Total Maximum Daily Load

Evaluation

for

Nine Stream Segments

in the

Chattahoochee River Basin

for

Fecal Coliform

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

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

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EXECUTIVE SUMMARY

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

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDLs in this document are based on the 2006 303(d) listing, which is available on the GA EPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

The State of Georgia has identified nine stream segments located in the Chattahoochee River Basin as water quality limited due to fecal coliform bacteria. A stream is placed on the partial support list if more than 10% of the samples exceed the fecal coliform criteria and on the not support list if more than 25% of the samples exceed the standard. Water quality samples collected within a 30-day period that have a geometric mean in excess of 200 counts per 100 milliliters during the period May through October, or in excess of 1,000 counts per 100 milliliters during the period November through April, are in violation of the bacteria water quality standard. There is also a single sample maximum criteria (4,000 counts per 100 milliliters) for the months of November through April. The water use classification of the impacted streams is Fishing, with the exception of the Chattahoochee River from Johns Creek to Morgan Falls Dam, which is classified as Recreation and Drinking Water.

An important part of the TMDL analysis is the identification of potential source categories. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulated fecal coliform bacteria that wash off land surfaces as a result of storm events.

The process of developing fecal coliform bacteria TMDLs for the Chattahoochee River Basin listed segments includes the determination of the following:

- The current critical fecal coliform load to the stream under existing conditions;
- The TMDL for similar conditions under which the current critical load was determined; and
- The percent reduction in the current critical fecal coliform load necessary to achieve the TMDL.

The calculation of the fecal coliform load at any point in a stream requires the fecal coliform concentration and stream flow. The availability of water quality and flow data varies considerably among the listed segments. The Loading Curve Approach was used to determine

the current fecal coliform load and TMDL. The fecal coliform loads and required reductions for each of the listed segments are summarized in the table below.

Management practices that may be used to help reduce fecal coliform source loads include:

- Compliance with NPDES permit limits and requirements;
- Adoption of NRCS Conservation Practices; and
- Application of Best Management Practices (BMPs) appropriate to reduce nonpoint sources.

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

Fecal Coliform Loads and Required Fecal Coliform Load Reductions

Stream Segment	Current Load (counts/ 30 days)	TMDL Components					Percent Reduction
		WLA (counts/ 30 days)[1]	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Chattahoochee River Soquee River to Mossy Creek	4.80E+16			1.80E+15	2.00E+14	2.00E+15	96
Chattahoochee River Mossy Creek to Lake Lanier	1.26E+15	1.96E+09		1.29E+14	1.43E+13	1.43E+14	89
Chattahoochee River Johns Creek to Morgan Falls	1.23E+15	1.86E+12	3.31E+14	1.46E+14	5.32E+13	5.32E+14	57
Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	2.39E+16	6.01E+11	1.29E+15	8.99E+15	1.14E+15	1.14E+16	52
East Fork Little River	4.66E+14		8.75E+11	2.71E+13	3.11E+12	3.11E+13	93
Little Mud Creek	1.26E+13	1.96E+09		4.81E+12	5.35E+11	5.35E+12	58
Mud Creek	1.16E+13	1.18E+11		4.31E+12	4.92E+11	4.92E+12	58
Soquee River	1.67E+16	2.96E+10		3.44E+15	3.83E+14	3.83E+15	77
Yahoola Creek	5.98E+14	2.65E+09		5.98E+13	6.65E+12	6.65E+13	89

Notes: [1] The assigned fecal coliform load from each NPDES permitted facility for WLA was determined as the product of the fecal coliform permit limit and the facility average monthly discharge at the time of the critical load.

1.0 INTRODUCTION

1.1 Background

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

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDLs in this document are based on the 2006 303(d) listing, which is available on the GA EPD website. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality based controls to be developed to reduce pollution and restore and maintain water quality.

The list identifies the waterbodies as either partially supporting or not supporting their designated use classifications, due to exceedances of water quality standards for fecal coliform bacteria. Fecal coliform bacteria are used as an indicator of the potential presence of pathogens in a stream. Table 1 presents the nine streams of the Chattahoochee River Basin included on the 2006 303(d) list for exceedances of the fecal coliform standard criteria. Four streams segment were listed as partially supporting their designated use and five stream segments were listed as not supporting their designated use on the 2006 303(d) list.

1.2 Watershed Description

The Chattahoochee River Basin is located primarily in west Georgia and east Alabama, with a small portion also occuring in north Florida. It occupies an area of 8,770 square miles, of which 6,140 square miles (70%) lie in Georgia. The Chattahoochee River basin falls within the Level III Blue Ridge, Piedmont, and Coastal Plain Ecoregions that extend throughout the southeastern United States.

The Chattahoochee River basin includes four United States Geologic Survey (USGS) eight-digit hydrologic units, HUC 03130001 – 03130004. The Chattahoochee River originates in the southeast corner of Union County, in north Georgia, within the Blue Ridge Mountains. The river flows southwest to Lake Sidney Lanier, then through the Atlanta metropolitan area to West Point Lake on the Alabama border. At this point, the Chattahoochee forms the border between Georgia and Alabama. It continues flowing south through Walter F. George Reservoir and converges with the Flint River in Lake Seminole, at the Georgia-Florida border. The outflow from Lake Seminole forms the Apalachicola River in Florida, which ultimately discharges to the Gulf of Mexico. Figure 1 shows the locations of the four hydrologic units in the Chattahoochee River Basin. Figures 2 and 3 show the locations of the listed segments and associated counties in HUCs 03130001 and 03130003.

Table 1. Water Bodies Listed on the 2006 303(d) List for Fecal Coliform Bacteria in the Chattahoochee River Basin

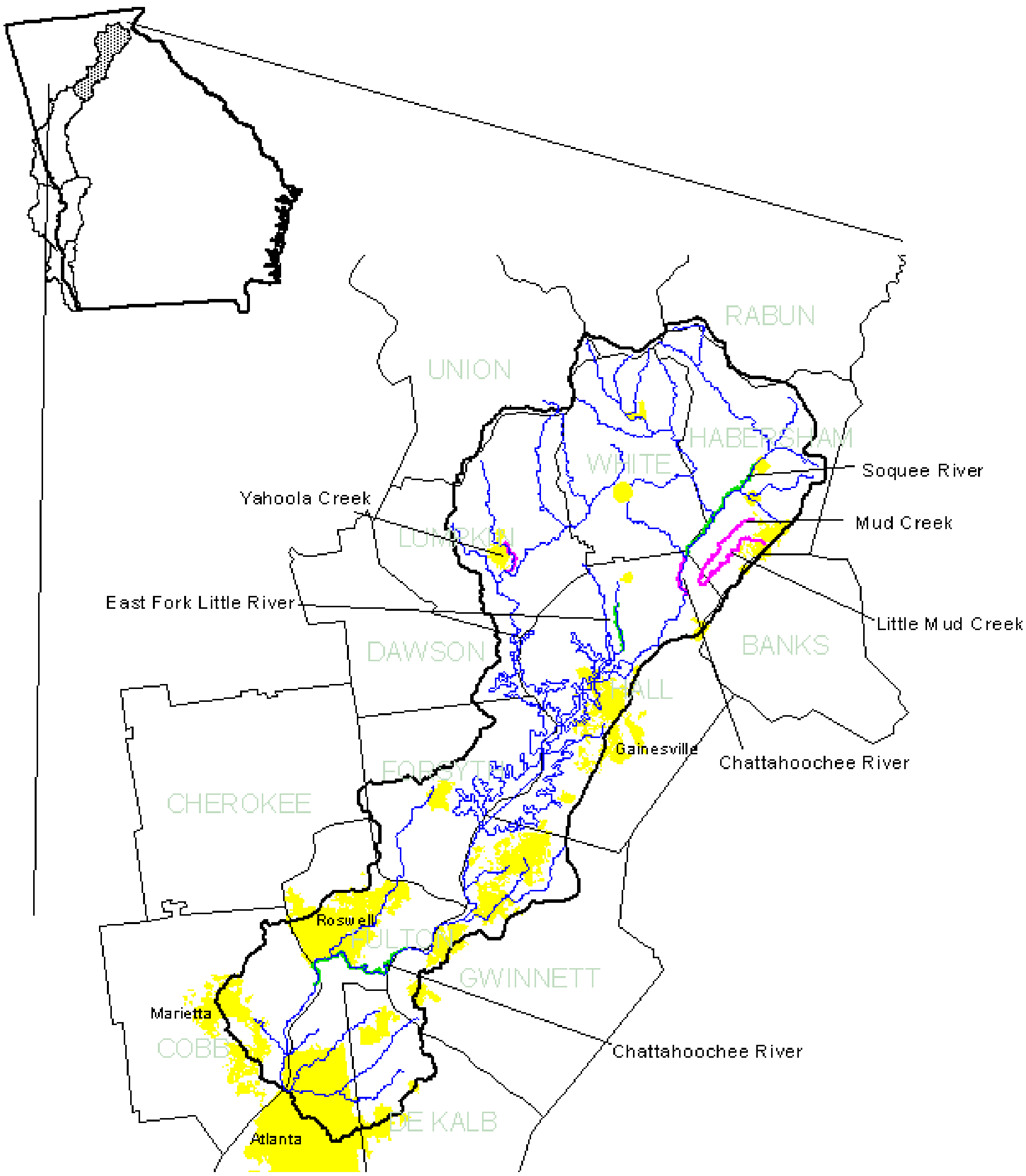
Stream Segment	Location	Segment Length (miles)	Designated Use	Listing
Chattahoochee River	Soquee River to Mossy Creek (Habersham/White/ Hall Co)	5	Recreation	PS
Chattahoochee River	Mossy Creek to Lake Lanier (Hall Co)	8	Recreation	NS
Chattahoochee River	Johns Creek to Morgan Falls Dam (Gwinnett/Fulton/Cobb Co)	17	Recreation/ Drinking Water	PS
Chattahoochee River	Chattahoochee/Stewart Co. line to Hannahatchee Ck (Stewart Co)	10	Fishing	NS
East Fork Little River	Downstream Hwy 52 to Lake Lanier (Hall Co)	6	Fishing	PS
Little Mud Creek	Headwaters to Mud Creek (Habersham/Hall Co)	11	Fishing	NS
Mud Creek	Headwaters to Little Mud Creek (Habersham/Hall Co)	13	Fishing	NS
Soquee River	SR17, Clarkesville to Chattahoochee River (Habersham Co)	6	Fishing	PS
Yahoola Creek	U.S. 19/SR 60 to Chestatee River (Lumpkin Co)	9	Fishing	NS

Notes: PS = Partially Supporting designated uses
NS = Not Supporting designated uses

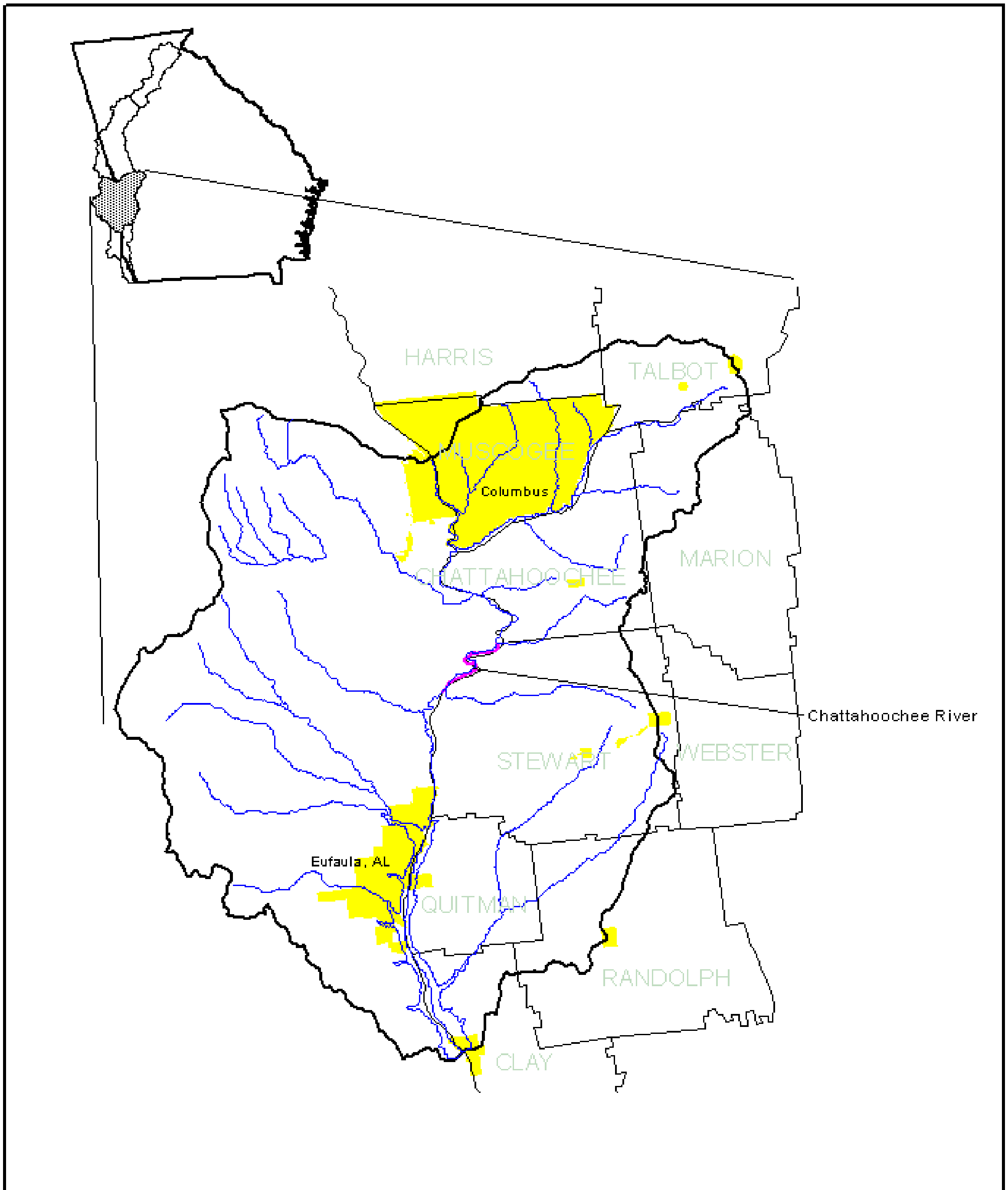
The land use characteristics of the Chattahoochee River Basin watersheds were determined using data from the National Land Cover Dataset (NLCD) for Georgia. This coverage was produced from Landsat Thematic Mapper digital images developed in 2001. Land use classification is based on a modified Anderson level one and two system. Table 2 lists the watershed land coverage distribution of the nine stream segments.

