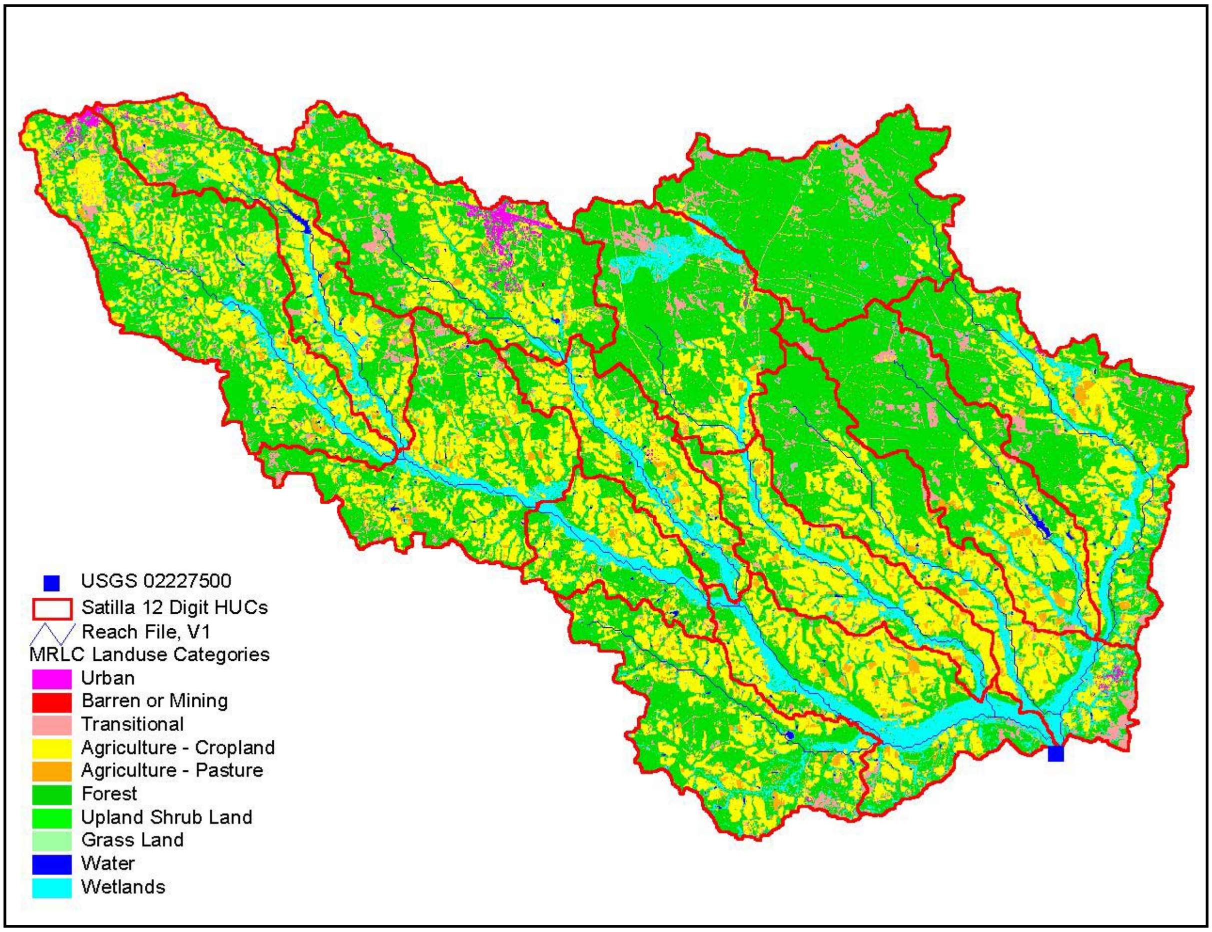


Figure B-2. Hydrology calibration drainage basin, Little Satilla River near Offerman, GA.

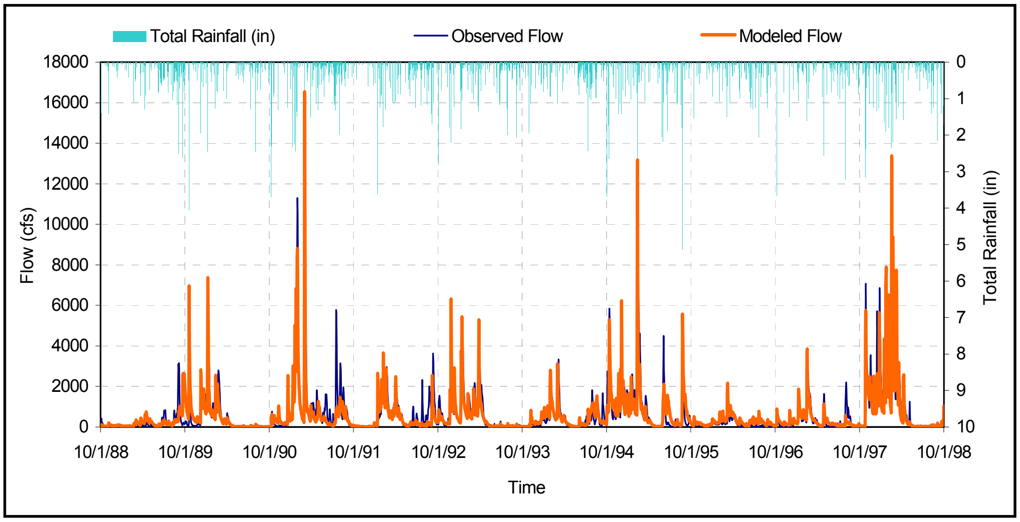


Figure B-3. 10-year calibration (daily flow) at Little Satilla River near Offerman, GA

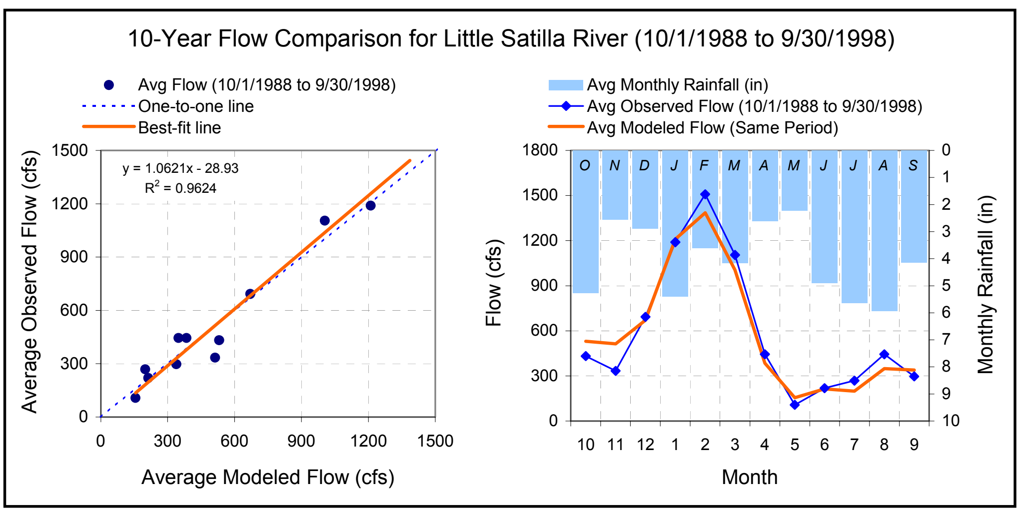


Figure B-4. 10-year calibration (monthly average) at Little Satilla River near Offerman, GA.

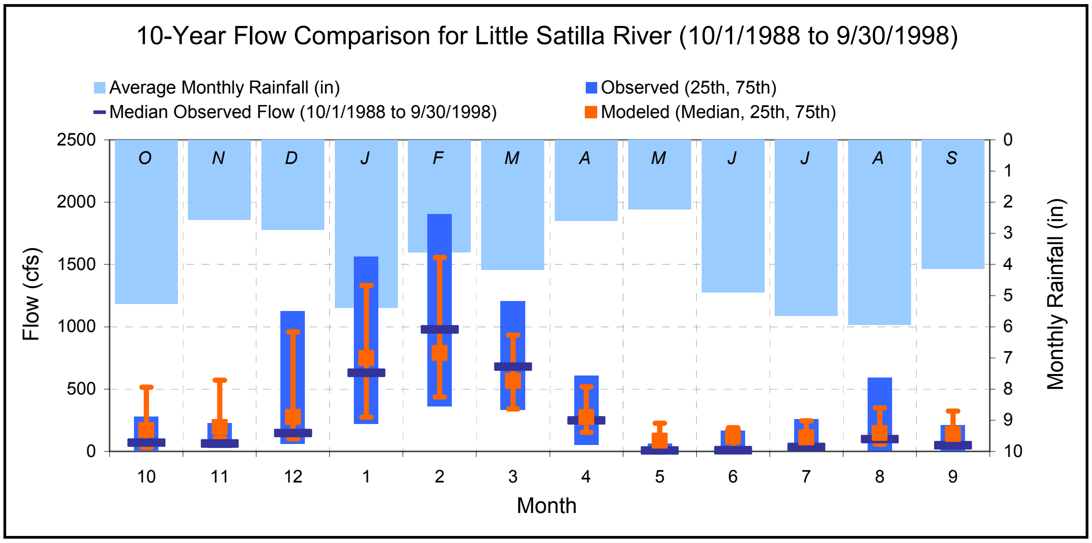


Figure B-5. 10-year calibration (monthly medians), Little Satilla River near Offerman, GA.

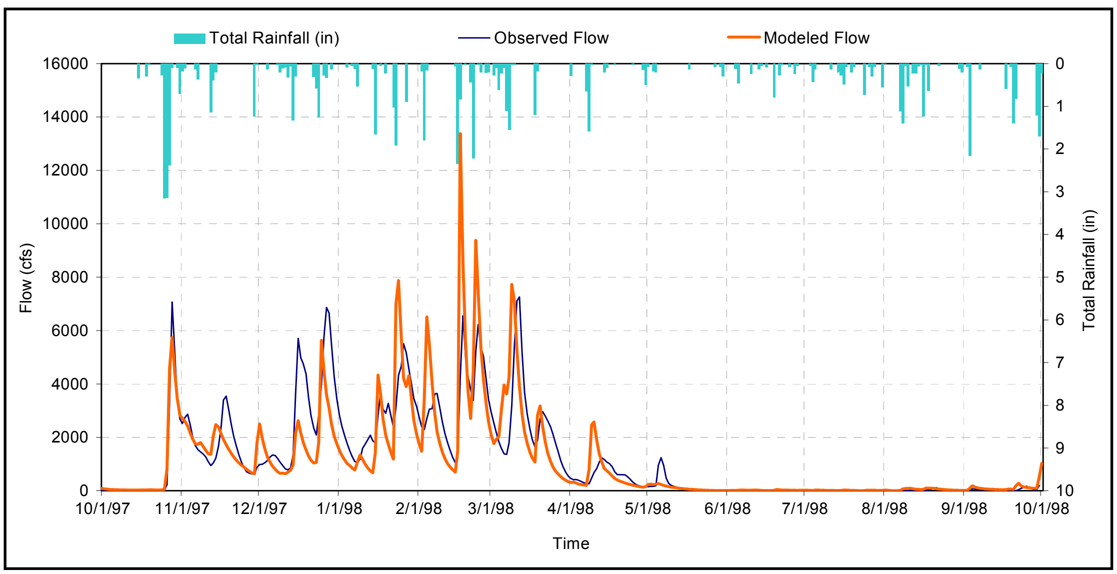


Figure B-6. Water year 1998 (daily flow), Little Satilla River near Offerman, GA.

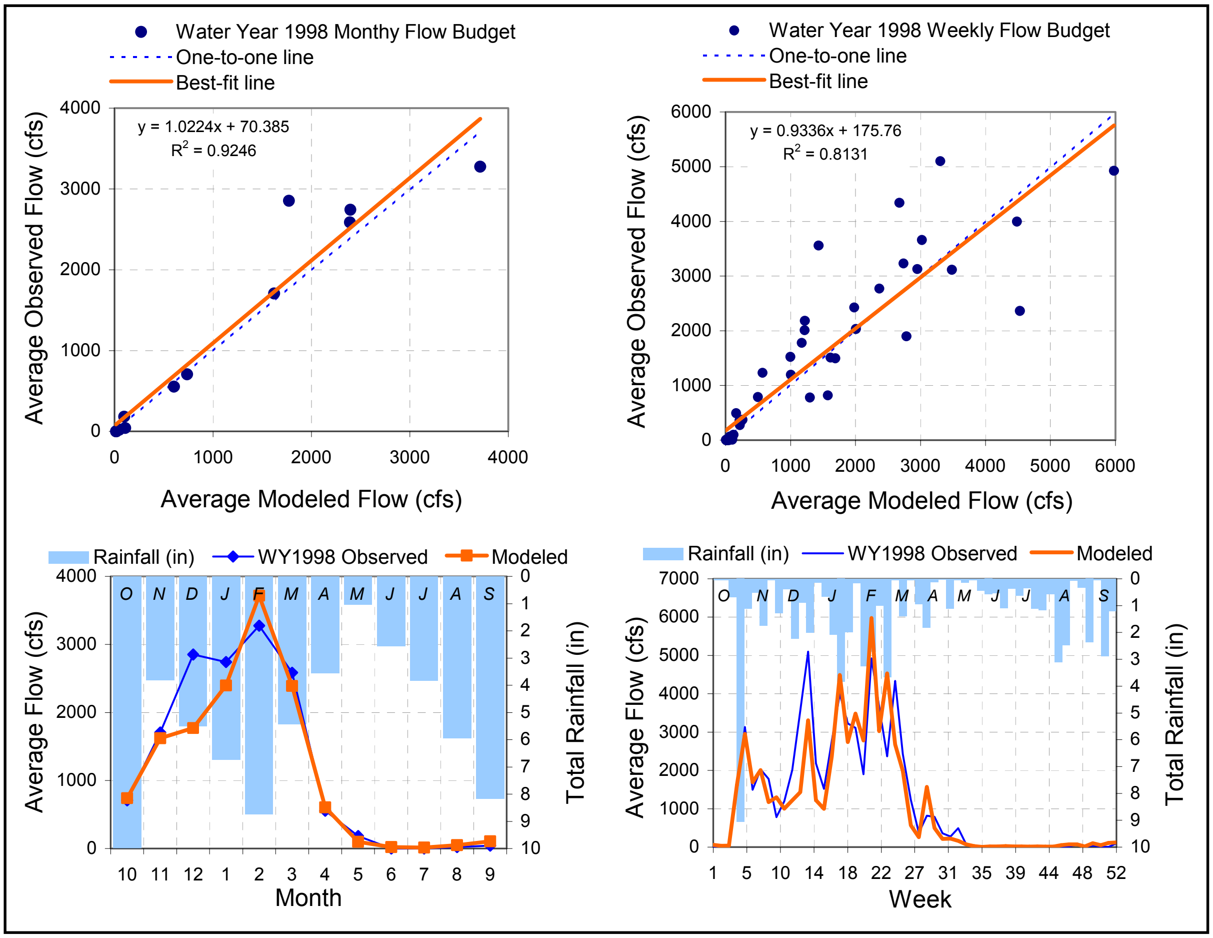


Figure B-7. Water year 1998 (monthly & weekly), Little Satilla River near Offerman, GA.

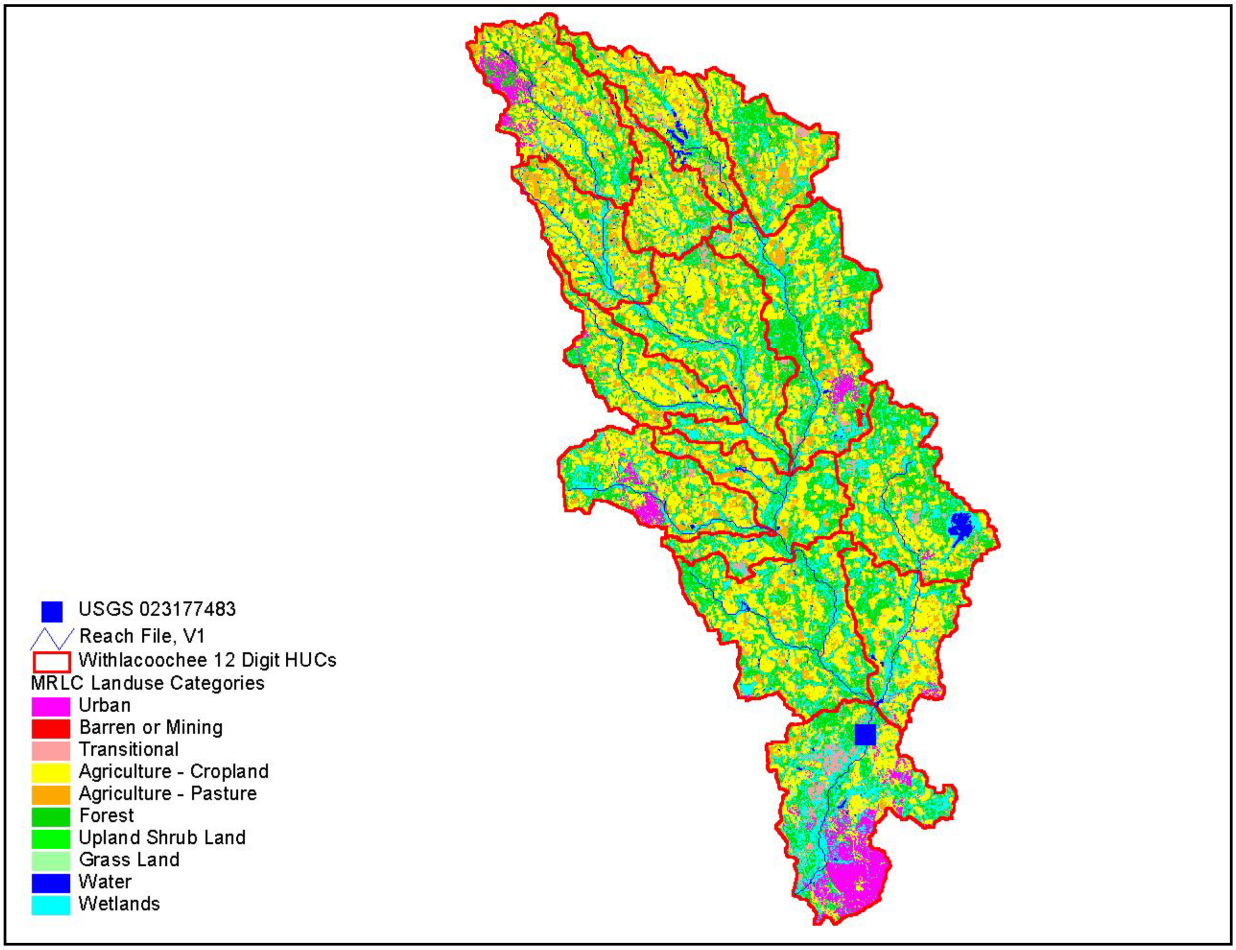


Figure B-8. Hydrology validation 1 drainage basin, Withlacoochee River at McMillan Rd near Bemiss, GA.

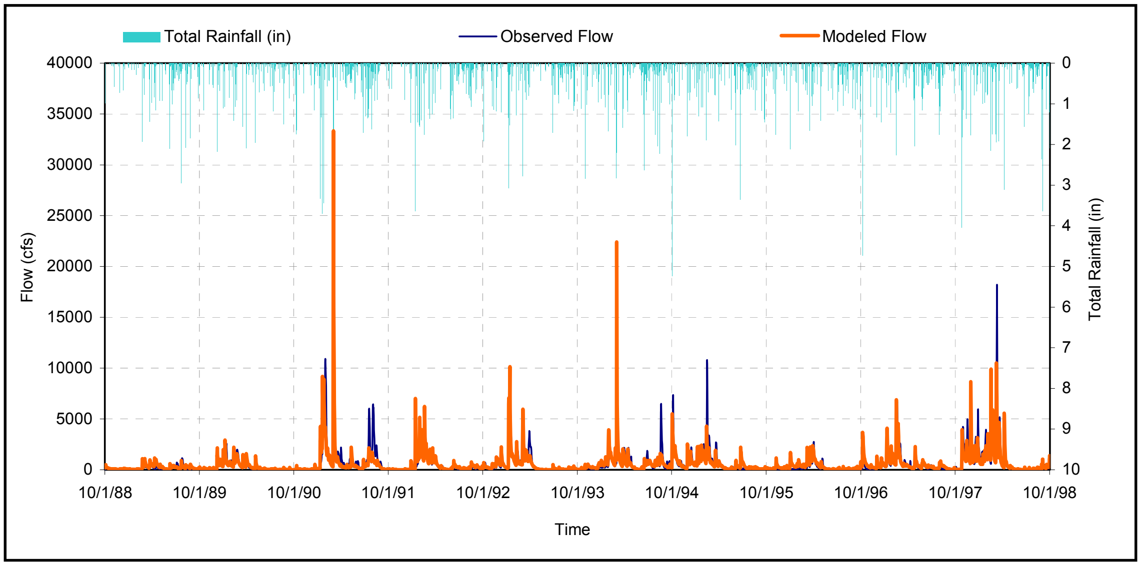


Figure B-9. 10-year validation (daily flow), Withlacoochee River at McMillan Rd near Bemiss, GA.

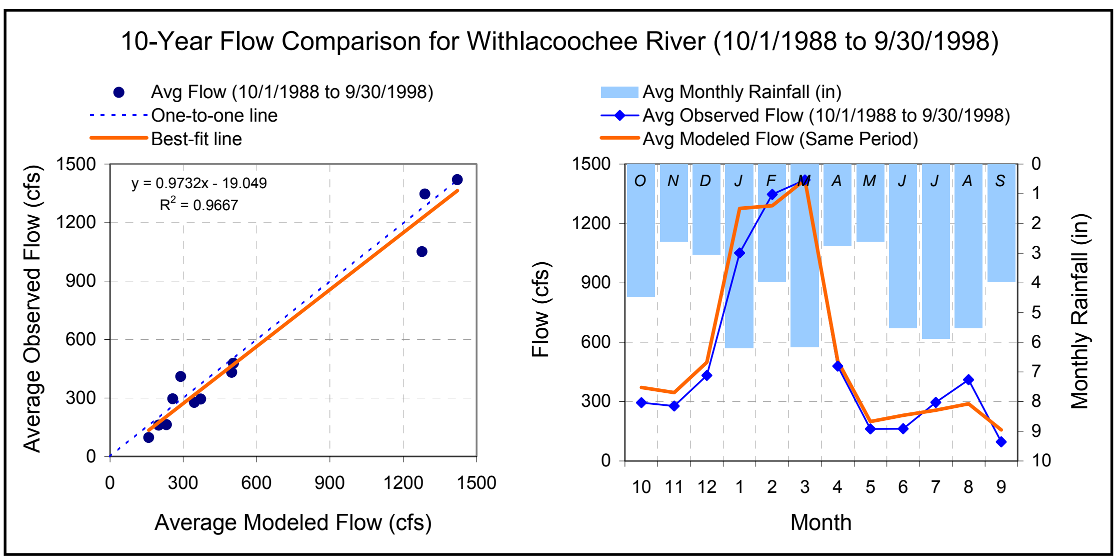


Figure B-10. 10-year validation (monthly average), Withlacoochee River at McMillan Rd near Bemiss, GA.