TMDL Evaluation - Fecal Coliform
Chattahoochee River Basin

Figure 1. USGS 8-Digit HUCs for Chattahoochee River Basin



TMDL Evaluation - Fecal Coliform Chattahoochee River Basin	Figure 2. 303(d) Listed Stream Segments in HUC 03130001



TMDL Evaluation - Fecal Coliform
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Figure 3. 303(d) Listed Stream Segment in HUC 03130003

Table 2. Chattahoochee River Basin Land Coverage

Stream/Segment	Landuse Categories - Acres (Percent)												
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial, Industrial, Transportation	Bare Rock, Sand, Clay	Quarries, Strip Mines, Gravel Pits	Forest	Row Crops	Pasture, Hay	Other Grasses (Urban, recreational; e.g. parks, lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total
Chattahoochee River Soquee River to Mossy Creek	1,116 (0.5)	2,450 (1.1)	760 (0.4)	218 (0.1)	661 (0.3)	172 (0.1)	15,3678 (71.9)	46 (0.0)	39,390 (18.4)	14,841 (6.9)	317 (0.1)	0 (0.0)	213,649 (100.0)
Chattahoochee River Mossy Creek to Lake Lanier	1,267 (0.5)	2,794 (1.2)	935 (0.4)	263 (0.1)	840 (0.4)	172 (0.1)	16,8052 (70.1)	46 (0.0)	48,467 (20.2)	16,552 (6.9)	358 (0.1)	1 (0.0)	239,747 (100.0)
Chattahoochee River Johns Creek to Morgan Falls Dam	2,518 (1.5)	38,715 (23.1)	11,390 (6.8)	4,616 (2.8)	1,638 (1.0)	251 (0.1)	53,730 (32.0)	11 (0.0)	13,952 (8.3)	37,263 (22.2)	3,597 (2.1)	1 (0.0)	167,682 (100.0)
Chattahoochee River Chattahoochee/ StewartCo. line to Hannahatchee Creek	11,131 (1.4)	34,954 (4.3)	8,953 (1.1)	3,919 (0.5)	5,496 (0.7)	1,552 (0.2)	533,590 (65.2)	25,643 (3.1)	102,291 (12.5)	49,300 (6.0)	39,477 (4.8)	1,737 (0.2)	818,043 (100.0)
East Fork Little River	33 (0.3)	236 (2.0)	31 (0.3)	7 (0.1)	63 (0.5)	0 (0.0)	5,619 (48.2)	0 (0.0)	4,870 (41.8)	770 (6.6)	15 (0.1)	0 (0.0)	11,646 (100.0)
Little Mud Creek	6 (0.0)	991 (8.1)	316 (2.6)	117 (1.0)	78 (0.6)	0 (0.0)	5,321 (43.3)	0 (0.0)	3,788 (30.8)	1,595 (13.0)	75 (0.6)	0 (0.0)	12,289 (100.0)
Mud Creek	17 (0.2)	630 (5.6)	207 (1.8)	150 (1.3)	73 (0.6)	0 (0.0)	5,930 (52.4)	0 (0.0)	3,281 (29.0)	978 (8.6)	44 (0.4)	0 (0.0)	11,310 (100.0)
Soquee River	517 (0.5)	1,760 (1.7)	593 (0.6)	182 (0.2)	303 (0.3)	69 (0.1)	65,197 (63.8)	42 (0.0)	24,922 (24.4)	8,449 (8.3)	220 (0.2)	0 (0.0)	102,254 (100.0)
Yahoola Creek	34 (0.2)	314 (1.4)	98 (0.4)	31 (0.1)	97 (0.4)	0 (0.0)	17,701 (80.2)	0 (0.0)	2,371 (10.7)	1,411 (6.4)	5 (0.0)	0 (0.0)	22,061 (100.0)

1.3 Water Quality Standard

The water use classification for the listed stream segments in the Chattahoochee River Basin is Drinking Water, Recreation and/or Fishing. The criterion violated is listed as fecal coliform. The potential cause(s) listed include urban runoff, nonpoint sources, and municipal facilities. The use classification water quality standards for fecal coliform bacteria, as stated in the *State of Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c)(iii) (GA EPD, 2005), are:

a) Drinking Water Supplies: Those waters approved as a source for public drinking water systems permitted or to be permitted by the Environmental Protection Division. Waters classified for drinking water supplies will also support the fishing use and any other use requiring water of a lower quality.

(i) Bacteria: For the months of May through October, when water contact recreation activities are expected to occur, fecal coliform not to exceed a geometric mean of 200 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams. For the months of November through April, fecal coliform not to exceed a geometric mean of 1,000 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100 ml for any sample. The State does not encourage swimming in surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of fecal coliform.

(b) Recreation: General recreational activities such as water skiing, boating, and swimming, or for any other use requiring water of a lower quality, such as recreational fishing. These criteria are not to be interpreted as encouraging water contact sports in proximity to sewage or industrial waste discharges regardless of treatment requirements:

(i) Bacteria: Fecal coliform not to exceed the following geometric means based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours:

(1) Coastal waters 100 per 100 ml

(2) All other recreational waters 200 per 100 ml

(3) Should water quality and sanitary studies show natural fecal coliform levels exceed 200/100 ml (geometric mean) occasionally in high quality recreational waters, then the allowable geometric mean fecal coliform level shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing fresh water streams.

(c) Fishing: Propagation of Fish, Shellfish, Game and Other Aquatic Life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality:

(iii) Bacteria: For the months of May through October, when water contact recreation activities are expected to occur, fecal coliform not to exceed a geometric mean of 200 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams. For the months of November through April, fecal coliform not to exceed a geometric mean of 1,000 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100 ml for any sample. The State does not encourage swimming in surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of fecal coliform. For waters designated as approved shellfish harvesting waters by the appropriate State agencies, the requirements will be consistent with those established by the State and Federal agencies responsible for the National Shellfish Sanitation Program. The requirements are found in the National Shellfish Sanitation Program Manual of Operation, Revised 1988, Interstate Shellfish Sanitation Conference, U. S. Department of Health and Human Services (PHS/FDA), and the Center for Food Safety and Applied Nutrition. Streams designated as generally supporting shellfish are listed in Paragraph 391-3-6-.03(14).

2.0 WATER QUALITY ASSESSMENT

Stream segments are placed on the 303(d) list as partially supporting or not supporting their water use classification based on water quality sampling data. A stream is placed on the partial support list if more than 10% of the samples exceed the fecal coliform criteria and on the not support list if more than 25% of the samples exceed the standard. Water quality samples collected within a 30-day period that have a geometric mean in excess of 200 counts per 100 milliliters during the period May through October, or in excess of 1000 counts per 100 milliliters during the period November through April, are in violation of the bacteria water quality standard. There is also a single sample maximum criterion (4000 counts per 100 milliliters) for the months of November through April.

Fecal coliform data were collected during calendar years 2001 and 2005 by the Georgia Environmental Protection Division (GA EPD) as part of the trend monitoring program.

These sources contained enough information to calculate a 30-day geometric mean. The data used for these TMDLs are presented in Appendix A.

3.0 SOURCE ASSESSMENT

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

3.1 Point Source Assessment

Title IV of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permit program. Basically, there are two categories of NPDES permits: 1) municipal and industrial wastewater treatment facilities, and 2) regulated storm water discharges.

3.1.1 Wastewater Treatment Facilities

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

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

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

Discharges municipal and industrial wastewater treatment facilities can contribute fecal coliform to receiving waters. There are 11 NPDES permitted discharges with flows greater than 0.1 MGD identified in the Chattahoochee River Basin that discharge treated municipal wastewater and that potentially impact streams on the 2006 303(d) list for fecal coliform bacteria. Table 3 provides the monthly average discharge flows and fecal coliform concentrations for the municipal and industrial treatment facilities, obtained from calendar year 2005 Discharge Monitoring Report (DMR) data. The permitted flow and fecal coliform concentrations for these facilities are also included in this table.

Combined sewer systems convey a mixture of raw sewage and storm water in the same conveyance structure to the wastewater treatment plant. These are considered a component of municipal wastewater treatment facilities. When the combined sewage exceeds the capacity of the wastewater treatment plant, the excess is diverted to a combined sewage overflow (CSO) discharge point. The CSOs are permitted to discharge only under high flow conditions with the WPCP facilities operating at full capacity.

Table 3. NPDES Facilities Discharging Fecal Coliform Bacteria into Chattahoochee River Basin 303(d) Listed Stream Segments

Facility Name	NPDES Permit No.	Receiving Stream	Actual 2003 Discharge		NPDES Permit Limits		Number of fecal coliform Violations 2003 –2005
			Average Monthly Flow (MGD)[1]	Geometric Mean (No./100 mL)[2]	Average Monthly Flow (MGD)	Average Monthly FC (No./100mL)	
Baldwin WPCP	GA0033243	Little Mud Creek	0.39	1.6	0.8	200	2
Clarkesville WPCP	GA0032514	Soquee River	0.31	16.4	0.75	200	
Columbus South	GA0020516	Chattahoochee River	34.48	16.3	42	200	
Columbus-Ft Benning WPCP 1	GA0000973	Chattahoochee River	2.11	33.6	4.6	200	
Columbus-Ft Benning WPCP 2	GA0000973	Chattahoochee River	1.70	21.6	3.8	200	
Cornelia WPCP	GA0021504	South Fork Little Mud Cr	2.35	3.1	3	200	
Dahlonega WPCP	GA0026077	Yahoola Creek Tributary	0.52	4.8	1.44	200	
Demorest WPCP	GA0032506	Hazel Creek Tributary	0.25	50.6	0.4	200	
Fulton Co Big Creek	GA0024333	Chattahoochee River	23.31[3] 23.25[4]	30.0[3] 18.4[4]	24	100[3] 200[4]	
Fulton Co Johns Creek	GA0030686	Chattahoochee River	5.01	16.2	7	200	
Gwinnett Co Crooked Cr/North	GA0026433	Chattahoochee River	18.08	1.2	36	23	

Source: GA EPD Regional Offices

Notes: [1] Values shown are the annual average of the monthly average flows.
[2] Values shown are the annual average of the monthly geometric means.
[3] Seasonal fecal coliform limit 100 cnts/100 ml
[4] Seasonal fecal coliform limit 200 cnts/100 ml

Four NPDES-permitted CSOs are located within the City of Atlanta, but do not discharge into streams in the Chattahoochee River Basin that are 303(d) listed for fecal coliform bacteria. Two NPDES-permitted CSOs are located in the City of Columbus, Georgia, and discharge directly into the Chattahoochee River. These CSOs are treated by chlorination. The permitted CSOs in the 303(d) listed segments are provided in Table 4.

Table 4. Permitted Combined Sewer Overflows (CSOs) in the Chattahoochee River Basin 303(d) Listed Stream Segments

Municipality/County	Permit No.	Facility Name	Receiving Stream
Columbus/Muscogee	GA0036838	Uptown Park – 19th Street	Chattahoochee River
Columbus/Muscogee	GA0036838	South Commons – State Docks	Chattahoochee River

Source: Permitting and Compliance Program, Environmental Protection Division, GA EPD, 2002

3.1.2 Regulated Storm Water Discharges

Some storm water runoff is covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe limits, storm water NPDES permits establish controls “to the maximum extent practicable” (MEP). Currently, regulated storm water discharges that may contain fecal coliform bacteria consist of those associated with industrial activities including construction sites disturbing one acre or greater, and large, medium, and small municipal separate storm sewer systems (MS4s) that serve populations of 50,000 or more.

Storm water discharges associated with industrial activities are currently covered under a General Storm Water NPDES Permit. This permit requires visual monitoring of storm water discharges, site inspections, implementation of Best Management Practices (BMPs), and record keeping.

Storm water discharges from MS4s are very diverse in pollutant loadings and frequency of discharge. At present, all cities and counties within the state of Georgia that had a population of greater than 100,000 at the time of the 1990 Census, are permitted for their storm water discharge under Phase I. This includes 60 permittees in Georgia, with about 45 located in the greater Atlanta metro area.

Phase I MS4 permits require the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990). A site-specific Storm Water Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. There are twenty-eight Phase I MS4s in the Chattahoochee River Basin (Table 5).

Table 5. Phase I Permitted MS4s in the Chattahoochee River Basin

Name	Permit No.	Watershed
Alpharetta	GAS000102	Chattahoochee
Atlanta	GAS000100	Chattahoochee, Flint, Ocmulgee
Austell	GAS000103	Chattahoochee
Berkley Lake	GAS000138	Chattahoochee
Buford	GAS000104	Chattahoochee
Chamblee	GAS000105	Chattahoochee
Clarkston	GAS000106	Chattahoochee, Ocmulgee
Cobb County	GAS000108	Chattahoochee, Coosa
College Park	GAS000109	Chattahoochee, Flint
Columbus Consolidated	GAS000202	Chattahoochee
Decatur	GAS000110	Chattahoochee, Ocmulgee
DeKalb County	GAS000111	Chattahoochee, Ocmulgee
Doraville	GAS000113	Chattahoochee
Duluth	GAS000112	Chattahoochee, Ocmulgee
East Point	GAS000114	Chattahoochee, Flint, Ocmulgee
Fairburn	GAS000115	Chattahoochee, Flint
Forsyth County	GAS000300	Chattahoochee, Coosa
Fulton County	GAS000117	Chattahoochee, Ocmulgee, Coosa, Flint
Gwinnett County	GAS000118	Chattahoochee, Ocmulgee, Oconee
Marietta	GAS000125	Chattahoochee, Coosa
Norcross	GAS000127	Chattahoochee, Ocmulgee
Palmetto	GAS000128	Chattahoochee, Flint
Powder Springs	GAS000129	Chattahoochee
Roswell	GAS000131	Chattahoochee, Coosa
Smyrna	GAS000132	Chattahoochee
Sugar Hill	GAS000135	Chattahoochee
Suwanee	GAS000144	Chattahoochee, Ocmulgee
Union City	GAS000136	Chattahoochee, Flint

Source: Nonpoint Source Permitting Program, GA DNR, 2007

As of March 10, 2003, small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an area with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty counties and 56 communities are permitted under the Phase II regulations in Georgia. There are twelve counties or communities located in the Chattahoochee River Basin that are covered by the Phase II General Storm Water Permit (Table 6).

Table 6. Phase II Permitted MS4s in the Chattahoochee River Basin

Name	Permit No.	Watershed
Cumming	GAG610000	Chattahoochee
Dallas	GAG610000	Chattahoochee, Coosa
Douglas County	GAG610000	Chattahoochee
Douglasville	GAG610000	Chattahoochee
Flowery Branch	GAG610000	Chattahoochee
Gainesville	GAG610000	Chattahoochee, Oconee
Hall County	GAG610000	Chattahoochee, Oconee
Hiram	GAG610000	Chattahoochee
Newnan	GAG610000	Chattahoochee, Flint
Oakwood	GAG610000	Chattahoochee, Oconee
Paulding County	GAG610000	Chattahoochee, Coosa, Tallapoosa
Sandy Springs	GAG610000	Chattahoochee

Source: Nonpoint Source Permitting Program, GA DNR, 2007

Those watersheds located within Phase I or Phase II MS4 city or county urbanized areas are listed in Table 7. The table provides the total area of each of these watersheds, and the percentage of the watersheds that is MS4 city or county urbanized area.

Table 7. Percentage of Watersheds Located in MS4 City or County Urbanized Areas

Name	Total Area (acres)	% in MS4 area
Chattahoochee River Johns Creek to Morgan Falls	167,682	99.2
Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	818,043	18.0
East Fork Little River	11,646	4.5

3.1.3 Confined Animal Feeding Operations

Confined livestock and confined animal feeding operations (CAFOs) are characterized by high animal densities. This results in large quantities of fecal material being contained in a limited area. Processed agricultural manure from confined hog, dairy cattle, and select poultry operations is generally collected in lagoons. It is then applied to pastureland and cropland as a fertilizer during the growing season, at rates that often vary monthly.

In 1990, the State of Georgia began registering CAFOs. Many of the CAFOs were issued land application or NPDES permits for treatment of wastewaters generated from their operations. The type of permit issued depends on the operation size (i.e., number of animal units). Table 8 presents the swine and non-swine (primarily dairies) CAFOs located in the Chattahoochee River Basin that are registered or have land application permits.

Table 8. Registered CAFOs in the Chattahoochee River Basin

Name	County	Animal Type	Total No. of Animals	Permit No.
Buckhorn Branch Farms	Habersham	Swine	2,100	GAU700000
Elmer Truelove Dairy Inc.	Hall	Dairy	150	GAU700000
Gilcrest Farms	Habersham	Swine	1,900	GAU700000
Lee Arrendale State Prison Swine Unit	Habersham	Swine	4,000	GAU700000
McClure Hog Farm	Lumpkin	Swine	2,000	GAU700000
R & R Farm #4	White	Swine	1,600	GAU700000
R & R Farm 1 & 2	White	Swine	1,600	GAU700000

Source: GA Dept. of Agriculture, 2006

3.2 Nonpoint Source Assessment

In general, nonpoint sources cannot be identified as entering a waterbody through a discrete conveyance at a single location. Typical nonpoint sources of fecal coliform bacteria include:

- Wildlife
- Agricultural Livestock
  - Animal grazing
  - Animal access to streams
  - Application of manure to pastureland and cropland
- Urban Development
  - Leaking sanitary sewer lines
  - Leaking septic systems
  - Land Application Systems
  - Landfills

In urban areas, a large portion of storm water runoff may be collected in storm sewer systems and discharged through distinct outlet structures. For large urban areas, these storm sewer discharge points may be regulated as described in Section 3.1.2.

3.2.1 Wildlife

The importance of wildlife as a source of fecal coliform bacteria in streams varies considerably, depending on the animal species present in the subwatersheds. Based on information provided by the Wildlife Resources Division (WRD) of GA DNR, the animals that spend a large portion of their time in or around aquatic habitats are the most important wildlife sources of fecal coliform. Waterfowl, most notably ducks and geese, are considered to potentially be the greatest contributors of fecal coliform. This is because they are typically found on the water surface, often in large numbers, and deposit their feces directly into the water. Other potentially important animals regularly found around aquatic environments include racoons, beavers, muskrats, and to a lesser extent, river otters and minks. Recently, rapidly expanding feral swine populations have become a significant presence in the floodplain areas of all the major rivers in Georgia. Population estimates of these animal species in Georgia are currently not available.

White-tailed deer populations are significant throughout the Chattahoochee River Basin. The WRD estimates deer populations each year for all of its deer management units. Estimated deer densities for 2005 – 2006 for counties in the Chattahoochee River Basin are presented in Table 9. Fecal coliform bacteria contributions from deer to water bodies are generally considered less significant than that of waterfowl, racoons, and beavers. This is because a greater portion of their time is spent in terrestrial habitats. This also holds true for other terrestrial mammals such as squirrels and rabbits, and for terrestrial birds (GA WRD, 2002). However, feces deposited on the land surface can result in the introduction of fecal coliform to streams during runoff events. It should be noted that between storm events, considerable decomposition of the fecal matter might occur, resulting in a decrease in the associated fecal coliform numbers. This is especially true in the warm, humid environments typical of the southeast.

3.2.2 Agricultural Livestock

Agricultural livestock are a potential source of fecal coliform to streams in the Chattahoochee River Basin. The animals grazing on pastureland deposit their feces onto land surfaces, where it can be transported during storm events to nearby streams. Animal access to pastureland varies monthly, resulting in varying fecal coliform loading rates throughout the year. Beef cattle spend all of their time in pastures, while dairy cattle and hogs are periodically confined. In addition, agricultural livestock will often have direct access to streams that pass through their pastures, and can thus impact water quality in a more direct manner (USDA, 2002).

Table 10 provides the estimated number of beef cattle, dairy cattle, goats, horse, swine, sheep, and chickens by category reported by county. These data were provided by the Natural Resources Conservation Service (NRCS).

Table 9. Deer Census Data in the Chattahoochee River Basin

County	2005-2006 Estimated Densities (Number/Sq Mi)
Banks	31.0
Calhoun	17.3
Carroll	29.7
Chattahoochee	17.3
Cherokee	31.0
Clay	17.3
Cobb	34.1
Coweta	29.7
Dawson	31.0
DeKalb	34.1
Douglas	34.1
Early	17.3
Forsyth	31.0
Fulton	34.1
Gwinnett	34.1
Habersham	21.3
Hall	31.0
Harris	29.7
Heard	29.7
Lumpkin	21.3
Marion	17.3
Meriwether	29.7
Muscogee	29.7
Paulding	31.0
Quitman	17.3
Randolph	17.3
Seminole	17.3
Stewart	17.3
Talbot	29.7
Taylor	29.7
Towns	21.3
Troup	29.7
Turner	17.3
Union	21.3
White	21.3

Source: Wildlife Resources Division, GA DNR, 2004

Table 10. Estimated Agricultural Livestock Populations in the Chattahoochee River Basin

County	Livestock							
	Beef Cattle	Dairy Cattle	Swine	Sheep	Goats	Horses	Chickens-Layers	Chickens-Broilers Sold
Banks	12,500	-	-	200	4,000	1,250	490,000	65,320,000
Calhoun	6,625	-	-	100		60	-	5,760,000
Carroll	29,500	150	50	100	5,700	2,200	200,000	43,140,000
Chattahoochee	650	-	-			25	-	1,150,000
Cherokee	4,000	125	-		1,000	4,000	-	10,815,800
Clay	6,900	-	25		75	70	-	-
Cobb	-	-	-			1,320	-	-
Coweta	6,520	350	-	20	180	1,250	-	-
Dawson	3,750	-	-	100	250	950	10,000	20,985,000
DeKalb	-	-	-			165	-	-
Douglas	1,200	-	-			575	-	260,000
Early	18,120	-	350		150	140	-	460,000
Forsyth	2,350	-	-		50	2,700	72,000	9,202,000
Fulton	4,350	-	-		325	500	-	-
Gwinnett	3,600	-	-		550	920	-	2,080,000
Habersham	15,850	-	1,833	-	2,250	1,200	800,000	73,200,000
Hall	15,900	700	-	50	2,200	3,675	1,800,000	89,860,000
Harris	2,480	-	150	250	300	760	20,000	-
Heard	5,400	-	25	20	500	575	80,000	14,856,000
Lumpkin	3,408	200	-	80	329	390	192,000	11,008,000
Marion	5,295	-	10	30	1,200	115	41,000	7,309,000
Meriwether	13,800	400	40	100	2,500	1,575	-	-
Muscogee	100	-	-			700	-	-
Paulding	3,000	45	-	250	650	1,200	-	7,150,000
Quitman	2,100	-	-		300	60	-	-
Randolph	5,310	390	2,550		50	110	-	-
Seminole	10,800	97	455	176	460	650	-	-
Stewart	3,500	-	-		200	160	-	1,150,000
Talbot	6,300	-	-		150	200	-	-
Taylor	7,375	-	200		570	130	54,000	7,280,000
Towns	5,700	-	13,300		250	900	-	360,000
Troup	10,500	700	-		1,400	550	-	-
Turner	17,000	-	30	80	700	525	-	4,000,000
Union	4,020	300	-		400	1,150	150,000	2,600,000
White	5,380	300	2,800	-	140	455	450,000	24,440,000

Source: NRCS, 2005

3.2.3 Urban Development

Fecal coliform from urban areas are attributable to multiple sources, including: domestic animals, leaks and overflows from sanitary sewer systems, illicit discharges, leaking septic systems, runoff from improper disposal of waste materials, and leachate from both operational and closed landfills.

Urban runoff can contain high concentrations of fecal coliform from domestic animals and urban wildlife. Fecal coliform bacteria enter streams by direct washoff from the land surface, or the runoff may be diverted to a storm water collection system and discharged through a discrete outlet structure. For large, medium, and small urban areas (populations greater than 50,000), the storm water outlets are regulated under MS4 permits (see Section 3.1.2). For smaller urban areas, the storm water discharge outlets currently remain unregulated.

In addition to urban animal sources of fecal coliform, there may be illicit connections to the storm sewer system. As part of the MS4 permitting program, municipalities are required to conduct dry-weather monitoring to identify and then eliminate these illicit discharges. Fecal coliform bacteria may also enter streams from leaky sewer pipes, or during storm events when combined sewer overflows discharge.

3.2.3.1 Leaking Septic Systems

A portion of the fecal coliform in the Chattahoochee River Basin may be attributed to failure of septic systems and illicit discharges of raw sewage. Table 11 presents the number of septic systems in each county of the Chattahoochee River Basin existing in 2000 and the number existing in 2005, based on the Georgia Department of Human Resources, Division of Public Health data. In addition, an estimate of the number of septic systems installed and repaired during the five year period from 2000 through 2005 is given. These data show that a substantial increase in the number of septic systems has occurred in some counties. Often, this is a reflection of population increases outpacing the expansion of sewage collection systems during this period. Hence, a large number of septic systems are installed to contain and treat the sanitary waste.

Table 11. Number of Septic Systems in the Chattahoochee River Basin

County	Existing Septic Systems (2000)	Existing Septic Systems (2005)	No. of Septic Systems Installed (2000 to 2005)	No. of Septic Systems Repaired (2000 to 2005)
Banks	5,727	6,987	1,260	239
Calhoun	1,027	1,173	146	23
Carroll	25,298	31,484	6,186	945
Chattahoochee	1,048	1,173	125	11
Cherokee	34,272	39,470	5,198	947
Clay	1,227	1,356	129	5
Cobb	33,209	35,389	2,180	2,126
Coweta	29,232	35,577	6,345	1,301
Dawson	8,504	10,472	1,968	227
DeKalb	24,333	25,236	903	2,094
Douglas	22,552	26,031	3,479	1,790
Early	3,727	4,386	659	288
Forsyth	39,885	46,655	6,770	1,659
Fulton	30,312	32,748	2,436	768
Gwinnett	75,333	78,512	3,179	4,013
Habersham	13,508	15,962	2,454	606
Hall	50,661	59,588	8,927	3,167
Harris	9,240	11,991	2,751	543
Heard	4,589	5,348	759	33
Lumpkin	8,477	10,781	2,304	117
Marion	8,477	6,877	242	11
Meriwether	7,052	8,620	1,568	224
Muscogee	2,834	3,338	504	75
Paulding	31,547	41,747	10,200	1,856
Quitman	1,616	1,757	141	5
Randolph	1,928	2,099	171	12
Seminole	6,399	7,073	674	203
Stewart	1,315	1,455	140	3
Talbot	2,742	3,038	296	23
Taylor	1,626	2,030	404	18
Towns	6,867	5,553	1,686	63
Troup	15,084	18,066	2,982	803
Turner	1,833	1,998	165	5
Union	10,718	13,693	2,975	344
White	10,046	12,265	2,219	384

Source: The Georgia Dept. of Human Resources, Division of Public Health, 2006

3.2.3.2 Land Application Systems

Many smaller communities use land application systems (LAS) for treatment of their sanitary wastewaters. These facilities are required through LAS permits to treat all their wastewater by land application and are to be properly operated as non-discharging systems that contribute no runoff to nearby surface waters. However, runoff during storm events may carry surface residual containing fecal coliform bacteria to nearby surface waters. Some of these facilities may also exceed the ground percolation rate when applying the wastewater, resulting in surface runoff from the field. If not properly bermed, this runoff, which probably contains fecal coliform bacteria, may discharge to nearby surface waters. There are 17 permitted LAS systems located in the Chattahoochee River Basin (Table 12).

Table 12. Permitted Land Application Systems in the Chattahoochee River Basin

LAS Name	County	Permit No.	Type	Flow (MGD)
American Proteins, Inc.	Forsyth	GA01-572	Industrial	0.5
Carroll Co Water Authority	Carroll	GA02-071	Municipal	0.45
Days Inn Lagrange	Troup	GA02-276	Private	0.137
Douglasville Reuse LAS	Douglas	GA02-057	Municipal	0.5
Fieldale Farms Corp.	Hall	GA02-080	Industrial	1.7
Georgetown	Quitman	GA02-010	Municipal	0.3
Grantville LAS	Coweta	GA02-287	Municipal	0.15
Hampton Creek Reuse	Forsyth	GA02-293	Private	0.275
Helen LAS	White	GA02-157	Municipal	0.5
Hogansville	Troup	GA02-019	Municipal	0.65
Olde Atlanta Club	Forsyth	GA03-980	Private	0.262
Paulding Co- Coppermine	Paulding	GA02-297	Municipal	0.75
Polo Golf & Country Club	Forsyth	GA03-950	Private	0.338
R-Ranch	Lumpkin	GA03-972	Private	0.1
Shasta Beverages	Hall	GA01-470	Industrial	Report
Windermere Urban Reuse	Forsyth	GA02-195	Private	0.25
Yellow Jacket Utilities, Llc	Troup	GA03-7960	Private	0.3

Source: Permitting Compliance and Enforcement Program, GA EPD, Atlanta, Georgia, 2006

3.2.3.3 Landfills

Leachate from landfills may contain fecal coliform bacteria that may at some point discharge into surface waters. Sanitary (or municipal) landfills are the most likely to serve as a source of fecal coliform bacteria. These types of landfills receive household wastes, animal manure, offal, hatchery and poultry processing plant wastes, dead animals, and other types of wastes. Older sanitary landfills were not lined and most have been closed. Those that remain active and have not been lined operate as construction/demolition landfills. Currently active sanitary landfills are lined and have leachate collection systems. All landfills, excluding inert landfills, are now required to install environmental monitoring systems for groundwater and methane sampling. There are 134 known landfills in the Chattahoochee River Basin (Table 13). Of these, 13 are active landfills and 121 are inactive or closed. As shown in Table 13, many of the older, inactive landfills were never permitted.

Table 13. Landfills in the Chattahoochee River Basin

Name	County	Permit No.	Type	Status
Arnco - Sargent	Coweta		NA	Inactive
Atlanta-Cascade Rd (Sl)	Fulton	060-046D(SL)	Sanitary Landfill	Closed
Atlanta-Gun Club Rd (Sl)	Fulton	060-026D(SL)	Sanitary Landfill	Closed
Austell	Cobb		NA	Inactive
Austell Box Board	Cobb		NA	Inactive
Austell Box Board (Li)	Cobb	033-031D(LI)	Industrial Landfill	Operating
Azalea - Willeo Rd.	Fulton		NA	Inactive
B.F.I. - Marietta Blvd.	Fulton		NA	Inactive
B.J.	Gwinnett	067-014D(SL)	NA	Inactive
Bfi-Richland Creek Rd (Sl)	Gwinnett	067-032D(SL)	Municipal Solid Waste Landfill	Operating
Bfi-Watts Rd (Sl)	Fulton	060-051D(SL)	Sanitary Landfill	Closed
Blythe Ga. Hwy 92	Douglas		NA	Inactive
Buford	Gwinnett	067-008D(SL)	SL	Closed
Buford Highway	De Kalb	044-009D(SL)	Sanitary Landfill	Closed
Buford-P'tree Ind Blvd Ph 2 (Sl)	Gwinnett	067-030D(SL)	Sanitary Landfill	Closed
Chambers - Oakdale/ I-285	Cobb	033-093P(RM)	NA	Inactive
Chambers-Bolton Rd (Sl)	Fulton	060-083D(SL)	Municipal Solid Waste Landfill	Operating
Chambers-Oakdale Rd/I-285 (L)	Cobb	033-081D(L)	Construction and Demolition Landfill	Closed
Chamblee-Keswick Dr (L)	Dekalb	044-031D(L)	Dry Trash Landfill	Closed
Clarkesville	Habersham		NA	Inactive
Clay Co-Sr 39 Ph 1 (Sl)	Clay	030-002D(SL)	Sanitary Landfill	Closed
Clay Co-Sr 39 Ph 2 (Sl)	Clay	030-003D(SL)	Sanitary Landfill	Closed
Cobb Co. Baler	Cobb	033-004P(BA)	NA	Inactive
Cobb Co. County Farm Rd.	Cobb	033-020D(L)	NA	Inactive
Cobb Co. County Farm Rd. Sl	Cobb	033-032D(SL)	NA	Inactive
Cobb Co-County Farm Dr Ph 2 (Sl)	Cobb	033-039D(SL)	Sanitary Landfill	Closed
Cobb Co-County Farm Rd #2 Phs 1-2-3 (L)	Cobb	033-037D(L)	Construction and Demolition Landfill	Closed
Coleman	Randolph		NA	Inactive
Cols. Cons. Govt. Schatlulge Rd. East Side	Muscogee	106-008D(L)	Dry Trash Landfill	Inactive
Columbus Sanitary Landfill	Muscogee	106-001D(SL)	Sanitary Landfill	Closed
Columbus, Pine Grove Mswl	Muscogee	106-016D(MSWL)	Municipal Solid Waste Landfill	Operating
Columbus-Schatulga Rd W Fill Ph 2 (Sl)	Muscogee	106-011D(SL)	Sanitary Landfill	Closed
Cornelia	Habersham		NA	Inactive
Coweta Co. Ishman Ballard Rd (Sl)	Coweta	038-009D(SL)	Sanitary Landfill	Inactive
Coweta Co.-Ishman Ballard Rd C/D Landfill	Coweta	038-015D(C&D)	Construction and Demolition Landfill	Operating
Coweta Co-Ishman Ballard Rd Ph 1a (Sl)	Coweta	038-007D(SL)	Sanitary Landfill	Closed
Cumming	Forsyth		NA	Inactive
Cusseta - Osteen St.	Chattahoochee		NA	Inactive
Douglas Co-Cedar Mt/Worthan Rd Ph 1 (Sl)	Douglas	048-009D(SL)	Construction and Demolition Landfill	Operating
Douglas Co-Cedar Mtn Rd (Sl)	Douglas	048-007D(SL)	Sanitary Landfill	Closed