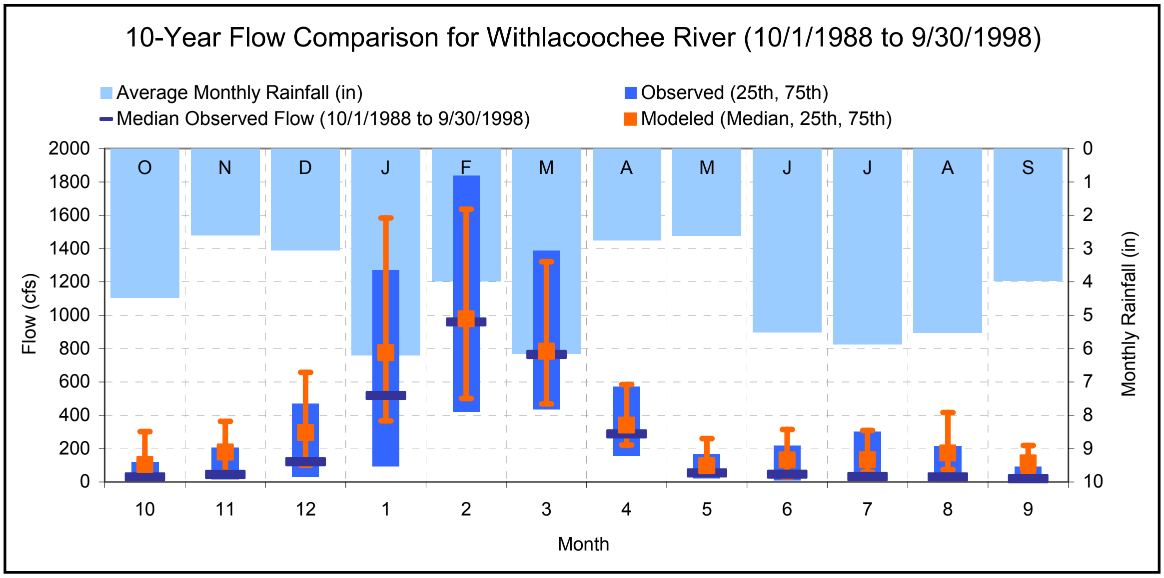


Figure B-11. 10-year validation (monthly medians), Withlacoochee River at McMillan Rd near Bemiss, GA.

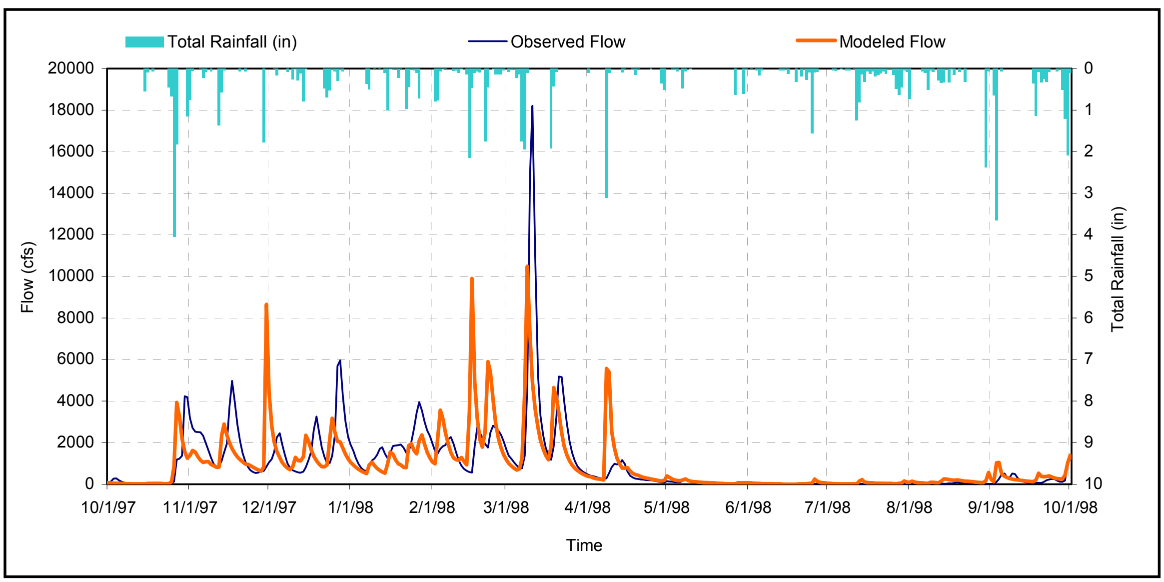


Figure B-12. Water year 1998 (daily flow), Withlacoochee River at McMillan Rd near Bemiss, GA.

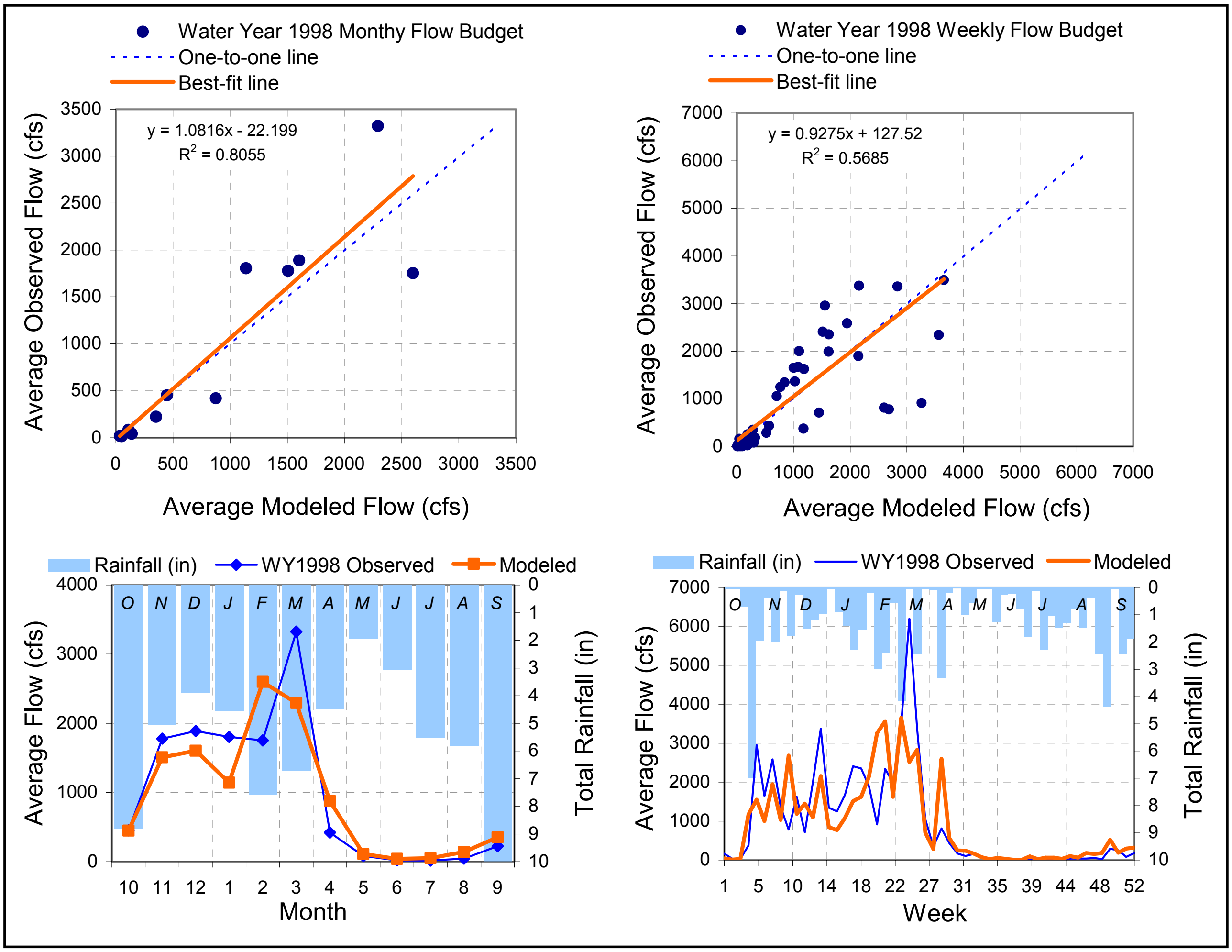


Figure B-13. Water year 1998 (monthly & weekly), Withlacoochee River at McMillan Rd near Bemiss, GA.

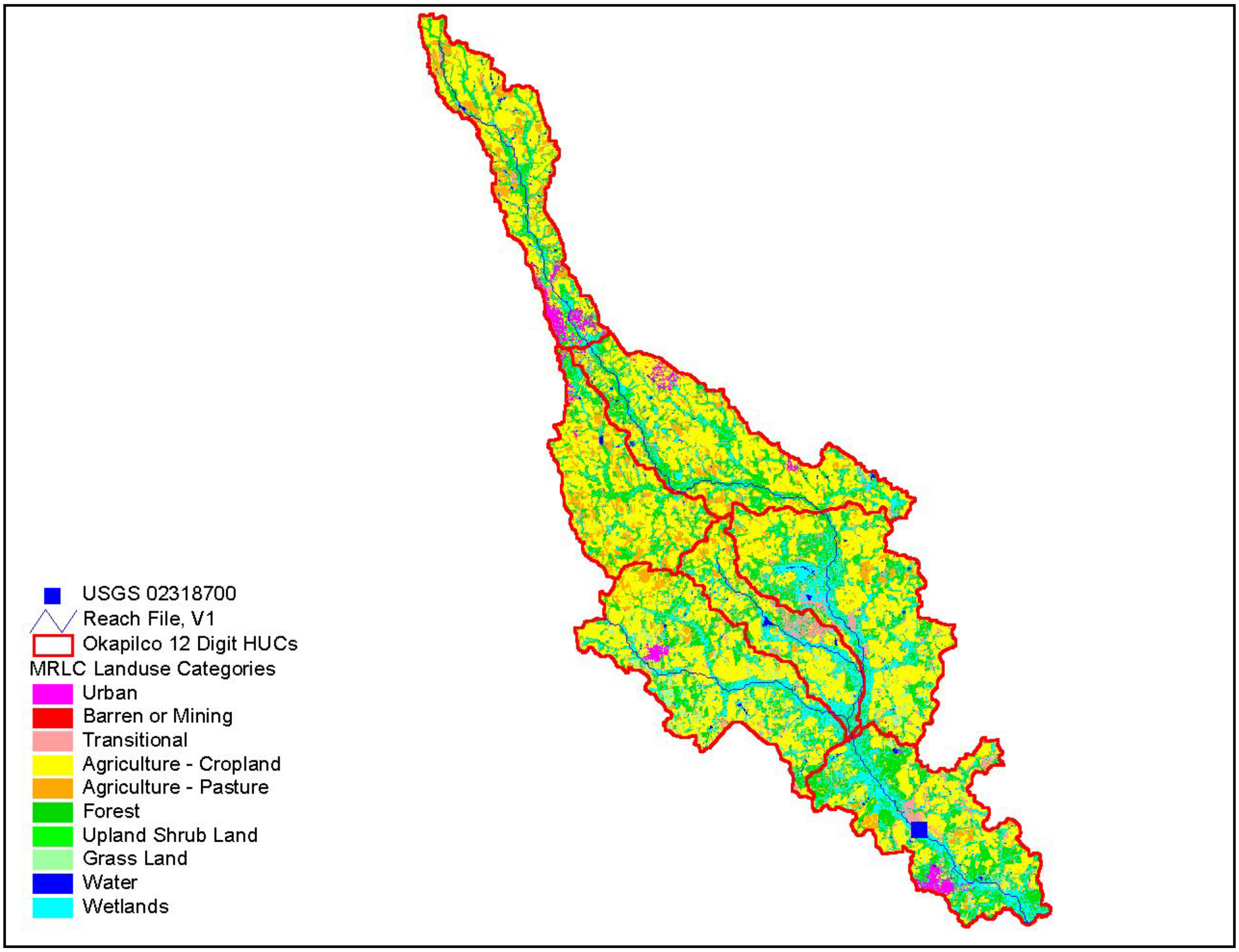


Figure B-14. Hydrology validation 2 drainage basin, Okapilco Creek at RT 33 near Quitman, GA.