Table 13. Landfills in the Chattahoochee River Basin

Name	County	Permit No.	Type	Status
Downs Rd.	Douglas		NA	Inactive
East Point Landfill	Fulton	060-017D(L)	Dry Trash Landfill	Closed
Emory - Old Briarcliff Rd.	De Kalb	044-036D(L)	Dry Trash Landfill	Inactive
Field Road #1	Fulton		NA	Inactive
Fields Road No. 2 Atlanta Landfill	Fulton	060-033D(L)	Dry Trash Landfill	Closed
Forsyth Co. - Kelly Mill Rd. Site # 2	Forsyth	058-001D(SL)	NA	Inactive
Forsyth Co. - Kelly Mill Rd. Site # 2	Forsyth	058-003D(SL)	NA	Inactive
Forsyth Co-Kelly Mill Rd Site #2 (Sl)	Forsyth	058-004D(SL)	Sanitary Landfill	Closed
Fort Gaines	Clay		NA	Inactive
Franklin	Heard		NA	Inactive
Ft. Benning - 1st Division Rd. (Sl)	Chattahoochee	026-004D(SL)	Sanitary Landfill	Closed
Fulton Co-Merk Rd (Sl)	Fulton	060-011D(SL)	Sanitary Landfill	Closed
Fulton Co-Merk/Miles Rd (Sl)	Fulton	060-064D(SL)	Sanitary Landfill	Closed
Fulton Co-Morgan Falls (Sl)	Fulton	060-007D(SL)	Sanitary Landfill	Closed
Ga Power-Plant Yates (Li)	Coweta	038-011D(LI)	Industrial Landfill	Operating
Ga Power-Plant Yates (Li) -Gypsum	Coweta	038-014D(I)	Industrial Landfill	Operating
Ga. Hwy 120	Fulton		NA	Inactive
Ga. Reclamation Center	Coweta	038-010P(RM)	NA	Inactive
Galilee Church (Co.)	Seminole		NA	Inactive
Garden Services Inc.	Meriwether	099-010D(L)	Dry Trash Landfill	Closed
Georgetown	Quitman		NA	Inactive
Giddens - Hwy. 92 Landfill	Douglas		NA	Inactive
Glaze Landfill	Dekalb		NA	Inactive
Grady Price - Hwy 29	Fulton		NA	Inactive
Grantville	Coweta		NA	Inactive
Greenleaf Recycling, Llc	Forsyth	058-013D(C&D)	Construction and Demolition Landfill	Operating
Grove Park	Fulton		NA	Inactive
Gwinnett Landfill Inc.	Gwinnett	067-007D(L)	NA	Inactive
Habersham Co- Sr13 Mswl	Habersham	068-020D(SL)	Municipal Solid Waste Landfill	Operating
Habersham Co-Pea Ridge Rd Ph 1 (Sl)	Habersham	068-016D(SL)	Sanitary Landfill	Closed
Habersham Co-Pea Ridge Rd Ph 2&3 (Sl)	Habersham	068-017D(SL)	Sanitary Landfill	Closed
Hagerman	Fulton		NA	Inactive
Hamil-Brumbelow Rd (L)	Fulton	060-054D(L)	Dry Trash Landfill	In-Closure
Harris Co. - S2651	Harris	072-004D(SL)	Sanitary Landfill	Closed
Harris Co-Hamilton Rd E (Sl)	Harris	072-009D(SL)	Sanitary Landfill	Closed
Heard Co-Frolona Rd (Sl)	Heard	074-004D(SL)	Sanitary Landfill	Closed
Hogansville-Blue Creek Rd (Sl)	Troup	141-009D(SL)	Sanitary Landfill	Closed
Holcombe Br. Baptist Ch.	Fulton		NA	Inactive
Hoyt Samples Landfill	Cobb		NA	Inactive
Hwy. 100	Heard	074-001D(SL)	Sanitary Landfill	Closed
James Ferell - Cascade Rd.	Fulton		NA	Inactive

Table 13. Landfills in the Chattahoochee River Basin

Name	County	Permit No.	Type	Status
Joe Jones	Fulton		NA	Inactive
Junction City	Talbot		NA	Inactive
Lagrange-I 85/Sr 109 (Sl)	Troup	141-013D(SL)	Municipal Solid Waste Landfill	Operating
Lagrange-Orchard Hill Rd (Sl)	Troup	141-005D(SL)	Sanitary Landfill	Closed
Laurelwood	Dekalb		NA	Inactive
Lee H. Wallace - Basket Creek Rd.	Douglas		NA	Inactive
Lumpkin Co-Barlow Homes Rd Ph 2 (Sl)	Lumpkin	093-003D(SL)	Sanitary Landfill	Closed
Macdougald Construction Co.	Fulton	060-039D(L)	Dry Trash Landfill	Closed
Meriwether Co-Cr 98 Durand (Sl)	Meriwether	099-015D(SL)	Sanitary Landfill	Closed
Meriwether Co-Whit Waddell Rd (Sl)	Meriwether	099-006D(SL)	Sanitary Landfill	Closed
Mid - South Supply - Bankhead Highway	Cobb		NA	Inactive
Miller/Trammel-Trammel Rd (L)	Forsyth	058-007D(L)	Construction and Demolition Landfill	In-Closure
Morris Road Dump	Fulton		NA	Inactive
Nesbitt Ferry Rd.	Fulton		NA	Inactive
Norcross	Gwinnett		NA	Inactive
North Cooper Lake Rd.	Cobb	033-030D(L)	Dry Trash Landfill	Closed
Omaha	Stewart		NA	Inactive
Oxbo	Fulton		NA	Inactive
Pacific Cabinet Co., Cousin St.	Cobb		NA	Inactive
Palmetto	Coweta		NA	Inactive
Pebblebrook Baptist Church	Cobb		NA	Inactive
Phillips Rd.	Meriwether	099-004D(SL)	Sanitary Landfill	Closed
Price-Roosevelt Hwy (L)	Fulton	060-075D(L)	Dry Trash Landfill	Closed
Quitman Co-Us 82/Sr 50 (Sl)	Quitman	118-002D(SL)	Sanitary Landfill	Closed
Rivermont - Holcombe Br. Rd.	Fulton		NA	Inactive
Roswell First Baptist Ch.	Fulton		NA	Inactive
Roy Pittman Prop. - Hwy 29	Fulton	060-028D(L)	Dry Trash Landfill	Closed
Safeguard Landfill Management C & D	Fulton	060-088D(C&D)	Construction and Demolition Landfill	Operating
Sam Floyd - Powder Springs Rd.	Cobb		NA	Inactive
Schatulga Road	Muscogee		NA	Inactive
Six Flags - I-20	Cobb		NA	Inactive
Skinner - Watts Rd.	Fulton		NA	Inactive
Southern States-Bolton Rd (Sl)	Fulton	060-010D(SL)	Sanitary Landfill	Closed
Stewart Co-Cr 145 S Ph 2 (Sl)	Stewart	128-001D(SL)	Sanitary Landfill	Closed
Strickland - Kimball Br. Rd.	Fulton		NA	Inactive
Sugar Hill-Appling Rd Ph 1 (Sl)	Gwinnett	067-016D(SL)	Sanitary Landfill	Closed
Suwanee	Gwinnett		NA	Inactive
Tomahawk Recycling	Forsyth	058-011P(RM)	Recover Materials	Inactive
Town & Country Motors	Fulton		NA	Inactive
Troup Co-Sr 109 Mountville Ph 1 (Sl)	Troup	141-008D(SL)	Sanitary Landfill	Closed
Troup Co-Sr 109 Mountville Ph 2 (Sl)	Troup	141-023D(SL)	Construction and Demolition Landfill	Operating

Table 13. Landfills in the Chattahoochee River Basin

Name	County	Permit No.	Type	Status
Troup Co-Warner Rd S (Sl)	Troup	141-012D(SL)	Sanitary Landfill	Closed
Tyler Buena Vista Rd.	Muscogee	106-004D(L)	Dry Trash Landfill	Inactive
United Waste-Westview Ph 2 (Sl)	Fulton	060-062D(SL)	Sanitary Landfill	Closed
Walt Mcmanus	Gwinnett		NA	Inactive
Weathers - Nelson & Budd, Inc.	Gwinnett		NA	Inactive
West Point-Sr 103 (Sl)	Harris	072-003D(SL)	Sanitary Landfill	Closed
Westview	Fulton	060-024D(SL)	NA	Inactive
White Co-Dukes Creek (Sl)	White	154-003D(SL)	Sanitary Landfill	Closed
Whitfield - Gordon Rd.	Cobb		NA	Inactive
Wmi-B J Landfill Expansion (Sl)	Gwinnett	067-025D(SL)	Sanitary Landfill	Closed
Wmi-B J Landfill Ph 3 &4 (Sl)	Gwinnett	067-027D(SL)	Municipal Solid Waste Landfill	Closed
Worley - Nesbitt Ferry Rd.	Fulton		NA	Inactive

Source: Land Protection Branch, GA DNR, 2006

4.0 ANALYTICAL APPROACH

The process of developing fecal coliform TMDLs for the Chattahoochee River Basin listed segments includes the determination of the following:

- The current critical fecal coliform load to the stream under existing conditions;
- The TMDL for similar conditions under which the current load was determined; and
- The percent reduction in the current critical fecal coliform load necessary to achieve the TMDL.

The calculation of the fecal coliform load at any point in a stream requires the fecal coliform concentration and stream flow. The Loading Curve Approach was used to determine the current fecal coliform load and the TMDL. For the listed segments, fecal coliform sampling data were sufficient to calculate at least one 30-day geometric mean to compare with the regulatory criteria (see Appendix A).

4.1 Loading Curve Approach

For those segments in which sufficient water quality data were collected to calculate at least one 30-day geometric mean that was above the regulatory standard, the loading curve approach was used. This method involves comparing the current critical load to summer and winter seasonal TMDL curves.

As mentioned in Section 2.0, the USGS monitored many of the listed segments and collected stream flow information concurrently with water quality samples. Stream depths were measured and used to determine stream flows, based on rating curves developed by the USGS for each sampling location.

In cases where no stream flow measurements were available, flow on the day the fecal coliform samples were collected was estimated using data from a nearby gaged stream. The nearby stream had relatively similar watershed characteristics, including landuse, slope, and drainage area. The stream flows were estimated by multiplying the gaged flow by the ratio of the listed stream drainage area to the gaged stream drainage area. Table 14 lists those segments for which no flow data were available and indicates the gaged station that was used to estimate the flow.

Table 14. Stream Segments with Estimated Flows and Corresponding USGS Flow Gages

Monitoring Station	USGS Station Name	Station No.
Chattahoochee River - Soquee River to Mossy Creek	Chattahoochee River Near Cornelia, GA	02331600
Chattahoochee River - Mossy Creek to Lake Lanier	Chattahoochee River Near Cornelia, GA	02331600
Chattahoochee River - Johns Creek to Morgan Falls Dam	Chattahoochee River Near Norcross, GA	02335000
Chattahoochee River - Stewart Co. line to Hannahatchee Ck	Chattahoochee River Near Columbia, AL	02343801
East Fork Little River - Downstream Hwy 52 to Lake Lanier	Chestatee River Near Dahlonega, GA	02333500
Little Mud Creek - Headwaters to Mud Creek	Chestatee River Near Dahlonega, GA	02333500
Mud Creek - Headwaters to Little Mud Creek	Chestatee River Near Dahlonega, GA	02333500
Soquee River - SR17, Clarkesville to Chattahoochee River	Chattahoochee River Near Cornelia, GA	02331600
Yahoola Creek - U.S. 19/SR 60 to Chestatee River	Chestatee River Near Dahlonega, GA	02333500

The current critical loads were determined using fecal coliform data collected within a 30-day period to calculate the geometric means, and multiplying these values by the arithmetic means of the flows measured at the time the water quality samples were collected. Georgia's instream fecal coliform standards are based on a geometric mean of samples collected over a 30-day period, with samples collected at least 24 hours apart. To reflect this in the load calculation, the fecal coliform loads are expressed as 30-day accumulated loads with units of counts per 30 days. This is described by the equation below:

$$L_{critical} = C_{geomean} \times Q_{mean}$$

Where:

$L_{critical}$ = current critical fecal coliform load
$C_{geomean}$ = fecal coliform concentration as a 30-day geometric mean
Q_{mean} = stream flow as an arithmetic mean

The current estimated critical load is dependent on the fecal coliform concentrations and stream flows measured during the sampling events. The number of events sampled is usually 16 per year. Thus, these loads do not represent the full range of flow conditions or loading rates that can occur. Therefore, it must be kept in mind that the current critical loads used only represent the worst-case scenario that occurred among the time periods sampled.

The maximum fecal coliform load at which the instream fecal coliform criteria will be met can be determined using a variation of the equation above. By setting C equal to the seasonal, instream fecal coliform standards, the load will equal the TMDL. However, the TMDL is dependent on stream flow. Figures in Appendix A graphically illustrate that the TMDL is a continuum for the range of flows (Q) that can occur in the stream over time. There are two TMDL curves shown in these figures. One represents the summer TMDL for the period May through October when the 30-day geometric mean standard is 200 counts/100 mL. The second curve represents the winter TMDL for the period November through April when the 30-day geometric mean standard is 1,000 counts/100 mL. The equations for these two TMDL curves are:

$$TMDL_{summer} = 200 \text{ counts (as a 30-day geometric mean)/100 mL} \times Q$$

$$TMDL_{winter} = 1{,}000 \text{ counts (as a 30-day geometric mean)/100 mL} \times Q$$

The graphs show the relationship between the current critical load ($L_{critical}$) and the TMDL. The TMDL for a given stream segment is the load for the mean flow corresponding to the current critical load. This is the point where the current load exceeds the TMDL curve by the greatest amount. This critical TMDL can be represented by the following equation:

$$TMDL_{critical} = C_{standard} \times Q_{mean}$$

Where:

$TMDL_{critical}$ = critical fecal coliform TMDL load
$C_{standard}$ = seasonal fecal coliform standard (as a 30-day geometric mean)
summer - 200 counts/100 mL
winter - 1,000 counts/ 100 mL
Q_{mean} = stream flow as an arithmetic mean (same as used for $L_{critical}$)

A 30-day geometric mean load that plots above the respective seasonal TMDL curve represents an exceedance of the instream fecal coliform standard. The difference between the current critical load and the TMDL curve represents the load reduction required for the stream segment to meet the appropriate instream fecal coliform standard. There is also a single sample maximum criterion (4,000 counts per 100 milliliters) for the months of November through April. If a single sample exceeds the maximum criterion, and the seasonal geometric mean criteria is also exceeded, then the TMDL is based on the criteria exceedance requiring the largest load reduction. The load reduction can be expressed as follows:

$$\text{Load Reduction} = \frac{L_{critical} - TMDL_{critical}}{L_{critical}} \times 100$$

5.0 TOTAL MAXIMUM DAILY LOADS

A Total Maximum Daily Load (TMDL) is the amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard, which in this case, is the seasonal fecal coliform standards. A TMDL is the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources, as well as natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For fecal coliform bacteria, the TMDLs are expressed as counts per 30 days as a geometric mean.