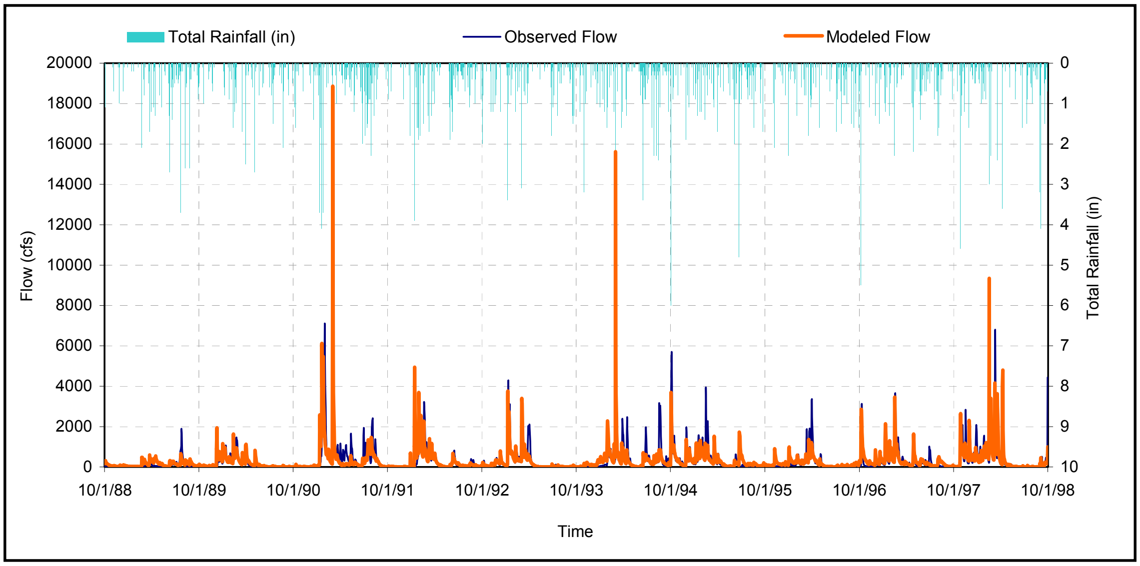


Figure B-15. 10-year validation (daily flow), Okapilco Creek at ST RT 33 near Quitman, GA.

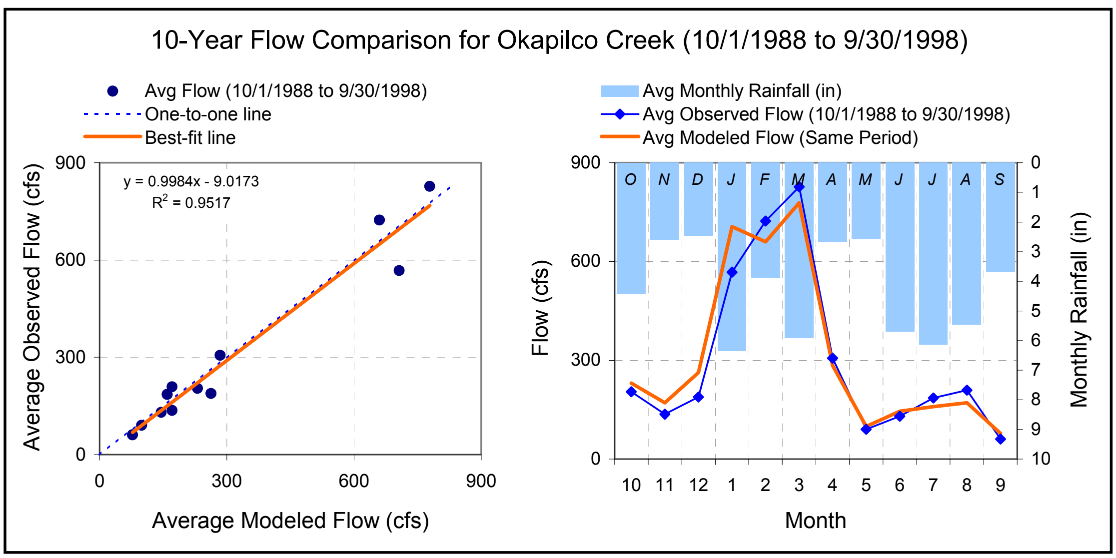


Figure B-16. 10-year validation (monthly average), Okapilco Creek at ST RT 33 near Quitman, GA.

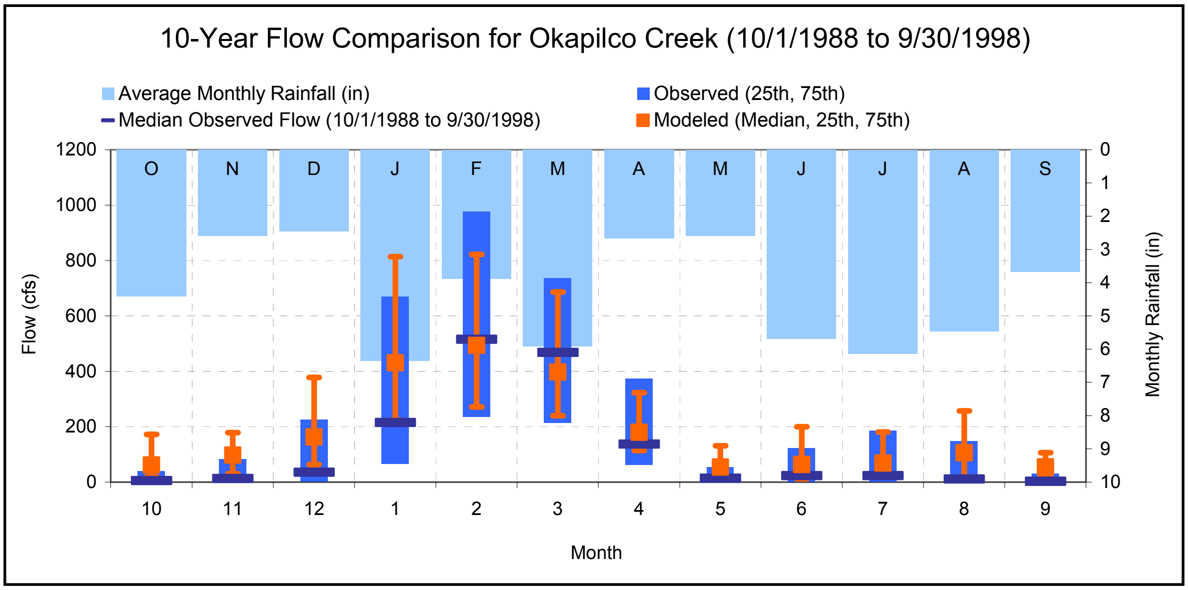


Figure B-17. 10-year validation (monthly medians), Okapilco Creek at ST RT 33 near Quitman, GA.

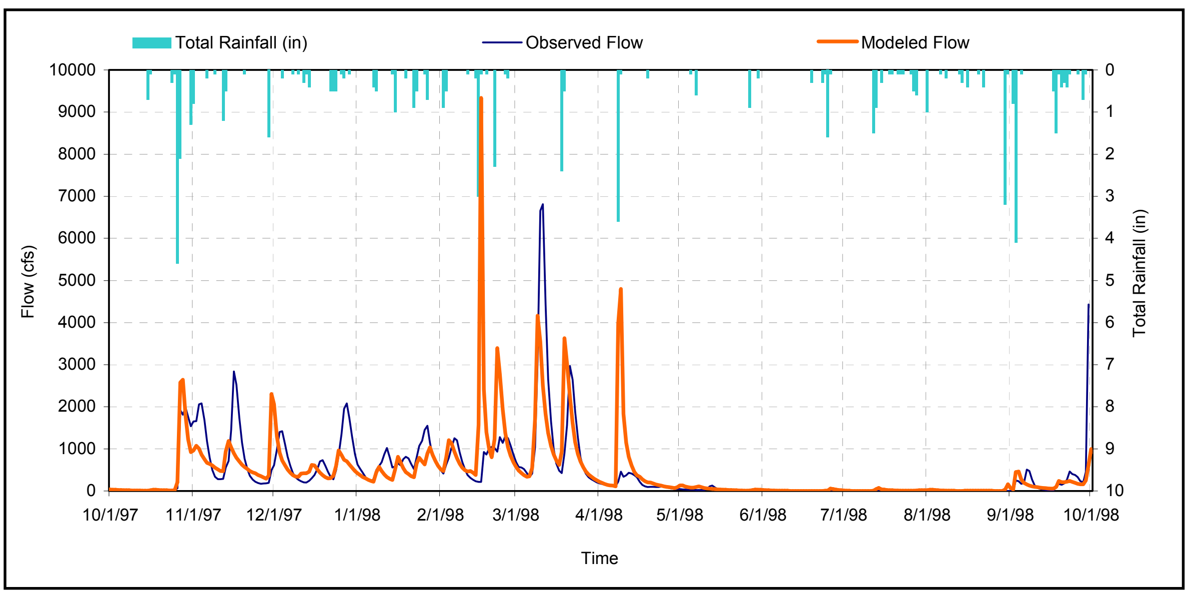


Figure B-18. Water year 1998 (daily flow), Okapilco Creek at ST RT 33 near Quitman, GA.

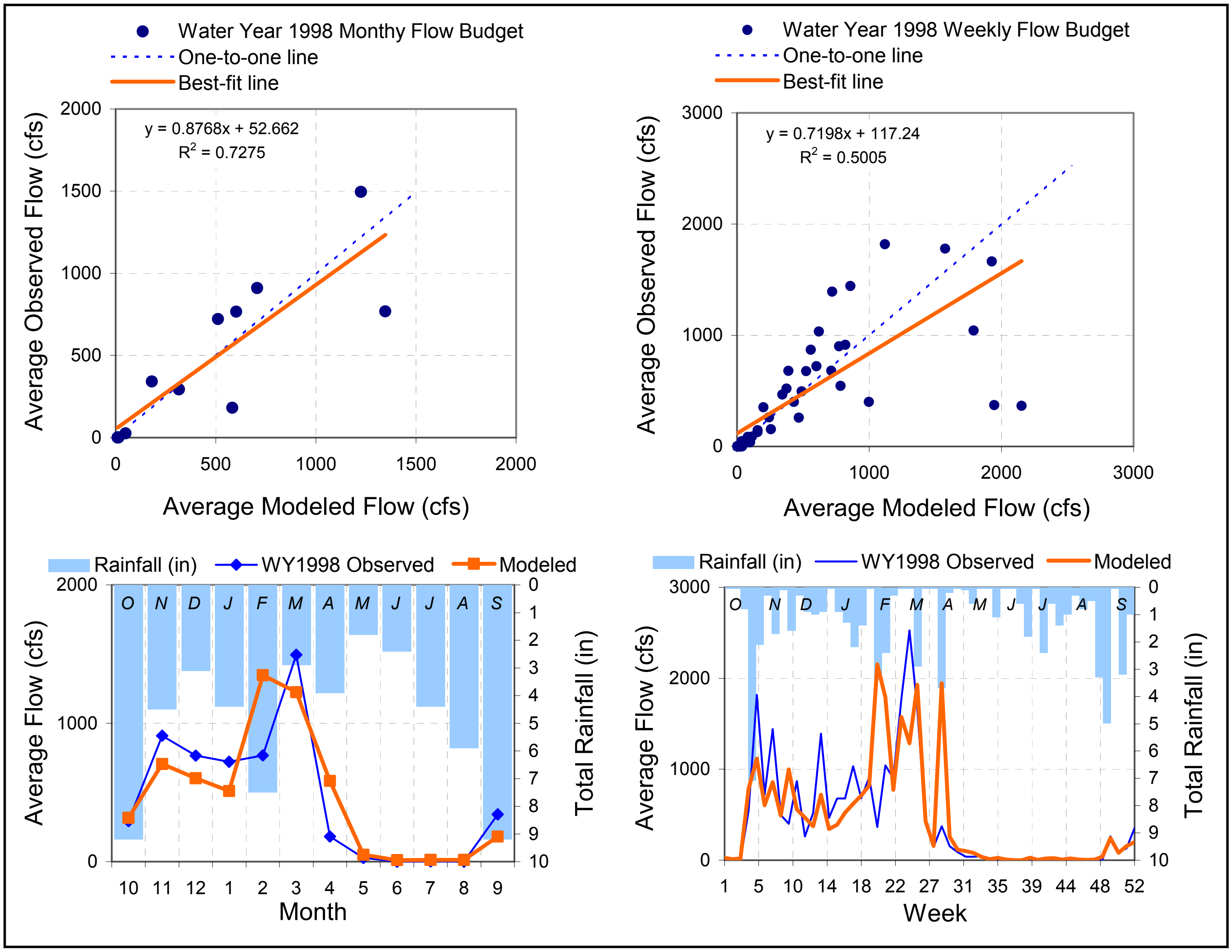


Figure B-19. Water year 1998 (monthly & weekly), Okapilco Creek at ST RT 33 near Quitman, GA.