A TMDL is expressed as follows:

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

The TMDL calculates the WLAs and LAs with margins of safety to meet the stream's water quality standards. The allocations are based on estimates that use the best available data and provide the basis to establish or modify existing controls so that water quality standards can be achieved. In developing a TMDL, it is important to consider whether adequate data are available to identify the sources, fate, and transport of the pollutant to be controlled.

TMDLs may be developed using a phased approach. Under a phased approach, the TMDL includes: 1) WLAs that confirm existing limits and controls or lead to new limits, and 2) LAs that confirm existing controls or include implementing new controls (USEPA, 1991). A phased TMDL requires additional data be collected to determine if load reductions required by the TMDL are leading to the attainment of water quality standards.

The TMDL Implementation Plan establishes a schedule or timetable for the installation and evaluation of point and nonpoint source control measures, data collection, assessment of water quality standard attainment, and if needed, additional modeling. Future monitoring of the listed segment water quality will then be used to evaluate this phase of the TMDL, and if necessary, to reallocate the loads.

The fecal coliform loads calculated for each listed stream segment include the sum of the total loads from all point and nonpoint sources for the segment. The load contributions to the listed segment from unlisted upstream segments are represented in the background loads, unless the unlisted segment contains point sources that had permit violations for fecal coliform. In these cases, the upstream point sources are included in the wasteload allocations for the listed segment. In situations where two or more adjacent segments are listed, the fecal coliform loads to each segment are individually evaluated on a localized watershed basis. Point source loads originating in upstream segments are included in the background loads of the downstream segment. The following sections describe the various fecal coliform TMDL components.

5.1 Waste Load Allocations

The waste load allocation is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. WLAs are provided to the point sources from municipal and industrial wastewater treatment systems with NPDES effluent limits. There are 13 active

NPDES permitted facilities with fecal coliform permit limits in the Chattahoochee River Basin watershed that discharge into listed segments or have permit violations upstream of a listed segment. The maximum allocated fecal coliform loads for these municipal wastewater treatment facilities are given in Table 15. These WLA loads were calculated from the permitted or design flows and permitted fecal coliform concentrations. If the permit had no fecal coliform limit, a concentration of 200 counts/100 mL was used. These were expressed as accumulated loads over a 30-day period, and presented in units of counts per 30 days. If a facility expands its capacity and the permitted flow increases, the wasteload allocation for the facility would increase in proportion to the flow.

Table 15. WLAs for the Chattahoochee River Basin

Facility Name	Permit No.	Receiving Stream	Listed Stream Segment	WLA (counts/30 days)
Baldwin WPCP	GA0033243	Little Mud Creek	Chattahoochee River Mossy Creek to Lake Lanier/ Little Mud Creek Headwaters to Mud Creek	1.82 E+11
Clarkesville WPCP	GA0032514	Soquee River	Soquee River	1.71 E+11
Columbus South	GA0020516	Chattahoochee River	Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	9.56 E+12
Columbus Uptown Park CSO	GA0036838	Chattahoochee River	Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	Q*200
Columbus South Commons CSO	GA0036838	Chattahoochee River	Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	Q*200
Columbus-Ft Benning WPCP 1	GA0000973	Chattahoochee River	Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	1.05 E+12
Columbus-Ft Benning WPCP 2	GA0000973	Chattahoochee River	Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	8.65 E+11
Cornelia WPCP	GA0021504	South Fork Little Mud Cr	Mud Creek	6.83 E+11
Dahlonega WPCP	GA0026077	Yahoola Creek Tributary	Yahoola Creek	3.28 E+11
Demorest WPCP	GA0032506	Hazel Creek Tributary	Soquee River	9.10 E+10
Fulton Co Big Creek	GA0024333	Chattahoochee River	Chattahoochee River Johns Creek to Morgan Falls Dam	2.73 E+12 (a) 5.46 E+12 (b)
Fulton Co Johns Creek	GA0030686	Chattahoochee River	Chattahoochee River Johns Creek to Morgan Falls Dam	1.59 E+12
Gwinnett Co Crooked Cr/North	GA0026433	Chattahoochee River	Chattahoochee River Johns Creek to Morgan Falls Dam	9.42 E+11

(a) Seasonal fecal coliform limit 100 cnts/100 ml
(b) Seasonal fecal coliform limit 200 cnts/100 ml

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

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

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

CAFOs are located within the Chattahoochee River Basin (see Section 3.1.3). These facilities are either included under an LAS General Permit or an NPDES General Permit. A small number have an individual NPDES permit. However, presently no CAFOs discharge wastewater, and therefore, they were not provided a WLA.

This TMDL will use a phased approach. Future phases of TMDL development will attempt to further define the sources of pollutants and the portion that enters the permitted storm sewer systems. As more information is collected and these TMDLs are implemented, it will become clearer as to which BMPs are needed and how the water quality standards can be achieved.

5.2 Load Allocations

The load allocation is the portion of the receiving water's loading capacity that is attributed to existing or future nonpoint sources or to natural background sources. Nonpoint sources are identified in 40 CFR 130.6 as follows:

- Residual waste;
- Land disposal;
- Agricultural and silvicultural;
- Mines;
- Construction;
- Saltwater intrusion; and
- Urban storm water (non-permitted).

The LA is calculated as the remaining portion of the TMDL load available, after allocating the WLA and the MOS, using the following equation:

$$\Sigma \text{ LA} = \text{TMDL} - (\Sigma \text{ WLA} + \Sigma \text{ WLAsw} + \Sigma\text{MOS})$$

As described above, there are two types of load allocations: loads to the stream independent of precipitation, including sources such as failing septic systems, leachate from landfills, animals in the stream, and leaking sewer system collection lines, or background loads; and loads associated with fecal coliform accumulation on land surfaces that is washed off during storm events, including runoff from saturated LAS fields. At this time, it is not possible to partition the various sources of load allocations. Table 16 presents the total load allocation expressed as counts per 30 days, or as winter instantaneous maximum counts for the 303(d) listed streams located in the Chattahoochee River Basin for the current critical condition. In the future, after additional data has been collected, it may be possible to partition the load allocation by source.

5.3 Seasonal Variation

The Georgia fecal coliform criteria are seasonal. One set of criteria applies to the summer season, while a different set applies to the winter season. To account for seasonal variations, the critical loads for each listed segment were determined from sampling data obtained during both summer and winter seasons, when possible. However, in some cases, the available data was limited to a single season for the calculation of the critical load. The TMDL and percent reduction given in Table 16 for each listed segment was based on the season in which the critical load occurred. The TMDLs for each season, for any given flow, are presented as equations in Section 5.5.

Analyses of the available fecal coliform data and corresponding flows were performed to determine if the fecal coliform violations occurred during wet weather (high flow) or dry weather (low flow) conditions. The flow data from each sampling site were normalized by dividing the measured flow by the product of the average annual runoff (cfs/sq mile), published in Open-File Report 82-577, and the appropriate drainage area (Carter, 1982). Plots of the normalized flows (Q/Q_o) versus fecal coliform are shown in Appendix B. The plots do not show a consistent relationship between fecal coliform concentrations and flow. The summer and winter plots show that the fecal coliform violations occur during both high (wet weather) and low (dry weather) flow conditions.

5.4 Margin of Safety

The MOS is a required component of TMDL development. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative modeling assumptions to develop allocations; or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For this TMDL, an explicit MOS of 10 percent of the TMDL was used. The MOS values are presented in Table 16.

5.5 Total Fecal Coliform Load

The fecal coliform TMDL for the listed stream segment is dependent on the time of year, the stream flow, and the applicable state water quality standard.

The total maximum daily seasonal fecal coliform loads for Georgia are given below:

$$TMDL_{summer} = 200 \text{ counts (as a 30-day geometric mean)/100 mL} \times Q$$

$$TMDL_{winter} = 1{,}000 \text{ counts (as a 30-day geometric mean)/100 mL} \times Q$$

$$TMDL_{winter} = 4{,}000 \text{ counts (instantaneous) /100 mL} \times Q$$

For purposes of determining necessary load reductions required to meet the instream water quality criteria, the current critical TMDL was determined. This load is the product of the applicable seasonal fecal coliform standard and the mean flow used to calculate the current critical load. It represents the sum of the allocated loads from point and nonpoint sources located within the immediate drainage area of the listed segment, the NPDES-permitted point discharges with recorded fecal coliform violations from the nearest upstream subwatersheds, and a margin of safety (MOS). For these calculations, the fecal load contributed by each facility to the WLA was not the maximum presented in Table 15, but rather was the product of the fecal coliform permitted limit and the average monthly discharge at the time of the critical load. The current critical loads and corresponding TMDLs, WLAs (WLA and WLA_{sw}), LAs, MOSs, and percent load reductions for the Chattahoochee River Basin listed stream segments are presented in Table 16.

The relationships of the current critical loads to the TMDLs are shown graphically in Appendix A. The vertical distance between the two values represents the load reductions necessary to achieve the TMDLs. If no TMDL or Critical Load is given on the graphs in Appendix A, the TMDL given in Table 16 is based on the instantaneous maximum standard. As a consequence of the localized nature of the load evaluations, the calculated fecal coliform load reductions pertain to point and nonpoint sources occurring within the immediate drainage area of the listed segment. These current critical values represent a worst-case scenario for the limited set of data. Thus, the load reductions required are conservative estimates, and should be sufficient to prevent exceedances of the instream fecal coliform standard for a wide range of conditions.

Evaluation of the relationship between instream water quality and the potential sources of pollutant loading is an important component of TMDL development, and is the basis for later implementation of corrective measures and BMPs. For the current TMDLs, the association between fecal coliform loads and the potential sources occurring within the subwatersheds of each segment was examined on a qualitative basis.

Table 16. Fecal Coliform Loads and Required Fecal Coliform Load Reductions

Stream Segment	Current Load (counts/ 30 days)	TMDL Components					Percent Reduction
		WLA (counts/ 30 days)[1]	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Chattahoochee River Soquee River to Mossy Creek	4.80E+16			1.80E+15	2.00E+14	2.00E+15	96
Chattahoochee River Mossy Creek to Lake Lanier	1.26E+15	1.96E+09		1.29E+14	1.43E+13	1.43E+14	89
Chattahoochee River Johns Creek to Morgan Falls	1.23E+15	1.86E+12	3.31E+14	1.46E+14	5.32E+13	5.32E+14	57
Chattahoochee River Chattahoochee/Stewart Co. line to Hannahatchee Creek	2.39E+16	6.01E+11	1.29E+15	8.99E+15	1.14E+15	1.14E+16	52
East Fork Little River	4.66E+14		8.75E+11	2.71E+13	3.11E+12	3.11E+13	93
Little Mud Creek	1.26E+13	1.96E+09		4.81E+12	5.35E+11	5.35E+12	58
Mud Creek	1.16E+13	1.18E+11		4.31E+12	4.92E+11	4.92E+12	58
Soquee River	1.67E+16	2.96E+10		3.44E+15	3.83E+14	3.83E+15	77
Yahoola Creek	5.98E+14	2.65E+09		5.98E+13	6.65E+12	6.65E+13	89

Notes: [1] The assigned fecal coliform load from each NPDES permitted facility for WLA was determined as the product of the fecal coliform permit limit and the facility average monthly discharge at the time of the critical load.

6.0 RECOMMENDATIONS

The TMDL process consists of an evaluation of the subwatersheds for each 303(d) listed stream segment to identify, as best as possible, the sources of the fecal coliform loads causing the stream to exceed instream standards. The TMDL analysis was performed using the best available data to specify WLAs and LAs that will meet fecal coliform water quality criteria so as to support the use classification specified for each listed segment.

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

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. The GA EPD has adopted a basin approach to water quality management that divides Georgia's major river basins into five groups. This approach provides for additional sampling work to be focused on one of the five basin groups each year and offers a five-year planning and assessment cycle. The Chattahoochee and Flint River Basins will again receive focused monitoring in 2010.

The TMDL Implementation Plan will outline an appropriate water quality monitoring program for the listed streams in the Chattahoochee River Basin. The monitoring program will be developed to help identify the various fecal coliform sources. The monitoring program may be used to verify the 303(d) stream segment listings. This will be especially valuable for those segments where no data, old data, or spill data resulted in the listing.

6.2 Fecal Coliform Management Practices

Based on the findings of the source assessment, NPDES point source fecal coliform loads from wastewater treatment facilities do not significantly contribute to the impairment of the listed stream segments. This is because most facilities are required to treat to levels corresponding to instream water quality criteria. Fecal coliform loads from NPDES permitted MS4 areas may be significant, but these sources cannot be easily segregated from other storm water runoff. Other sources of fecal coliform in urban areas include wastes that are attributable to domestic animals, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, leaking septic systems, runoff from improper disposal of waste materials, and leachate from both operational and closed landfills. In agricultural areas, potential sources of fecal coliform may include CAFOs, animals grazing in pastures, dry manure storage facilities and lagoons, chicken litter storage areas, and direct access of livestock to streams. Wildlife, especially waterfowl can be a significant source of fecal coliform bacteria.

Management practices are recommended to reduce fecal coliform source loads to the listed 303(d) stream segments, with the result of achieving the instream fecal coliform standard criteria. These recommended management practices include:

- Compliance with NPDES permit limits and requirements;
- Adoption of NRCS Conservation Practices; and
- Application of Best Management Practices (BMPs) appropriate to agricultural or urban land uses, where applicable.

6.2.1 Point Source Approaches

Point sources are defined as discharges of treated wastewater or storm water into rivers and streams at discrete locations. The NPDES permit program provides a basis for municipal, industrial and storm water permits, monitoring and compliance with limitations, and appropriate enforcement actions for violations.

In accordance with GA EPD rules and regulations, all discharges from point source facilities are required to be in compliance with the conditions of their NPDES permit at all times. In the future, all municipal and industrial wastewater treatment facilities with the potential for the occurrence of fecal coliform in their discharge will be given end-of-pipe limits equivalent to the water quality standard of 200 counts/100 mL. An exception is constructed wetland systems, which have a natural level of fecal coliform input from animals attracted to the artificial wetlands. In addition, the permits will include routine monitoring and reporting requirements.

6.2.2 Nonpoint Source Approaches

The GA EPD is responsible for administering and enforcing laws to protect the waters of the State. The GA EPD is the lead agency for implementing the State's Nonpoint Source Management Program. Regulatory responsibilities that have a bearing on nonpoint source pollution include establishing water quality standards and use classifications, assessing and reporting water quality conditions, and regulating land use activities that may affect water quality. Georgia is working with local governments, agricultural and forestry agencies such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission, to foster the implementation of BMPs to address nonpoint source pollution. In addition, public education efforts are being targeted to individual stakeholders to provide information regarding the use of BMPs to protect water quality. The following sections describe, in more detail, recommendations to reduce nonpoint source loads of fecal coliform bacteria in Georgia's surface waters.