Appendix C

In-Stream Dissolved Oxygen Calibration

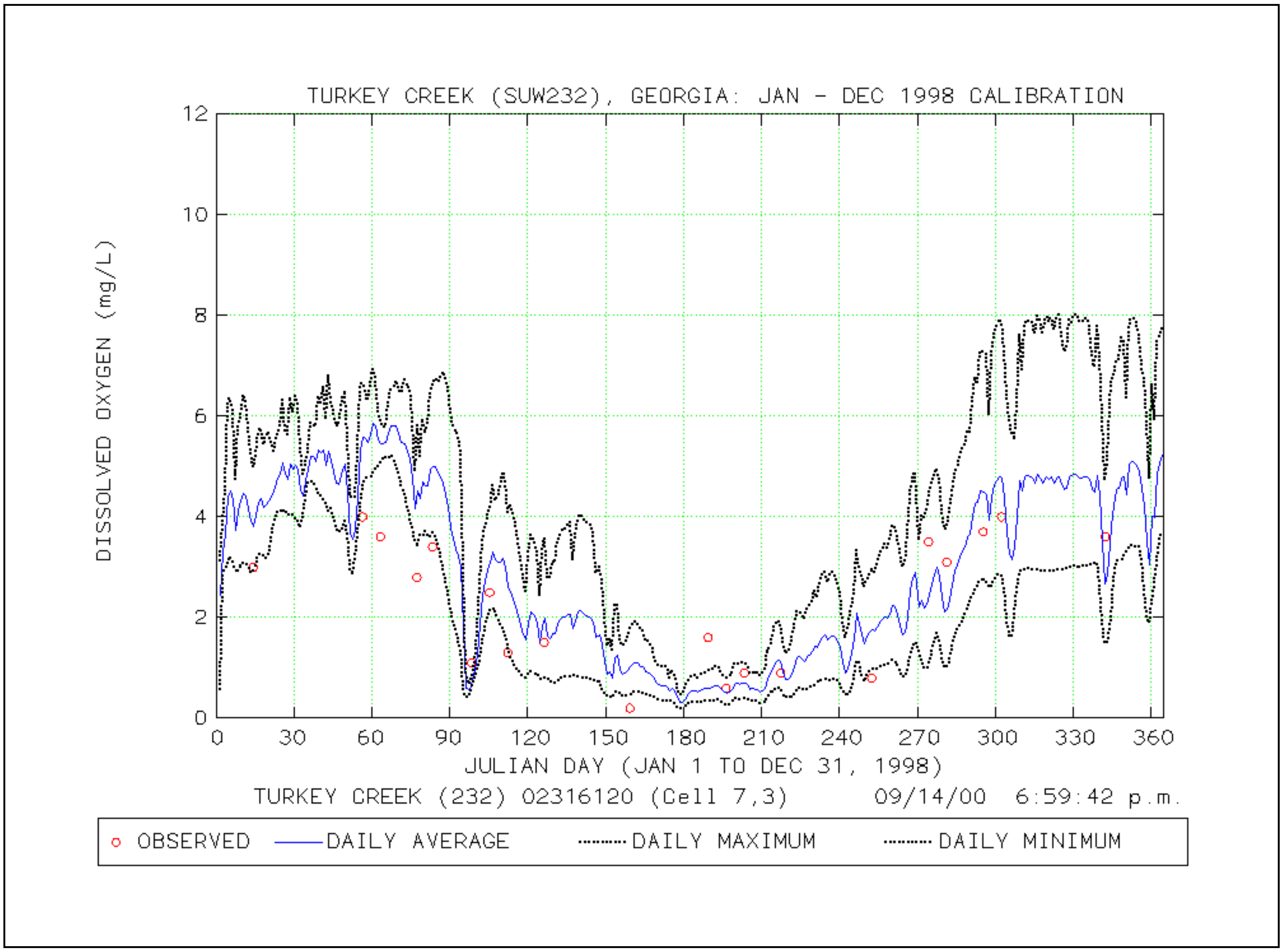


Figure C-1: In-Stream Water Quality Calibration for DO at USGS02326120 – Turkey Branch near Fitzgerald, GA (Subwatershed 232).

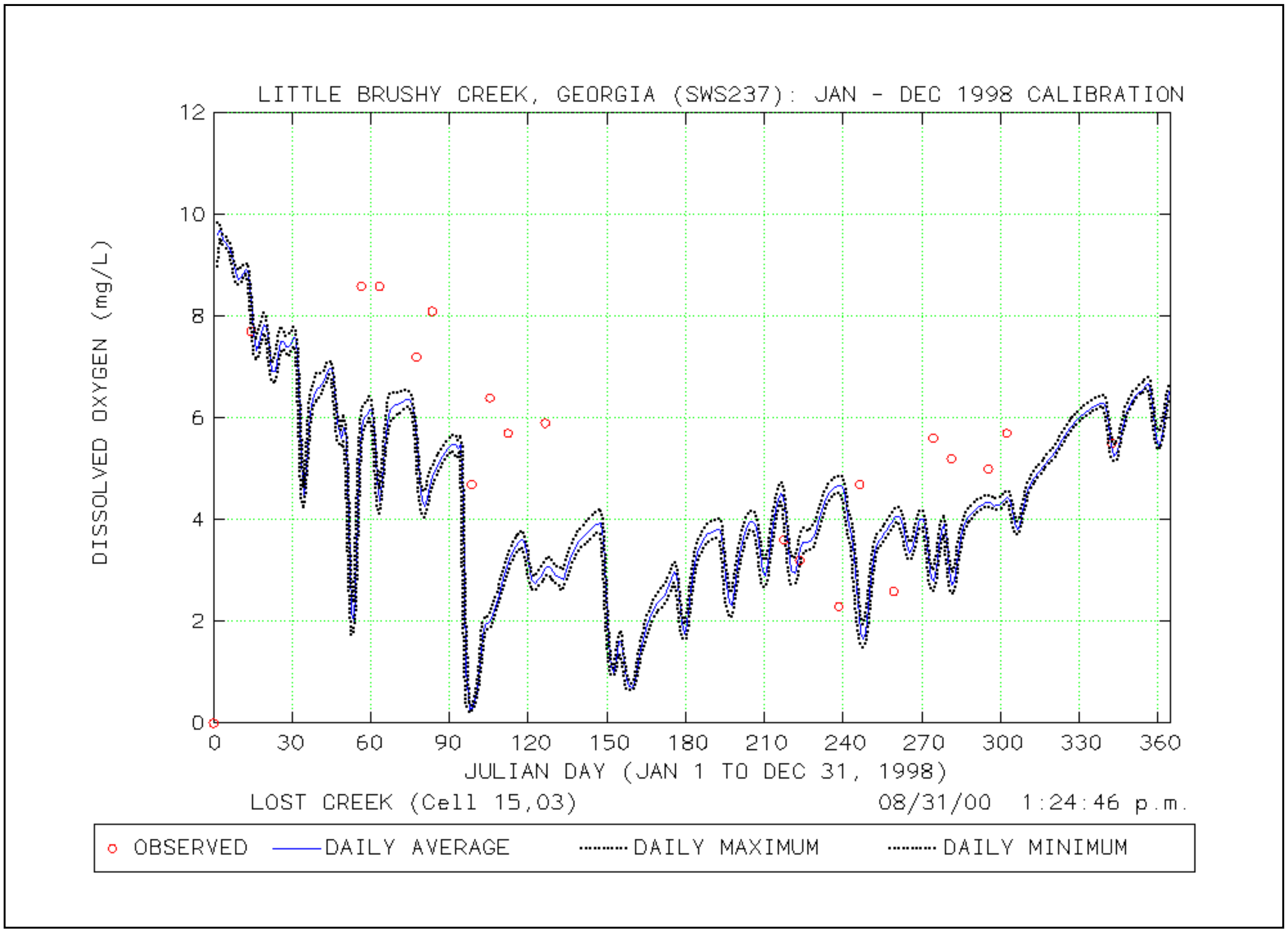


Figure C-2: In-Stream Water Quality Calibration for DO at USGS02316241 – Little Brushy Creek at CR 63 near Ocilla, GA (Subwatershed 237).

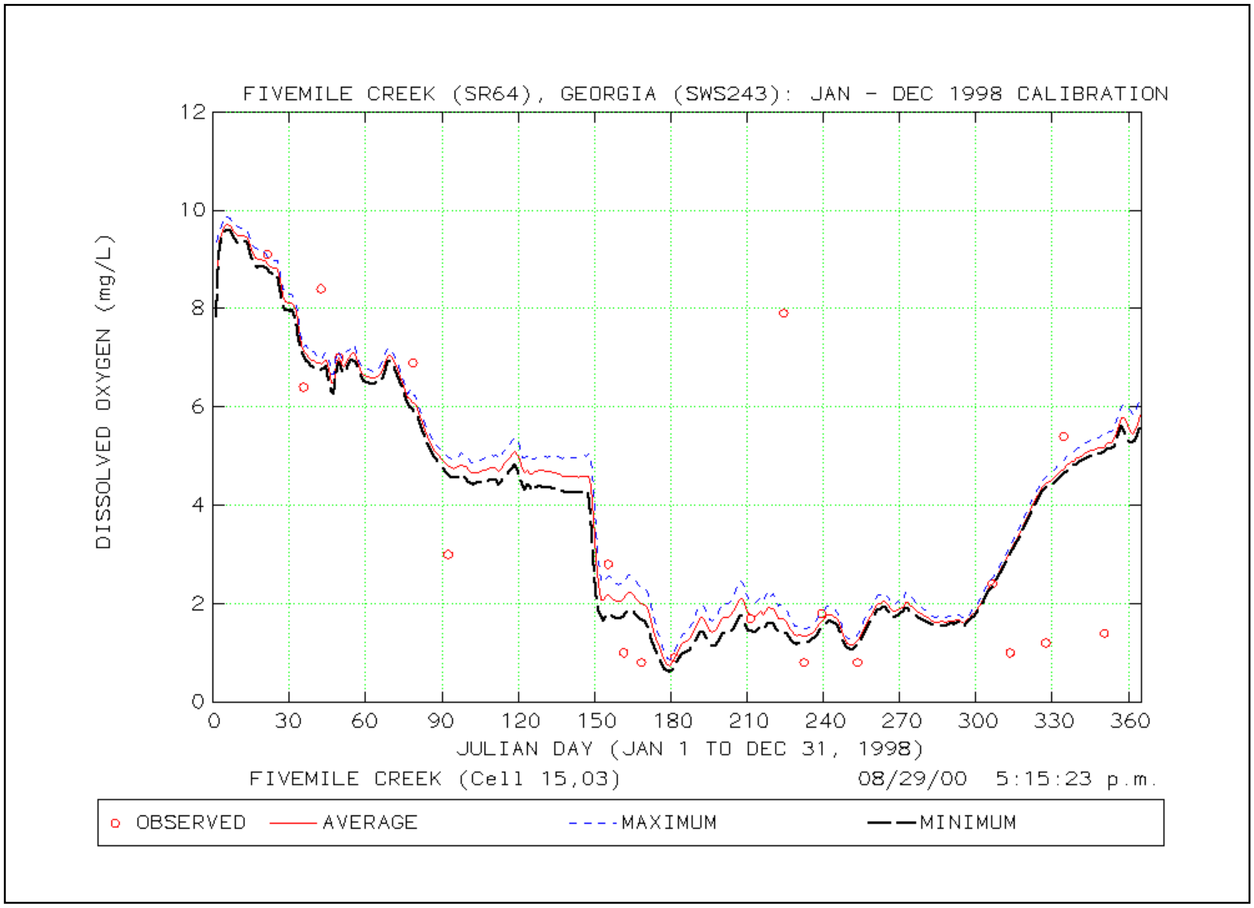


Figure C-3: In-Stream Water Quality Calibration for DO at USGS02316490 – Five Mile Creek at CR 64 near Lakeland, GA (Subwatershed 243).

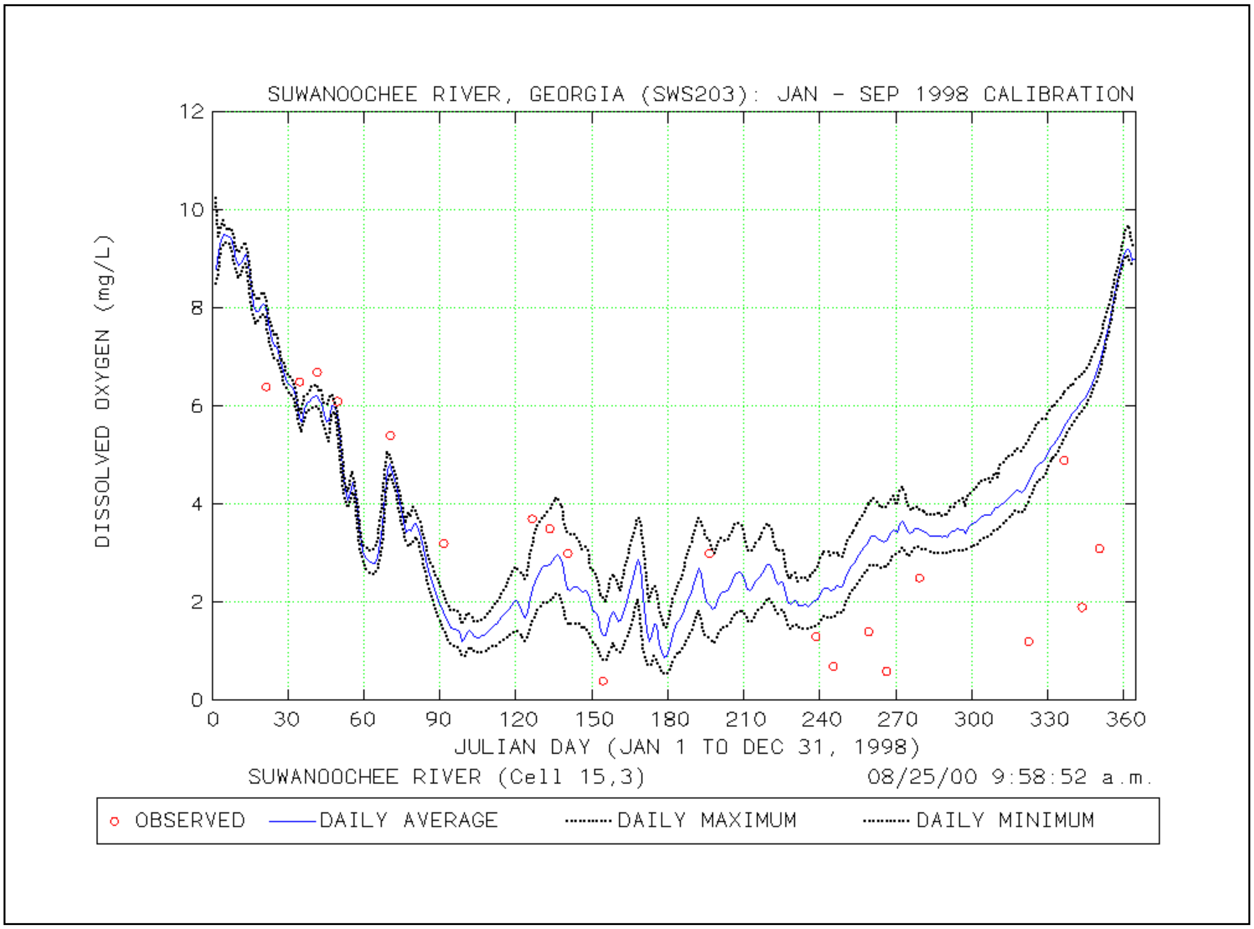


Figure C-4: In-Stream Water Quality Calibration for DO at USGS02314600 – Suwannoochee Creek at US 84 near Dupont, GA (Subwatershed 203).

Appendix D

TMDL Components

Table D-1

Alapaha Creek - Segment #1

TMDL = WLA + LA		
TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
29,675,612	1,062,816	131,954

Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020101	3,290,514	116,243	14,230	1,865,976	65,919	8,070	43.29	43.29	43.29
031102020102	2,628,280	97,583	11,734	1,458,030	54,134	6,509	44.53	44.53	44.53
031102020103	2,162,940	71,137	8,524	1,626,484	53,493	6,410	24.80	24.80	24.80
031102020104	2,724,953	100,153	13,087	1,915,262	70,394	9,198	29.71	29.71	29.71
031102020105	3,905,120	129,876	15,100	2,982,882	99,205	11,534	23.62	23.62	23.62
031102020106	2,801,304	114,607	13,621	1,953,550	79,924	9,499	30.26	30.26	30.26
031102020201	2,428,979	81,215	11,112	1,734,608	57,998	7,936	28.59	28.59	28.59
031102020202	3,075,613	114,450	15,336	2,197,084	81,758	10,955	28.56	28.56	28.56
031102020203	3,028,969	88,490	10,470	2,329,886	68,066	8,054	23.08	23.08	23.08
031102020204(a)	1,951,416	78,018	9,260	1,340,008	53,574	6,359	31.33	31.33	31.33
031102020204(b)	1,933,334	46,249	6,539	1,487,476	35,583	5,031	23.06	23.06	23.06
031102020205	6,958,631	331,420	39,036	4,397,671	209,448	24,670	36.80	36.80	36.80
031102020301(a)	1,550,135	55,773	7,492	1,123,369	40,419	5,429	27.53	27.53	27.53
031102020301(b)	1,096,312	25,840	2,733	875,495	20,635	2,182	20.14	20.14	20.14
031102020302	3,112,806	94,207	13,190	2,387,832	72,266	10,118	23.29	23.29	23.29
Total	42,649,307	1,545,260	191,464	29,675,612	1,062,816	131,954	30	31	31

Table D-2

Bear Creek - Segment #2

TMDL = WLA + LA		
TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
3,675,805	92,548	13,434

Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040404	5,632,713	141,818	20,585	3,675,805	92,548	13,434	34.74	34.74	34.74
Total	5,632,713	141,818	20,585	3,675,805	92,548	13,434	35	35	35

Table D-3

Cane Creek - Segment #3

TMDL = WLA + LA		
TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
5,089,829	93,207	5,795

Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010104	2,595,119	63,908	3,708	2,595,119	63,908	3,708	0.00	0.00	0.00
031102010105(b)	2,494,710	29,299	2,087	2,494,710	29,299	2,087	0.00	0.00	0.00
Total	5,089,829	93,207	5,795	5,089,829	93,207	5,795	0	0	0

Table D-4

Cat Creek - Segment#4				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				5,365,126	150,357	23,859			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030301	4,999,592	132,013	20,473	3,119,872	82,380	12,775	37.60	37.60	37.60
031102030302	3,690,723	111,741	18,219	2,245,254	67,978	11,084	39.16	39.16	39.16
Total	8,690,315	243,754	38,692	5,365,126	150,357	23,859	38	38	38

Table D-5

Double Run Creek- Segemnt#5				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,982,882	99,205	11,534			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020105	3,905,120	129,876	15,100	2,982,882	99,205	11,534	23.62	23.62	23.62
Total	3,905,120	129,876	15,100	2,982,882	99,205	11,534	24	24	24

Table D-6

Fivemile Creek - Segment #6				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				4,532,300	140,125	13,182			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020801	5,253,259	162,415	15,279	4,532,300	140,125	13,182	13.72	13.72	13.72
Total	5,253,259	162,415	15,279	4,532,300	140,125	13,182	14	14	14

Table D-7

Greasy Branch - Segment #7				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				4,637,054	61,090	5,349			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010102	2,748,949	46,526	4,045	2,571,327	43,520	3,784	6.46	6.46	6.46
031102010105(c)	2,173,252	18,485	1,646	2,065,727	17,571	1,565	4.95	4.95	4.95
Total	4,922,201	65,011	5,692	4,637,054	61,090	5,349	6	6	6

Table D-8

Indian Creek - Segment#8				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				7,929,460	200,146	29,735			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040402	3,087,284	86,688	12,063	2,145,143	60,234	8,382	30.52	30.52	30.52
031102040403(a)	3,073,811	70,575	11,804	2,037,800	46,788	7,825	33.70	33.70	33.70
031102040403(b)	82,762	675	110	70,712	577	94	14.56	14.56	14.56
031102040404	5,632,713	141,818	20,585	3,675,805	92,548	13,434	34.74	34.74	34.74
Total	11,876,570	299,756	44,562	7,929,460	200,146	29,735	33	33	33

Table D-9

Little River - Segment#9				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				1,603,658	57,067	6,323			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040101	2,843,679	101,193	11,212	1,603,658	57,067	6,323	43.61	43.61	43.61
Total	2,843,679	101,193	11,212	1,603,658	57,067	6,323	44	44	44

Table D-10

Mill Creek - Segment#10				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,028,305	53,900	14,781			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020103	2,162,940	71,137	8,524	1,626,484	53,493	6,410	24.80	24.80	24.80
Total	2,162,940	71,137	8,524	1,626,484	53,493	6,410	25	25	25
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Rochelle - Northwest WPCP (GA0024244)	372,598	377	7,762	372,598	377	7,762	0.00	0.00	0.00
Rochelle - Southwest WPCP (GA0024236)	29,223	30	609	29,223	30	609	0.00	0.00	0.00
Total	401,821	407	8,371	401,821	407	8,371	0	0	0

Table D-11

Mule Creek Segment#11				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				1,696,257	44,692	7,351			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030601	2,216,464	58,398	9,605	1,696,257	44,692	7,351	23.47	23.47	23.47
Total	2,216,464	58,398	9,605	1,696,257	44,692	7,351	23	23	23

Table D-12

New River - Segment #12				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,682,646	67,545	9,017			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030101	3,483,768	87,716	11,710	2,682,646	67,545	9,017	23.00	23.00	23.00
Total	3,483,768	87,716	11,710	2,682,646	67,545	9,017	23	23	23

Table D-13

Piscola River - Segment #13				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				11,998,002	408,412	61,408			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030701	6,125,731	231,735	36,499	3,261,791	123,393	19,435	46.75	46.75	46.75
031102030702	5,793,492	230,826	35,693	2,743,156	109,294	16,900	52.65	52.65	52.65
031102030703(a)	2,319,618	72,233	11,277	1,784,368	55,565	8,675	23.08	23.08	23.08
031102030703(b)	2,680,642	86,724	11,819	2,182,159	70,597	9,621	18.60	18.60	18.60
031102030703(c)	2,523,594	61,721	8,439	2,026,537	49,564	6,777	19.70	19.70	19.70
Total	19,443,076	683,239	103,727	11,998,002	408,412	61,408	38	40	41

Table D-14

Suwannee Creek -Segment#14				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,571,327	43,520	3,784			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010102	2,748,949	46,526	4,045	2,571,327	43,520	3,784	6.46	6.46	6.46
Total	2,748,949	46,526	4,045	2,571,327	43,520	3,784	6	6	6

Table D-15

Suwannoochee Creek - Segment#15				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				18,653,555	549,373	37,759			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010301	5,585,270	132,046	12,903	5,585,270	132,046	12,903	0.00	0.00	0.00
031102010302	8,049,208	239,418	15,551	8,049,208	239,418	15,551	0.00	0.00	0.00
031102010303	5,019,077	177,909	9,305	5,019,077	177,909	9,305	0.00	0.00	0.00
Total	18,653,555	549,373	37,759	18,653,555	549,373	37,759	0	0	0