6.2.2.1 Agricultural Sources

The GA EPD should coordinate with other agencies that are responsible for agricultural activities in the state to address issues concerning fecal coliform loading from agricultural lands. It is recommended that information (e.g., livestock populations by subwatershed, animal access to streams, manure storage and application practices, etc.) be periodically reviewed so that watershed evaluations can be updated to reflect current conditions. It is also recommended that BMPs be utilized to reduce the amount of fecal coliform bacteria transported to surface waters from agricultural sources to the maximum extent practicable.

The following three organizations have primary responsibility for working with farmers to promote soil and water conservation, and to protect water quality:

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

UGA has faculty, County Cooperative Extension Agents, and technical specialists who provide services in several key areas relating to agricultural impacts on water quality.

The GA EPD designated the GSWCC as the lead agency for agricultural Nonpoint Source Management in the State. The GSWCC develops nonpoint source management programs and conducts educational activities to promote conservation and protection of land and water devoted to agricultural uses.

The NRCS works with federal, state, and local governments to provide financial and technical assistance to farmers. The NRCS develops standards and specifications for BMPs that are to be used to improve, protect, and/or maintain our state's natural resources. In addition, every five years, the NRCS conducts the National Resources Inventory (NRI). The NRI is a statistically based sample of land use and natural resource conditions and trends that covers non-federal land in the United States.

The NRCS is also providing technical assistance to the GSWCC and the GA EPD with the Georgia River Basin Planning Program. Planning activities associated with this program will describe conditions of the agricultural natural resource base once every five years. It is recommended that the GSWCC and the NRCS continue to encourage BMP implementation, education efforts, and river basin surveys with regard to river basin planning.

6.2.2.2 Urban Sources

Both point and nonpoint sources of fecal coliform bacteria can be significant in the Chattahoochee River Basin urban areas. Urban sources of fecal coliform can best be addressed using a strategy that involves public participation and intergovernmental coordination to reduce the discharge of pollutants to the maximum extent practicable. Management practices, control techniques, public education, and other appropriate methods and provisions may be employed. In addition to water quality monitoring programs, discussed in Section 6.1, the following activities and programs conducted by cities, counties, and state agencies are recommended:

- Uphold requirements that all new and replacement sanitary sewage systems be designed to minimize discharges into storm sewer systems;

- Further develop and streamline mechanisms for reporting and correcting illicit connections, breaks, surcharges, and general sanitary sewer system problems;

- Sustained compliance with storm water NPDES permit requirements; and

- Continue efforts to increase public awareness and education towards the impact of human activities in urban settings on water quality, ranging from the consequences of industrial and municipal discharges to the activities of individuals in residential neighborhoods.

6.3 Reasonable Assurance

Permitted discharges will be regulated through the NPDES permitting process described in this report. An allocation to a point source discharger does not automatically result in a permit limit or a monitoring requirement. Through its NPDES permitting process, Georgia will determine whether the permitted dischargers to the listed watersheds have a reasonable potential of discharging fecal coliform levels equal to or greater than the allocated load. The results of this reasonable potential analysis will determine the specific type of requirements in an individual facility's NPDES permit. As part of its analysis, the EPD will use its EPA-approved 2001 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

Georgia is working federal and state agencies such as the NRCS and the GSWCC, and with local governments to foster the implementation of best management practices to address nonpoint sources. In addition, public education efforts will be targeted to individual stakeholders to provide information regarding the use of best management practices to protect water quality.

6.4 Public Participation

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

7.0 INITIAL TMDL IMPLEMENTATION PLAN

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

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

1. EPA has identified a number of management strategies for the control of nonpoint sources of pollutants, representing some best management practices. The “Management Measure Selector Table” shown below identifies these management strategies by source category and pollutant. Nonpoint sources are the primary cause of excessive pollutant loading in most cases. Any wasteload allocations for wastewater treatment plant facilities will be implemented in the form of water-quality based effluent limitations in NPDES permits. Any wasteload allocations for regulated storm water will be implemented in the form of best management practices in the NPDES permits. NPDES permit discharges are a secondary source of excessive pollutant loading, where they are a factor, in most cases.

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

3. As part of the Initial TMDL Implementation Plan, the GA EPD brochure entitled *“Watershed Wisdom -- Georgia’s TMDL Program*” will be distributed by GA EPD to the GA EPD Contractor for use with appropriate stakeholders for this TMDL. Also, a copy of the video of that same title will be provided to the GA EPD

Contractor for its use in making presentations to appropriate stakeholders on TMDL implementation plan development.

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

5. The deadline for development of a Revised TMDL Implementation Plan is the end of September 2010.

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

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

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

8. The Revised TMDL Implementation Plan will supersede this Initial TMDL Implementation Plan once GA EPD accepts the Revised TMDL Implementation Plan.

Management Measure Selector Table

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

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

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Appendix A

30-day Geometric Mean Fecal Coliform Monitoring Data

2001 Monitoring Water Quality Stations

Stream Segment	Location	USGS Monitoring Station No.	Monitoring Station Description
Chattahoochee River	Soquee River to Mossy Creek (Habersham/White/ Hall Co)	12030001	Chattahoochee River at Duncan Bridge Road near Cornelia, Georgia
Chattahoochee River	Mossy Creek to Lake Lanier (Hall Co)	02332017	Chattahoochee River at Belton Bridge Road near Lula, Georgia
Chattahoochee River	Johns Creek to Morgan Falls Dam (Gwinnett/Fulton/Cobb Co)	12218501	Chattahoochee River at Hitchitee Creek
Chattahoochee River	Chattahoochee/Stewart Co. line to Hannahatchee Ck (Stewart Co)	12218501	Chattahoochee River at Hitchitee Creek
East Fork Little River	Downstream Hwy 52 to Lake Lanier (Hall Co)	12030151	Little Fork Little River at Honeysuckle Road
Little Mud Creek	Headwaters to Mud Creek (Habersham/Hall Co)	12030041	Little Mud Creek at Coon Creek Road near Alto, Georgia
Mud Creek	Headwaters to Little Mud Creek (Habersham/Hall Co)	112030031	Mud Creek at Crane Mill Road near Alto, Georgia
Soquee River	SR17, Clarkesville to Chattahoochee River (Habersham Co)	12028001	Soquee River at State Road 105 near Demorest, Georgia
Yahoola Creek	U.S. 19/SR 60 to Chestatee River (Lumpkin Co)	12035071	Yahoola Creek at State Road 60 near Dahlonega, Georgia

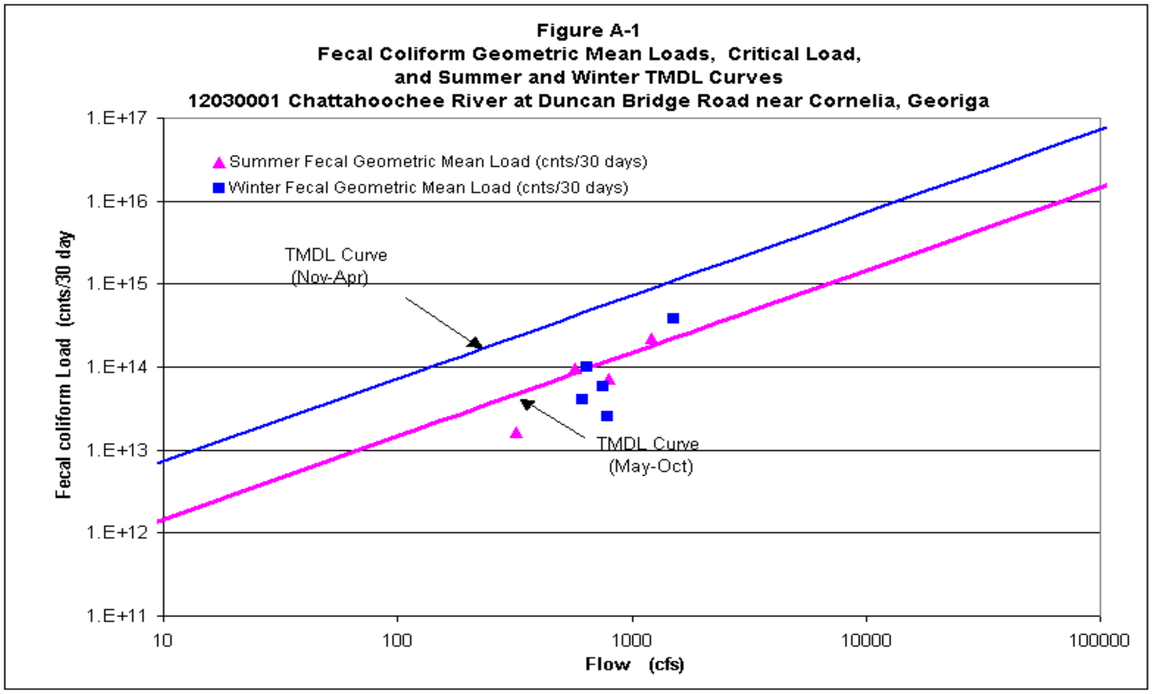


Table A-1. Data for Figure A-1

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
7-Mar-01	20	506.6				
4-Apr-01	1700	943.2				
3-Jul-01	270	491.7	209.4	647.2	9.9E+13	9.5E+13
6-Mar-02	20	527.8				
13-Mar-02	70	784.2				
20-Mar-02	140	528.8				
27-Mar-02	330	606.2	89.7	611.8	4.0E+13	4.5E+14
5-Jun-02	300	493.9				
17-Jun-02	20	270.2				
19-Jun-02	60	252.2				
26-Jun-02	70	262.8	70.9	319.8	1.7E+13	4.7E+13
9-Sep-02	20	135.7				
16-Sep-02	2400	910.3				
23-Sep-02	170	647.5				
30-Sep-02	330	614.7	227.8	577.0	9.6E+13	8.5E+13
3-Dec-02	170	567.0				
10-Dec-02	110	778.9				
17-Dec-02	80	863.7				
19-Dec-02	80	795.9	104.6	751.4	5.8E+13	5.5E+14
20-Mar-03	**24000**	2723.6				
26-Mar-03	20	1040.7				
9-Apr-03	340	1261.1				
17-Apr-03	80	1038.6	338.0	1516.0	3.8E+14	1.1E+15
18-Jun-03	1300	1642.6				
25-Jun-03	170	959.1				
30-Jun-03	130	940.0				
9-Jul-03	140	1292.9	251.8	1208.7	2.2E+14	1.8E+14
15-Sep-03	170	621.0				
22-Sep-03	130	1504.9				
1-Oct-03	110	556.4				
6-Oct-03	90	518.2	121.6	800.1	7.1E+13	1.2E+14
9-Dec-03	20	614.7				
15-Dec-03	80	909.3				
17-Dec-03	20	920.9				
22-Dec-03	110	702.6	43.3	786.9	2.5E+13	5.8E+14

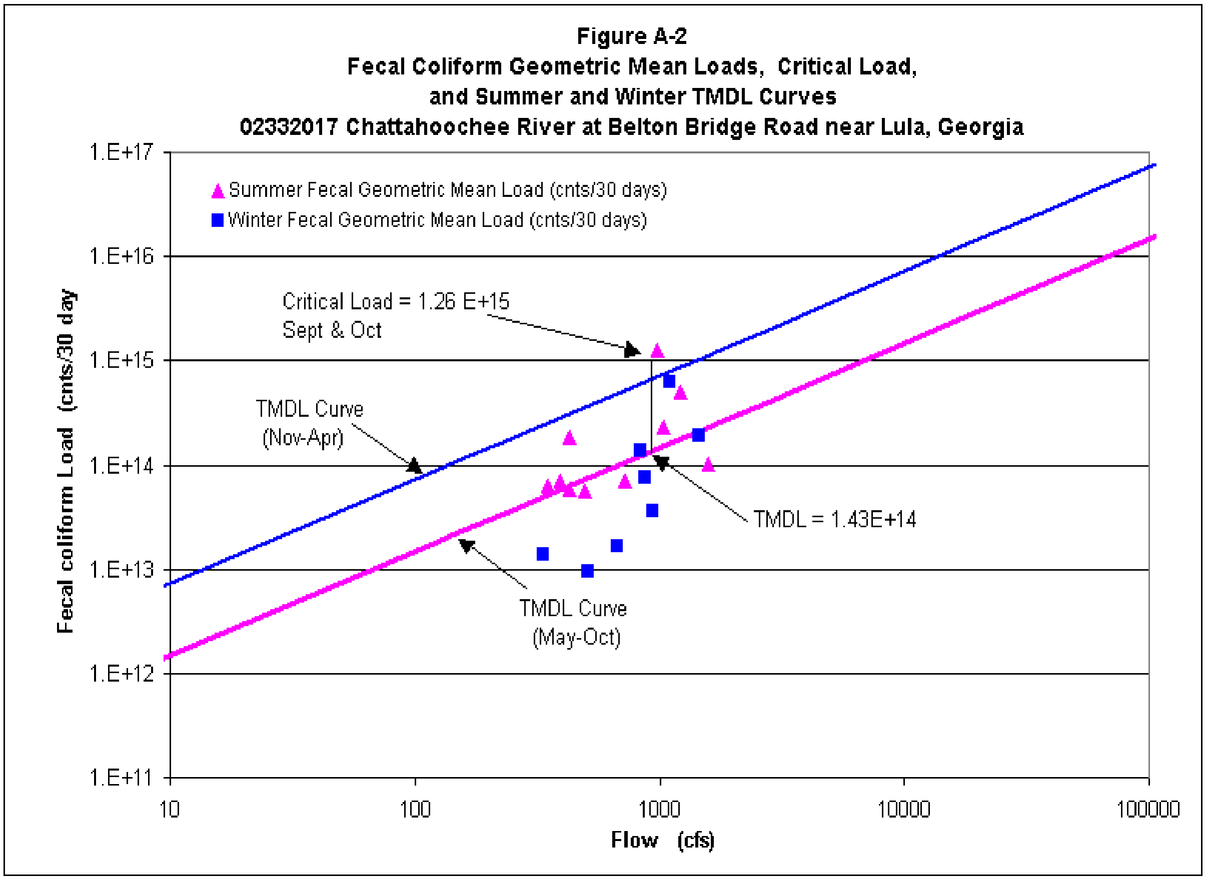


Figure A-2
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
02332017 Chattahoochee River at Belton Bridge Road near Lula, Georgia
Summer Fecal Geometric Mean Load (cnts/30 days)
Winter Fecal Geometric Mean Load (cnts/30 days)
Critical Load = 1.26 E+15
Sept & Oct
TMDL Curve
(Nov-Apr)
TMDL = 1.43E+14
TMDL Curve
(May-Oct)
Fecal coliform Load (cnts/30 day
1.E+17
1.E+16
1.E+15
1.E+14
1.E+13
1.E+12
1.E+11
10
100
1000
10000
100000
Flow (cfs)