Table D-16

Suwannoochee Creek - Segment#16				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				27,708,823	708,374	50,486			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010301	5,585,270	132,046	12,903	5,585,270	132,046	12,903	0.00	0.00	0.00
031102010302	8,049,208	239,418	15,551	8,049,208	239,418	15,551	0.00	0.00	0.00
031102010303	5,019,077	177,909	9,305	5,019,077	177,909	9,305	0.00	0.00	0.00
031102010304	3,404,076	53,479	4,211	3,404,076	53,479	4,211	0.00	0.00	0.00
031102010305	5,651,192	105,521	8,516	5,651,192	105,521	8,516	0.00	0.00	0.00
Total	27,708,823	708,374	50,486	27,708,823	708,374	50,486	0	0	0

Table D-17

Tatum Creek - Segment# 17				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				13,584,289	278,582	23,106			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010201	5,150,125	121,560	7,791	5,150,125	121,560	7,791	0.00	0.00	0.00
031102010202	8,281,959	143,152	11,509	8,281,959	143,152	11,509	0.00	0.00	0.00
Total	13,432,084	264,712	19,300	13,432,084	264,712	19,300	0	0	0
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Homerville Industrial Park (GA0037460)	152,205	13,870	3,805	152,205	13,870	3,805	0.00	0.00	0.00
Total	152,205	13,870	3,805	152,205	13,870	3,805	0	0	0

Table D-18

Tenmile Creek - Segment#18				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				3,111,107	73,293	8,749			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020802	3,416,643	80,491	9,608	3,111,107	73,293	8,749	8.94	8.94	8.94
Total	3,416,643	80,491	9,608	3,111,107	73,293	8,749	9	9	9

Table D-19

Toms Creek Segment #19				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				8,087,197	407,550	19,439			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102010502	3,720,627	212,440	9,943	3,247,816	185,444	8,679	12.71	12.71	12.71
031102010503	5,443,235	249,821	12,103	4,839,381	222,106	10,760	11.09	11.09	11.09
Total	9,163,862	462,261	22,045	8,087,197	407,550	19,439	12	12	12

Table D-20

Ty Ty Creek - Segment #20				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				7,518,520	213,039	28,668			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040201	2,800,705	59,543	8,067	1,996,097	42,437	5,749	28.73	28.73	28.73
031102040202	2,879,656	81,716	10,229	1,878,864	53,317	6,674	34.75	34.75	34.75
031102040203	2,142,849	76,617	9,086	1,190,531	42,567	5,048	44.44	44.44	44.44
031102040204	1,968,686	73,668	9,167	1,058,100	39,594	4,927	46.25	46.25	46.25
031102040205	2,083,303	54,602	7,914	1,337,942	35,066	5,083	35.78	35.78	35.78
Total	11,875,199	346,146	44,463	7,461,534	212,981	27,481	37	38	38
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Ty Ty WPCP (GA0025500)	56,986	58	1,187	56,986	58	1,187	0.00	0.00	0.00
Total	56,986	58	1,187	56,986	58	1,187	0	0	0

Table D-21

Warrior Creek - Segment #21				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				14,703,389	449,224	53,008			
Nonpoint Sources (LA)	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**
Contributing Subwatersheds	**Existing Loads**			**Allocation Loads (LA)**			**% Reduction**		
031102040301	3,128,211	96,242	11,732	2,297,104	70,672	8,615	26.57	26.57	26.57
031102040302	1,944,913	61,491	5,741	1,531,910	48,433	4,522	21.24	21.24	21.24
031102040303	2,417,967	76,352	8,776	1,789,819	56,517	6,496	25.98	25.98	25.98
031102040204	3,389,102	107,306	11,259	2,537,177	80,332	8,429	25.14	25.14	25.14
031102040305(a)	1,334,121	43,983	4,756	963,252	31,756	3,434	27.80	27.80	27.80
031102040305(b)	2,160,060	74,398	9,580	1,484,945	51,146	6,586	31.25	31.25	31.25
031102040306	2,866,184	71,783	9,682	2,210,822	55,369	7,468	22.87	22.87	22.87
031102040307	2,603,654	75,831	10,285	1,888,360	54,998	7,459	27.47	27.47	27.47
Total	19,844,210	607,385	71,810	14,703,389	449,224	53,008	26	26	26

Table D-22

West Fork Deep Creek - Segment #22				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				5,182,209	157,248	19,960			
Nonpoint Sources (LA)	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**
Contributing Subwatersheds	**Existing Loads**			**Allocation Loads (LA)**			**% Reduction**		
031102020203	3,028,969	88,490	10,470	2,329,886	68,066	8,054	23.08	23.08	23.08
031102020204(a)	1,951,416	78,018	9,260	1,340,008	53,574	6,359	31.33	31.33	31.33
031102020204(b)	1,933,334	46,249	6,539	1,487,476	35,583	5,031	23.06	23.06	23.06
Total	6,913,720	212,757	26,269	5,157,370	157,223	19,443	25	26	26
Point Sources (WLA)	**Existing Loads**			**Allocation Loads (WLA)**			**% Reduction**		
Regency Inn - Budget Inn (GA0031151)	14,612	15	304	14,612	15	304	0.00	0.00	0.00
Knights Inn (GA0023370)	10,228	10	213	10,228	10	213	0.00	0.00	0.00
Total	24,840	25	517	24,840	25	517	0	0	0

Table D-23

Withlacoochee River - Segment#23				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				10,823,557	291,935	38,545			
Nonpoint Sources (LA)	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**
Contributing Subwatersheds	**Existing Loads**			**Allocation Loads (LA)**			**% Reduction**		
031102040301	3,483,768	87,716	11,710	2,682,646	67,545	9,017	23.00	23.00	23.00
031102040302	2,840,938	73,747	10,213	2,147,599	55,749	7,721	24.41	24.41	24.41
031102040303	3,119,580	82,098	10,468	2,254,218	59,325	7,564	27.74	27.74	27.74
031102040204(a)	4,875,026	143,793	18,793	3,323,593	98,032	12,812	31.82	31.82	31.82
031102040204(b)	540,110	14,668	1,860	415,501	11,284	1,431	23.07	23.07	23.07
Total	14,859,421	402,022	53,044	10,823,557	291,935	38,545	27	27	27

Table D-24

Alapaha River- Segment#24				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				43,782,072	1,651,316	202,625			
Nonpoint Sources (LA)	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**	**TOC(lb/yr)**	**TN(lb/yr)**	**TP(lb/yr)**
Contributing Subwatersheds	**Existing Loads**			**Allocation Loads (LA)**			**% Reduction**		
031102020101	3,290,514	116,243	14,230	1,865,976	65,919	8,070	43.29	43.29	43.29
031102020102	2,628,280	97,583	11,734	1,458,030	54,134	6,509	44.53	44.53	44.53
031102020103	2,162,940	71,137	8,524	1,626,484	53,493	6,410	24.80	24.80	24.80
031102020104	2,724,953	100,153	13,087	1,915,262	70,394	9,198	29.71	29.71	29.71
031102020105	3,905,120	129,876	15,100	2,982,882	99,205	11,534	23.62	23.62	23.62
031102020106	2,801,304	114,607	13,621	1,953,550	79,924	9,499	30.26	30.26	30.26
031102020201	2,428,979	81,215	11,112	1,734,608	57,998	7,936	28.59	28.59	28.59
031102020202	3,075,613	114,450	15,336	2,197,084	81,758	10,955	28.56	28.56	28.56
031102020203	3,028,969	88,490	10,470	2,329,886	68,066	8,054	23.08	23.08	23.08
031102020204(a)	1,951,416	78,018	9,260	1,340,008	53,574	6,359	31.33	31.33	31.33
031102020204(b)	1,933,334	46,249	6,539	1,487,476	35,583	5,031	23.06	23.06	23.06
031102020205	6,958,631	331,420	39,036	4,397,671	209,448	24,670	36.80	36.80	36.80
031102020301(a)	1,550,135	55,773	7,492	1,123,369	40,419	5,429	27.53	27.53	27.53
031102020301(b)	1,096,312	25,840	2,733	875,495	20,635	2,182	20.14	20.14	20.14
031102020301(c)	244,827	7,093	488	204,520	5,925	408	16.46	16.46	16.46
031102020302	3,112,806	94,207	13,190	2,387,832	72,266	10,118	23.29	23.29	23.29
031102020303	3,965,529	119,717	14,433	3,210,191	96,914	11,684	19.05	19.05	19.05
031102020304	4,062,829	135,709	15,499	3,260,800	108,919	12,440	19.74	19.74	19.74
031102020305	2,736,688	111,700	11,800	2,038,342	83,197	8,789	25.52	25.52	25.52
031102020401	2,325,604	108,188	10,640	1,727,938	80,385	7,906	25.70	25.70	25.70
031102020402	3,617,693	103,664	14,176	2,946,748	84,438	11,547	18.55	18.55	18.55
Total	59,602,476	2,131,333	258,500	43,064,152	1,522,594	184,726	28	29	29
Point Sources (WLA)	**Existing Loads**			**Allocation Loads (WLA)**			**% Reduction**		
Ashburn WPCP (GA0025852)	706,231	128,711	17,656	706,231	128,711	17,656	0.00	0.00	0.00
Red Carpet Inn (GA0024465)	11,689	12	244	11,689	12	244	0.00	0.00	0.00
Total	717,921	128,722	17,899	717,921	128,722	17,899	0	0	0

Table D-25

Bear Creek Segment #25				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				4,632,470	259,169	34,668			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030402	4,522,508	140,102	18,501	3,798,779	117,681	15,540	16.00	16.00	16.00
Total	4,522,508	140,102	18,501	3,798,779	117,681	15,540	16	16	16
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Sparks WPCP (GA0021563)	93,352	11,342	3,501	93,352	11,342	3,501	0.00	0.00	0.00
Aluminum Fishing of GA (GA0000108)	1,948	59	244	1,948	59	244	0.00	0.00	0.00
Adel WPCP (GA0024911) *	738,390	130,086	15,383	738,390	130,086	15,383	0.00	0.00	0.00
Total	833,691	141,487	19,127	833,691	141,487	19,127	0	0	0

* HCR system with 3:1 (winter) and 6:1 (summer) discharge ratios of stream to pond. LAS when discharge ratio to stream cannot be met.

Table D-26

Big Creek - Segment#26				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,387,832	72,266	10,118			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020302	3,112,806	94,207	13,190	2,387,832	72,266	10,118	23.29	23.29	23.29
Total	3,112,806	94,207	13,190	2,387,832	72,266	10,118	23	23	23

Table D-27

Cow Creek - Segment #27				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				3,725,616	65,206	5,866			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020903	3,725,616	65,206	5,866	3,725,616	65,206	5,866	0.00	0.00	0.00
Total	3,725,616	65,206	5,866	3,725,616	65,206	5,866	0	0	0

Table D-28

Deep Creek -Segment #28				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				13,511,573	506,453	63,521			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020201	2,428,979	81,215	11,112	1,734,608	57,998	7,936	28.59	28.59	28.59
031102020202	3,075,613	114,450	15,336	2,197,084	81,758	10,955	28.56	28.56	28.56
031102020203	3,028,969	88,490	10,470	2,329,886	68,066	8,054	23.08	23.08	23.08
031102020204(a)	1,951,416	78,018	9,260	1,340,008	53,574	6,359	31.33	31.33	31.33
031102020204(b)	1,933,334	46,249	6,539	1,487,476	35,583	5,031	23.06	23.06	23.06
031102020205	6,958,631	331,420	39,036	4,397,671	209,448	24,670	36.80	36.80	36.80
Total	19,376,943	739,842	91,753	13,486,733	506,428	63,003	30	32	31
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Regency Inn - Budget Inn (GA0031151)	14,612	15	304	14,612	15	304	0.00	0.00	0.00
Knights Inn (GA0023370)	10,228	10	213	10,228	10	213	0.00	0.00	0.00
Total	24,840	25	517	24,840	25	517	0	0	0

Table D-29

Franks Creek - Segment#29				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				5,062,584	126,552	26,132			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040505	5,562,785	149,880	21,641	4,682,680	126,167	18,217	15.82	15.82	15.82
Total	5,562,785	149,880	21,641	4,682,680	126,167	18,217	16	16	16
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
DOT Rest Safety Area no 4 (GA0022055)	7,306	7	152	7,306	7	152	0.00	0.00	0.00
DOT Rest Safety Area no 3 (GA0022047)	7,306	7	152	7,306	7	152	0.00	0.00	0.00
Days Inn (GA0048909)	365,292	370	7,610	365,292	370	7,610	0.00	0.00	0.00
Total	379,904	385	7,915	379,904	385	7,915	0	0	0

Table D-30

Giddens Mills Creek - Segment#30				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				3,892,131	63,200	9,741			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030402	4,522,508	61,737	7,429	3,798,779	51,858	6,240	16.00	16.00	16.00
Total	4,522,508	61,737	7,429	3,798,779	51,858	6,240	16	16	16
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Sparks WPCP (GA0021563)	93,352	11,342	3,501	93,352	11,342	3,501	0.00	0.00	0.00
Total	93,352	11,342	3,501	93,352	11,342	3,501	0	0	0

Table D-31

Hardy Mill Creek - Segment#31				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				5,245,746	134,578	18,169			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030101	3,483,768	87,716	11,710	2,682,646	67,545	9,017	23.00	23.00	23.00
031102030102	2,840,938	73,747	10,213	2,147,599	55,749	7,721	24.41	24.41	24.41
031102030104(b)	540,110	14,668	1,860	415,501	11,284	1,431	23.07	23.07	23.07
Total	6,864,816	176,131	23,783	5,245,746	134,578	18,169	24	24	24

Table D-32

Horse Creek Segment #32				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,537,177	80,332	8,429			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040304	3,389,102	107,306	11,259	2,537,177	80,332	8,429	25.14	25.14	25.14
Total	3,389,102	107,306	11,259	2,537,177	80,332	8,429	25	25	25

Table D-33

Little Brushy Creek- Segment#33				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,896,552	93,520	12,740			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020603	3,751,672	121,129	16,502	2,896,552	93,520	12,740	22.79	22.79	22.79
Total	3,751,672	121,129	16,502	2,896,552	93,520	12,740	23	23	23

Table D-34

Little River - Segment#34				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				15,758,116	454,325	57,977			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040101	2,843,679	101,193	11,212	1,603,658	57,067	6,323	43.61	43.61	43.61
031102040102	2,051,737	55,456	7,586	1,334,537	36,071	4,934	34.96	34.96	34.96
031102040103	3,617,139	96,558	12,388	2,288,320	61,086	7,837	36.74	36.74	36.74
031102040104	2,928,036	107,668	14,280	1,452,127	53,397	7,082	50.41	50.41	50.41
031102040105	3,603,599	156,157	17,257	1,872,301	81,134	8,966	48.04	48.04	48.04
031102040106(a)	1,313,387	32,138	4,112	1,013,463	24,799	3,173	22.84	22.84	22.84
031102040106(b)	1,314,409	33,460	4,534	973,615	24,784	3,358	25.93	25.93	25.93
031102040106(c)	142,884	1,568	71	136,822	1,502	68	4.24	4.24	4.24
031102040107	2,690,047	61,737	7,429	2,159,709	49,566	5,965	19.71	19.71	19.71
031102040108	3,363,722	75,324	11,302	2,897,994	64,895	9,737	13.85	13.85	13.85
Total	23,868,640	721,259	90,172	15,732,546	454,299	57,444	34	37	36
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Magnolia Plantation (GA0033928)	25,570	26	533	25,570	26	533	0.00	0.00	0.00
Total	25,570	26	533	25,570	26	533	0	0	0

Table D-35

Negro Branch Segment #35				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				2,182,159	70,597	9,621			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030703	2,680,642	86,724	11,819	2,182,159	70,597	9,621	18.60	18.60	18.60
Total	2,680,642	86,724	11,819	2,182,159	70,597	9,621	19	19	19

Table D-36

New River - Segment #36				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				13,998,770	925,518	223,383			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030201	9,176,782	488,889	52,866	5,880,447	313,278	33,876	35.92	35.92	35.92
031102030202	3,416,409	114,276	14,861	2,308,137	77,205	10,040	32.44	32.44	32.44
031102030203(b)	4,632,254	138,832	21,769	3,177,648	95,236	14,933	31.40	31.40	31.40
Total	17,225,445	741,997	89,496	11,366,232	485,720	58,850	34	35	34
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Tifton New River WPCP (GA0048470)	2,632,538	439,798	164,534	2,632,538	439,798	164,534	0.00	0.00	0.00
Total	2,632,538	439,798	164,534	2,632,538	439,798	164,534	0	0	0

Table D-37

New River - Segment #37				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				18,221,206	1,030,510	239,585			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030201	9,176,782	488,889	52,866	5,880,447	313,278	33,876	35.92	35.92	35.92
031102030202	3,416,409	114,276	14,861	2,308,137	77,205	10,040	32.44	32.44	32.44
031102030203(a)	1,458,810	40,609	6,587	1,017,985	28,338	4,597	30.22	30.22	30.22
031102030203(b)	4,632,254	138,832	21,769	3,177,648	95,236	14,933	31.40	31.40	31.40
031102030204	4,270,282	102,150	15,465	3,204,451	76,654	11,605	24.96	24.96	24.96
Total	22,954,537	884,756	111,549	15,588,668	590,712	75,052	32	33	33
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Tifton New River WPCP (GA0048470)	2,632,538	439,798	164,534	2,632,538	439,798	164,534	0.00	0.00	0.00
Total	2,632,538	439,798	164,534	2,632,538	439,798	164,534	0	0	0

Table D-38

Okapilco Creek-Segment#38				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				3,622,475	107,764	12,990			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030501	4,244,144	120,053	15,912	3,464,795	98,008	12,990	18.36	18.36	18.36
Total	4,244,144	120,053	15,912	3,464,795	98,008	12,990	18	18	18
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Premium Pork (GA0000175)	157,680	9,756	0	157,680	9,756	0	0.00	0.00	0.00
Total	157,680	9,756	0	157,680	9,756	0	0	0	0

Table D-39

Okapilco Creek - Segment#39				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				5,395,811	146,171	19,355			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030501	4,244,144	120,053	15,912	3,464,795	98,008	12,990	18.36	18.36	18.36
031102030502(b)	2,237,944	48,469	8,033	1,773,336	38,407	6,365	20.76	20.76	20.76
Total	6,482,088	168,522	23,945	5,238,131	136,415	19,355	19	19	19
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Premium Pork (GA0000175)	157,680	9,756	0	157,680	9,756	0	0.00	0.00	0.00
Total	157,680	9,756	0	157,680	9,756	0	0	0	0

Table D-40

Okapilco Creek- Segment#40				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				26,845,935	793,837	122,708			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030501	4,244,144	120,053	15,912	3,464,795	98,008	12,990	18.36	18.36	18.36
031102030502(a)	3,844,303	123,892	21,673	2,696,297	86,895	15,201	29.86	29.86	29.86
031102030502(b)	2,237,944	48,469	8,033	1,773,336	38,407	6,365	20.76	20.76	20.76
031102030503	4,393,555	127,752	21,159	3,187,647	92,688	15,351	27.45	27.45	27.45
031102030504	5,422,113	190,459	31,860	3,733,447	131,142	21,938	31.14	31.14	31.14
031102030601(a)	2,696,250	77,550	13,365	2,001,463	57,567	9,921	25.77	25.77	25.77
031102030601(b)	1,931,506	51,961	8,304	1,490,267	40,091	6,407	22.84	22.84	22.84
031102030601(c)	2,216,464	58,398	9,605	1,696,257	44,692	7,351	23.47	23.47	23.47
031102030602	3,673,463	99,638	13,496	2,916,717	79,113	10,716	20.60	20.60	20.60
031102030603(a)	1,665,645	46,389	6,091	1,249,776	34,807	4,570	24.97	24.97	24.97
031102030603(b)	3,530,881	125,869	16,551	2,535,083	90,371	11,883	28.20	28.20	28.20
031102030603(c)	50,331	28	7	49,082	28	7	2.48	2.48	2.48
031102030603(d)	53,144	31	8	51,767	30	8	2.59	2.59	2.59
Total	35,959,741	1,070,490	166,064	26,845,935	793,837	122,708	25	26	26

Table D-41

Reedy Creek - Segment #41				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				4,227,020	128,002	18,544			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020601	2,822,624	94,432	12,651	2,160,581	72,283	9,684	23.45	23.45	23.45
031102020602	2,660,202	71,730	11,405	2,066,439	55,719	8,860	22.32	22.32	22.32
Total	5,482,827	166,161	24,057	4,227,020	128,002	18,544	23	23	23

Table D-42

Sand Creek - Segment #42				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				3,210,191	96,914	11,684			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020303	3,965,529	119,717	14,433	3,210,191	96,914	11,684	19.05	19.05	19.05
Total	3,965,529	119,717	14,433	3,210,191	96,914	11,684	19	19	19

Table D-43

Town Creek - Segment #43				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				1,531,910	48,433	4,522			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040302	1,944,913	61,491	5,741	1,531,910	48,433	4,522	21.24	21.24	21.24
Total	1,944,913	61,491	5,741	1,531,910	48,433	4,522	21	21	21

Table D-44

Tributary to Withlacoocheee -Segment #44				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				415,501	58,336	7,912			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102030104(c)	540,110	75,831	10,285	415,501	58,336	7,912	23.07	23.07	23.07
Total	540,110	75,831	10,285	415,501	58,336	7,912	23	23	23

Table D-45

Ty Ty Creek - Segment #45				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				6,180,578	177,972	23,586			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040201	2,800,705	59,543	8,067	1,996,097	42,437	5,749	28.73	28.73	28.73
031102040202	2,879,656	81,716	10,229	1,878,864	53,317	6,674	34.75	34.75	34.75
031102040203	2,142,849	76,617	9,086	1,190,531	42,567	5,048	44.44	44.44	44.44
031102040204	1,968,686	73,668	9,167	1,058,100	39,594	4,927	46.25	46.25	46.25
Total	9,791,896	291,544	36,549	6,123,592	177,915	22,398	37	39	39
Point Sources (WLA)	Existing Loads			Allocation Loads (WLA)			% Reduction		
Ty Ty WPCP (GA0025500)	56,986	58	1,187	56,986	58	1,187	0.00	0.00	0.00
Total	56,986	58	1,187	56,986	58	1,187	0	0	0

Table D-46

Warrior Creek - Segment #46				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				12,815,030	394,225	45,549			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102040301	3,128,211	96,242	11,732	2,297,104	70,672	8,615	26.57	26.57	26.57
031102040302	1,944,913	61,491	5,741	1,531,910	48,433	4,522	21.24	21.24	21.24
031102040303	2,417,967	76,352	8,776	1,789,819	56,517	6,496	25.98	25.98	25.98
031102040304	3,389,102	107,306	11,259	2,537,177	80,332	8,429	25.14	25.14	25.14
031102040305(a)	1,334,121	43,983	4,756	963,252	31,756	3,434	27.80	27.80	27.80
031102040305(b)	2,160,060	74,398	9,580	1,484,945	51,146	6,586	31.25	31.25	31.25
031102040306	2,866,184	71,783	9,682	2,210,822	55,369	7,468	22.87	22.87	22.87
Total	17,240,557	531,554	61,525	12,815,030	394,225	45,549	26	26	26

Table D-47

Willacoochee River - Segment #47				TMDL = WLA + LA					
				TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)			
				5,627,463	199,007	24,502			
Nonpoint Sources (LA)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)	TOC(lb/yr)	TN(lb/yr)	TP(lb/yr)
Contributing Subwatersheds	Existing Loads			Allocation Loads (LA)			% Reduction		
031102020501	2,544,969	90,645	12,538	1,597,647	56,904	7,871	37.22	37.22	37.22
031102020502	1,983,582	84,108	8,421	1,350,658	57,271	5,734	31.91	31.91	31.91
031102020503	4,339,859	137,415	17,652	2,679,158	84,831	10,897	38.27	38.27	38.27
Total	8,868,410	312,169	38,610	5,627,463	199,007	24,502	37	36	37