Table A-2. Data for Figure A-2

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
12-Feb-01	40	433.0				
20-Feb-01	80	462.0				
26-Feb-01	2200	1680.0				
5-Mar-01	330	776.0	219.5	837.8	1.35E+14	6.15E+14
30-May-01	40	529.0				
5-Jun-01	2800	474.0				
11-Jun-01	80	406.0				
20-Jun-01	130	291.0	184.7	425.0	5.76E+13	6.24E+13
10-Jul-01	130	354.0				
18-Jul-01	140	266.0				
25-Jul-01	220	334.0				
1-Aug-01	940	445.0	247.7	349.8	6.36E+13	2.57E+14
8-Nov-01	20	266.0				
15-Nov-01	20	276.0				
26-Nov-01	490	474.0				
6-Dec-01	50	322.0	56.0	334.5	1.37E+13	2.46E+14
29-Jan-02	50	673.0				
5-Feb-02	20	446.0				
12-Feb-02	20	509.0				
19-Feb-02	20	408.0	25.1	509.0	9.40E+12	3.74E+14
7-May-02	2400	723.0				
14-May-02	170	580.0				
23-May-02	20	391.0				
4-Jun-02	70	288.0	154.6	495.5	5.62E+13	7.27E+13
20-Aug-02	80	155.0				
27-Aug-02	17000	1110.0				
3-Sep-02	50	173.0				
10-Sep-02	50	131.0	241.5	392.3	6.95E+13	5.76E+13
2-Oct-02	170	419.0				
7-Oct-02	2300	321.0				
15-Oct-02	170	308.0				
30-Oct-02	1700	665.0	579.8	428.3	1.82E+14	6.29E+13
9-Jan-03	40	870.0				
16-Jan-03	50	750.0				
30-Jan-03	230	910.0				
4-Feb-03	460	930.0	120.6	865.0	7.66E+13	6.35E+14
30-May-03	130	950.0				
5-Jun-03	1300	940.0				
12-Jun-03	170	1000.0				
19-Jun-03	3300	2000.0	554.9	1222.5	4.98E+14	1.79E+14
24-Jul-03	790	970.0				
31-Jul-03	4900	1000.0				
7-Aug-03	3500	1000.0				
14-Aug-03	700	940.0	**1754.9**	**977.5**	**1.26E+15**	**1.43E+14**
20-Nov-03	3300	1490.0				
3-Dec-03	80	630.0				
11-Dec-03	2800	1320.0				
17-Dec-03	490	970.0	775.8	1102.5	6.28E+14	8.09E+14
5-Feb-04	80	871.7				
10-Feb-04	40	1050.1				
17-Feb-04	110	1041.8				
25-Feb-04	20	800.3	51.5	941.0	3.56E+13	6.91E+14
11-Mar-04	170	748.0				
14-Mar-04	20	717.1				
23-Mar-04	20	638.6				
8-Apr-04	20	581.5	34.1	671.3	1.68E+13	4.93E+14
4-Jul-04	500	1343.8				
15-Jul-04	40	557.7				
22-Jul-04	110	443.6				
5-Aug-04	130	553.0	130.0	724.5	6.92E+13	1.06E+14
16-Sep-04	110	3020.6				
22-Sep-04	230	1379.5				
27-Sep-04	80	1145.2				
6-Oct-04	30	814.6	88.3	1590.0	1.03E+14	2.33E+14
29-Mar-05	800	1879.0				
6-Apr-05	20	1355.7				
12-Apr-05	500	1355.7				
18-Apr-05	130	1213.0	179.6	1450.8	1.91E+14	1.06E+15
10-May-05	80	928.8				
24-May-05	170	783.7				
31-May-05	70	740.9				
7-Jun-05	9000	1676.8	304.2	1032.5	2.31E+14	7.58E+14

Figure A-3
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
12218501 Chattahoochee River at Hitchitee Creek

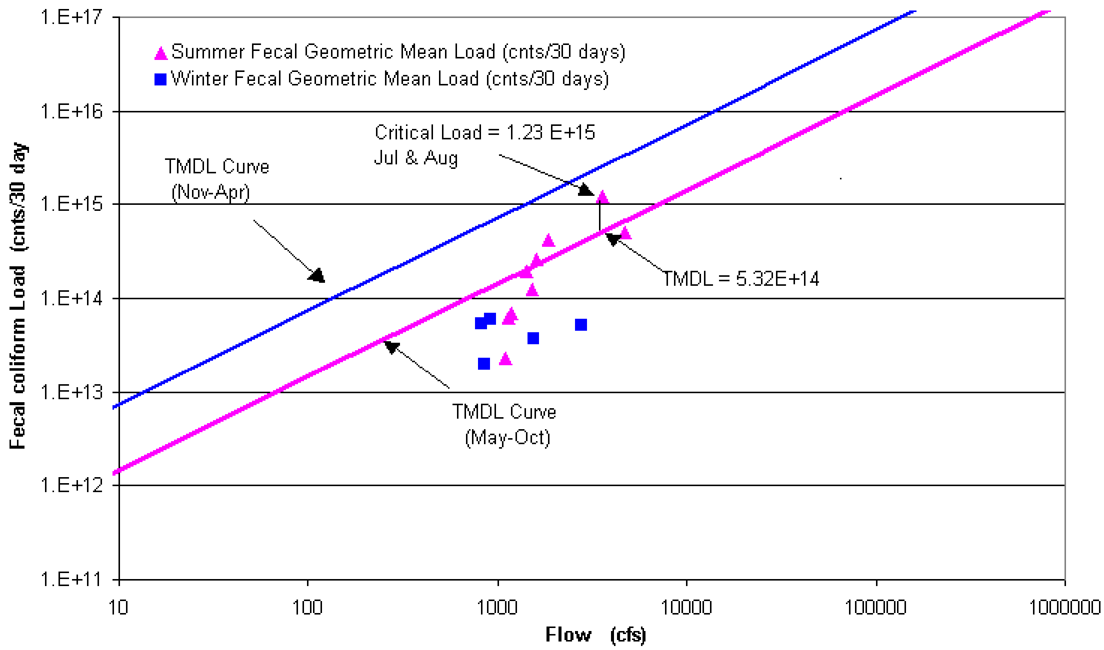


Table A-3. Data for Figure A-3

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
26-Mar-01	20	1019.9				
2-Apr-01	20	885.8				
10-Apr-01	20	702.8				
17-Apr-01	80	721.5				
24-Apr-01	50	951.3	31.7	856.3	1.99E+13	6.28E+14
7-May-01	80	888.9				
4-Jun-01	490	1143.6				
2-Jul-01	4900	951.3				
10-Jul-01	230	1185.2				
17-Jul-01	50	1569.9				
24-Jul-01	20	1965.0	183.2	1417.8	1.91E+14	2.08E+14
1-Oct-01	20	1070.8				
16-Oct-01	40	1091.6				
23-Oct-01	20	1174.8				
30-Oct-01	40	1070.8	28.3	1102.0	2.29E+13	1.62E+14
9-Jan-02	80	700.7				
16-Jan-02	20	878.5				
23-Jan-02	800	1413.9				
30-Jan-02	50	664.3	89.4	914.4	6.00E+13	6.71E+14
3-Apr-02	80	764.1				
10-Apr-02	40	681.0				
17-Apr-02	70	681.0				
24-Apr-02	270	1143.6	88.2	817.4	5.29E+13	6.00E+14
10-Jul-02	110	1060.5				
31-Jul-02	20	1154.0				
1-Aug-02	270	1185.2				
9-Aug-02	50	1154.0	73.8	1138.4	6.17E+13	1.67E+14
3-Oct-02	130	1050.1				
9-Oct-02	40	1403.5				
16-Oct-02	9000	2734.3				
24-Oct-02	50	1237.2	219.9	1606.3	2.59E+14	2.36E+14
16-Jan-03	20	1164.4				
22-Jan-03	140	1195.6				
29-Jan-03	20	1528.3				
6-Feb-03	20	2297.6	32.5	1546.5	3.69E+13	1.14E+15
18-Apr-03	50	2297.6				
21-Apr-03	20	1673.8				
23-Apr-03	20	2328.8				
30-Apr-03	20	4782.4	25.1	2770.7	5.11E+13	2.03E+15
16-Jul-03	110	6705.8				
23-Jul-03	2800	1829.8				
30-Jul-03	300	2942.2				
6-Aug-03	500	3004.6	**463.6**	**3620.6**	**1.23E+15**	**5.32E+14**
8-Oct-03	700	1746.6				
20-Oct-03	80	1310.0				
22-Oct-03	20	1590.7				
28-Oct-03	140	1413.9	111.9	1515.3	1.24E+14	2.22E+14
17-Mar-04	20	1705.0				
24-Mar-04	10	1497.1				
31-Mar-04	52	1206.0				
7-Apr-04	20	1299.6	21.4	1426.9	2.24E+13	1.05E+15
23-Jun-04	300	1143.6				
30-Jun-04	170	1216.4				
12-Jul-04	20	1070.8				
19-Jul-04	40	1299.6	79.9	1182.6	6.94E+13	1.74E+14
21-Sep-04	130	7641.5				
28-Sep-04	9000	5416.6				
6-Oct-04	20	3992.3				
19-Oct-04	20	1850.6	147.1	4725.2	5.10E+14	6.94E+14
13-Dec-04	20	3451.7				
15-Dec-04	51	7776.6				
22-Dec-04	10	4626.5	21.7	5284.9	8.41E+13	3.88E+15
10-Jan-05	20	1517.9				
21-Feb-05	749	3108.6				
28-Feb-05	683	3264.5				
7-Mar-05	20	1965.0				
14-Mar-05	10	2775.9				
22-Mar-05	20	2671.9	72.8	2757.2	1.47E+14	2.02E+15
16-May-05	230	2495.2				
23-May-05	20	1642.7				
6-Jun-05	700	1403.5				
13-Jun-05	3000	1861.0	313.5	1850.6	4.26E+14	2.72E+14

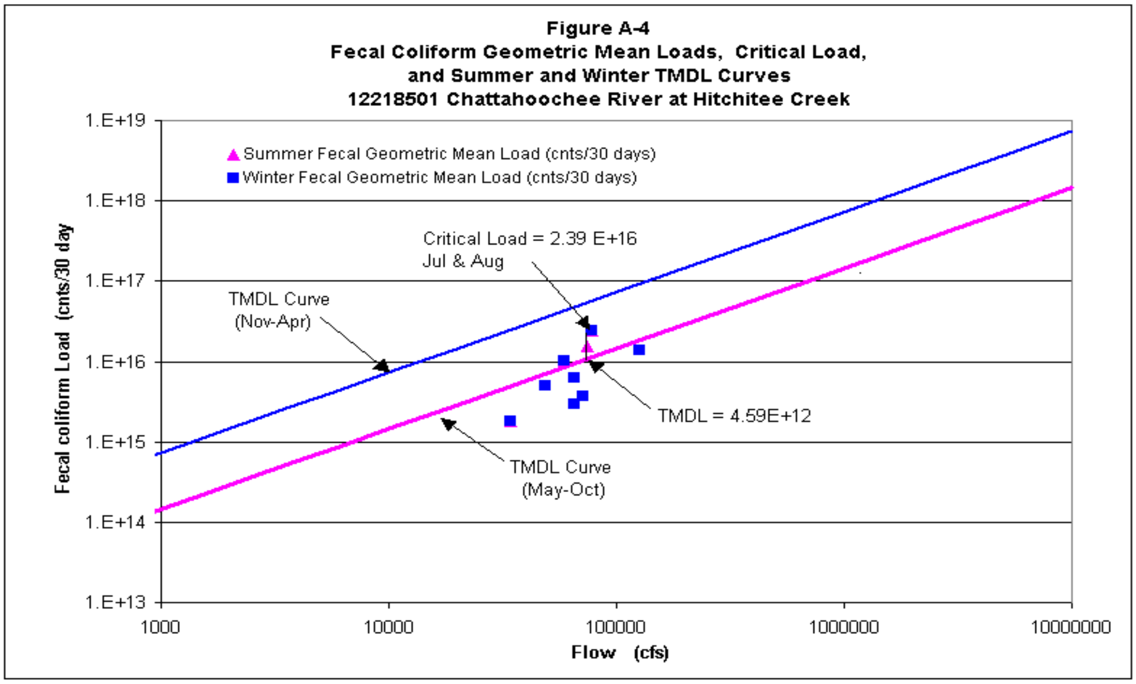


Table A-4. Data for Figure A-4

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
28-Jan-03	80	26680.3				
5-Feb-03	35	43451.9				
19-Feb-03	330	93807.4				
24-Feb-03	310	97462.3	130.1	65350.5	6.24E+15	4.80E+16
14-Apr-03	20	33462.0				
16-Apr-03	170	33096.6				
28-Apr-03	220	82436.8				
5-May-03	490	45888.5	138.4	48721.0	4.95E+15	7.15E+15
14-Jul-03	1300	79594.2				
23-Jul-03	130	88528.2				
30-Jul-03	230	99492.7				
4-Aug-03	790	43858.0	**418.6**	**77868.3**	**2.39E+16**	**1.14E+16**
13-Oct-03	130	31594.0				
22-Oct-03	80	41015.4				
27-Oct-03	50	30700.6				
5-Nov-03	50	33299.6	71.4	34152.4	1.79E+15	2.51E+16
14-Jan-04	20	58477.4				
20-Jan-04	110	45076.3				
28-Jan-04	310	98680.5				
2-Feb-04	20	60507.8	60.8	65685.5	2.93E+15	4.82E+16
29-Sep-04	1300	76751.5				
6-Oct-04	50	60913.9				
13-Oct-04	200	40365.6	235.1	59343.7	1.02E+16	8.71E+15
15-Nov-04	50	44264.1				
29-Nov-04	40	127513.1				
6-Dec-04	90	49137.2				
14-Dec-04	130	64974.8	69.6	71472.3	3.65E+15	5.25E+16
24-Jan-05	130	42639.7				
21-Mar-05	130	77969.8				
4-Apr-05	1700	299696.5				
13-Apr-05	110	73908.9				
18-Apr-05	20	51979.9	148.5	125888.8	1.37E+16	9.24E+16
23-May-05	75	39959.5				
6-Jun-05	130	68629.7				
8-Jun-05	1300	62538.3				
13-Jun-05	490	125076.6	280.7	74051.0	1.53E+16	1.09E+16

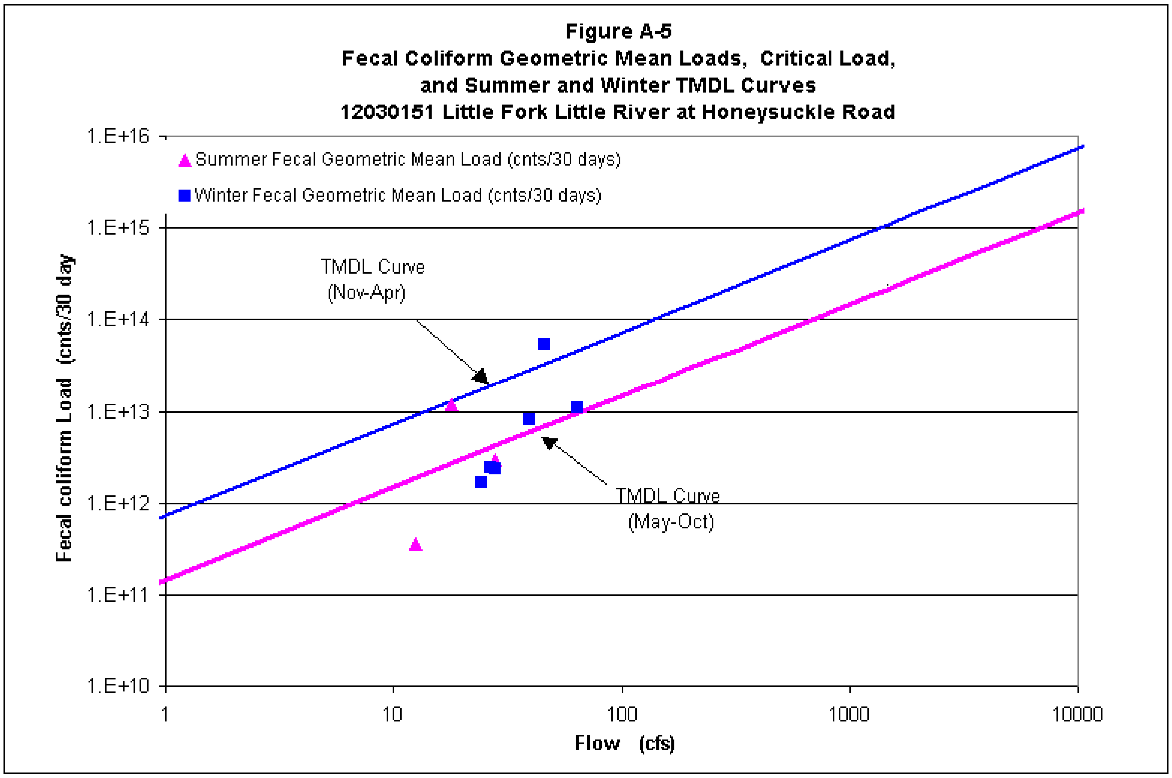


Figure A-5
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
12030151 Little Fork Little River at Honeysuckle Road
Summer Fecal Geometric Mean Load (cnts/30 days)
Winter Fecal Geometric Mean Load (cnts/30 days)
TMDL Curve
(Nov-Apr)
TMDL Curve
(May-Oct)
Fecal coliform Load (cnts/30 day
1.E+16
1.E+15
1.E+14
1.E+13
1.E+12
1.E+11
1.E+10
1
10
100
1000
10000
Flow (cfs)

Table A-5. Data for Figure A-5

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
11-Jan-01	110	18.0				
18-Jan-01	330	36.9				
25-Jan-01	130	27.5				
1-Feb-01	50	24.1				
7-Mar-01	220	29.4	279.7	39.3	8.07E+12	2.89E+13
3-May-01	50	22.1				
6-Jun-01	790	47.3				
3-Jul-01	90	16.5				
25-Jul-01	1300	18.0				
30-Jul-01	1700	17.6				
1-Aug-01	3300	20.2	900.1	18.1	1.19E+13	2.65E+12
3-Oct-01	20	11.5				
10-Oct-01	40	12.0				
17-Oct-01	20	13.9				
24-Oct-01	140	12.3	38.7	12.4	3.53E+11	1.82E+12
5-Feb-02	50	25.3				
12-Feb-02	500	28.3				
19-Feb-02	90	22.1				
26-Feb-02	35	21.5	94.2	24.3	1.68E+12	1.79E+13
7-May-02	330	37.0				
14-May-02	40	30.2				
20-May-02	20	23.0				
28-May-02	1700	20.9	145.6	27.8	2.97E+12	2.04E+13
6-Aug-02	210	9.3				
13-Aug-02	20	7.0				
20-Aug-02	20	6.8				
27-Aug-02	2300	15.1	117.9	9.5	8.26E+11	7.01E+12
7-Nov-02	**15000**	42.3				
12-Nov-02	9000	70.6				
19-Nov-02	220	40.9				
26-Nov-02	220	30.9	1598.8	46.2	5.42E+13	3.39E+13
17-Feb-03	3500	67.2				
24-Feb-03	500	72.0				
3-Mar-03	20	58.5				
10-Mar-03	80	58.0	230.0	63.9	1.08E+13	4.69E+13
19-May-03	640	54.4				
27-May-03	40	52.3				
2-Jun-03	20	40.7				
9-Jun-03	790	68.3	141.8	53.9	5.61E+12	7.91E+12
18-Aug-03	80	42.6				
25-Aug-03	70	32.5				
2-Sep-03	130	32.7				
8-Sep-03	80	30.3	87.4	34.5	2.21E+12	5.07E+12
4-Nov-03	110	22.2				
10-Nov-03	80	23.5				
18-Nov-03	40	25.1				
24-Nov-03	490	40.1	114.6	27.7	2.33E+12	2.04E+13
16-Mar-04	76	34.4				
23-Mar-04	74	29.6				
30-Mar-04	455	33.8				
6-Apr-04	703	26.4	205.9	31.0	4.69E+12	2.28E+13
22-Jun-04	110	26.0				
29-Jun-04	950	36.4				
7-Jul-04	130	31.4				
14-Jul-04	230	20.2	236.4	28.5	4.95E+12	4.19E+12
20-Sep-04	3000	62.4				
27-Sep-04	230	34.1				
5-Oct-04	110	26.5				
13-Oct-04	40	26.6	234.7	37.4	6.45E+12	5.50E+12
8-Dec-04	233	92.1				
14-Dec-04	256	59.9				
21-Dec-04	30	43.2	121.4	65.1	5.80E+12	4.78E+13
5-Jan-05	30	39.5				
24-Jan-05	20	35.0				
26-Jan-05	80	35.4				
1-Feb-05	63	35.9	41.7	36.5	1.12E+12	2.68E+13
5-Apr-05	80	73.7				
11-Apr-05	230	69.6				
18-Apr-05	170	58.0				
26-Apr-05	110	53.2	136.2	63.6	6.36E+12	4.67E+13
18-Jul-05	1100	81.4				
25-Jul-05	110	53.8				

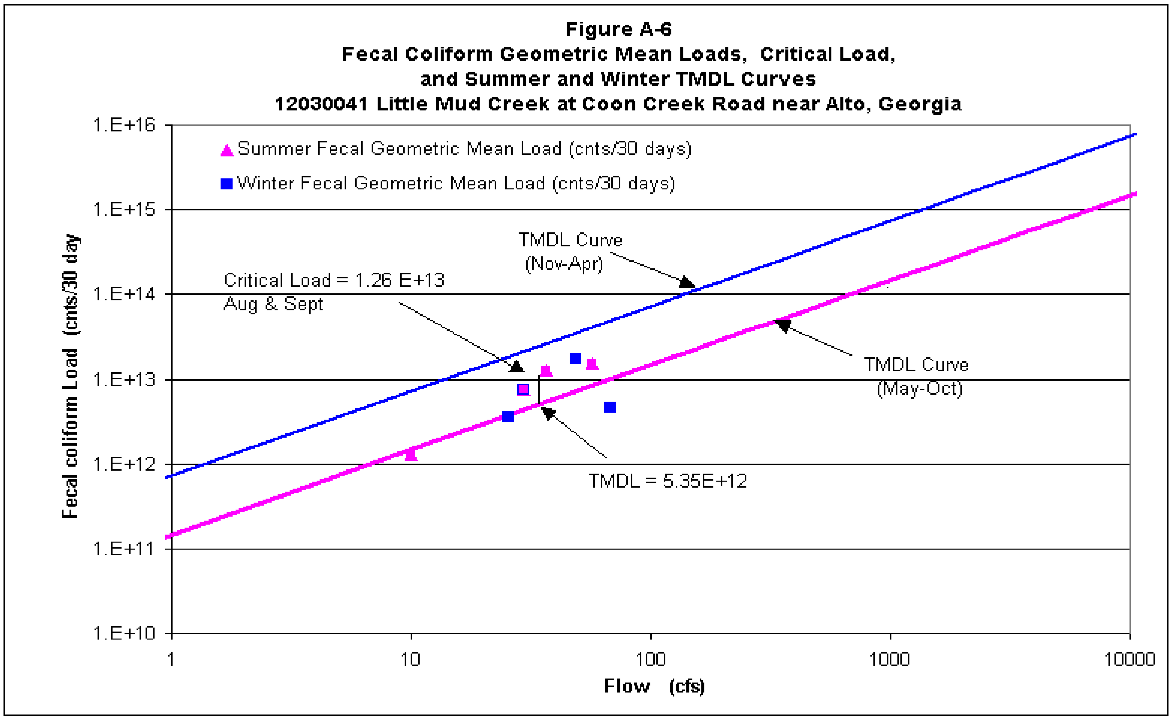


Table A-6. Data for Figure A-6

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
5-Feb-02	270	26.7				
12-Feb-02	130	29.9				
19-Feb-02	80	23.3				
26-Feb-02	460	22.7	189.6	25.7	3.57E+12	1.88E+13
7-May-02	1300	39.0				
14-May-02	220	31.9				
20-May-02	170	24.2				
28-May-02	330	22.1	355.9	29.3	7.66E+12	4.30E+12
6-Aug-02	50	9.8				
13-Aug-02	110	7.4				
20-Aug-02	20	7.2				
27-Aug-02	7900	15.9	171.7	10.1	1.27E+12	1.48E+12
7-Nov-02	310	44.7				
12-Nov-02	2800	74.5				
19-Nov-02	300	43.2				
26-Nov-02	220	32.6	489.2	48.8	1.75E+13	3.58E+13
17-Feb-03	230	70.9				
24-Feb-03	155	75.9				
3-Mar-03	20	61.7				
10-Mar-03	110	61.2	94.1	67.5	4.66E+12	4.95E+13
19-May-03	1700	57.4				
27-May-03	170	55.2				
2-Jun-03	300	42.9				
9-Jun-03	230	72.0	375.8	56.9	1.57E+13	8.35E+12
18-Aug-03	5000	44.9				
25-Aug-03	700	34.3				
2-Sep-03	110	34.5				
8-Sep-03	130	32.0	**473.0**	**36.4**	**1.26E+13**	**5.35E+12**
4-Nov-03	170	23.5				
10-Nov-03	230	24.8				
18-Nov-03	220	26.5				
24-Nov-03	1800	42.3	352.8	29.3	7.58E+12	2.15E+13

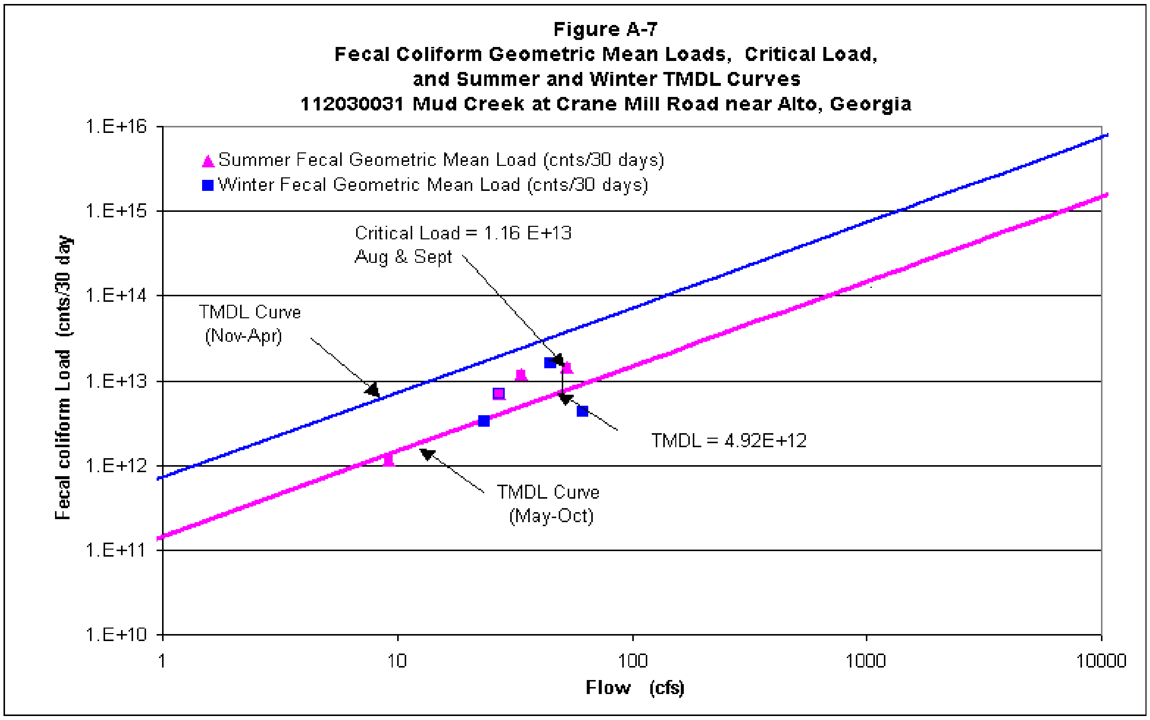


Table A-7. Data for Figure A-7

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
5-Feb-02	270	24.6				
12-Feb-02	130	27.5				
19-Feb-02	80	21.5				
26-Feb-02	460	20.9	189.6	23.6	3.29E+12	1.73E+13
7-May-02	1300	35.9				
14-May-02	220	29.3				
20-May-02	170	22.3				
28-May-02	330	20.3	355.9	27.0	7.05E+12	3.96E+12
6-Aug-02	50	9.0				
13-Aug-02	110	6.8				
20-Aug-02	20	6.6				
27-Aug-02	7900	14.7	171.7	9.3	1.17E+12	1.36E+12
7-Nov-02	310	41.1				
12-Nov-02	2800	68.6				
19-Nov-02	300	39.7				
26-Nov-02	220	30.0	489.2	44.9	1.61E+13	3.29E+13
17-Feb-03	230	65.3				
24-Feb-03	155	69.9				
3-Mar-03	20	56.8				
10-Mar-03	110	56.4	94.1	62.1	4.29E+12	4.56E+13
19-May-03	1700	52.8				
27-May-03	170	50.8				
2-Jun-03	300	39.5				
9-Jun-03	230	66.3	375.8	52.4	1.44E+13	7.69E+12
18-Aug-03	5000	41.3				
25-Aug-03	700	31.5				
2-Sep-03	110	31.8				
8-Sep-03	130	29.5	**473.0**	**33.5**	**1.16E+13**	**4.92E+12**
4-Nov-03	170	21.6				
10-Nov-03	230	22.9				
18-Nov-03	220	24.4				
24-Nov-03	1800	38.9	352.8	26.9	6.98E+12	1.98E+13

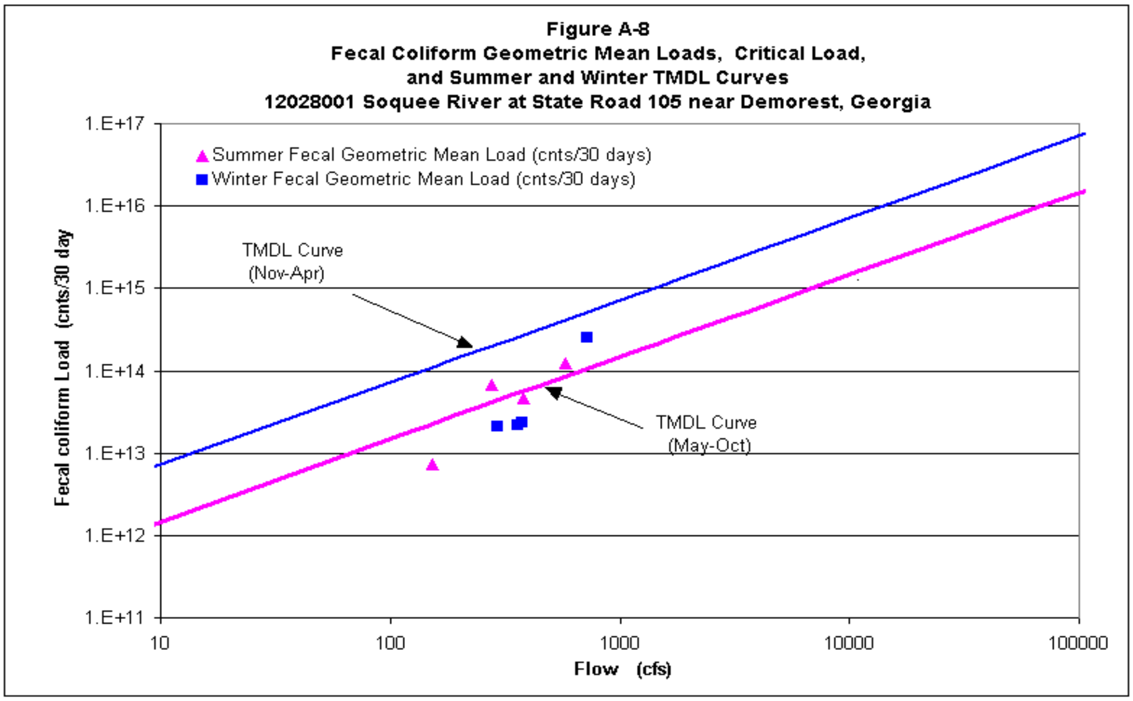


Table A-8. Data for Figure A-8

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
6-Mar-02	110	252.6				
13-Mar-02	500	375.3				
20-Mar-02	20	253.1				
27-Mar-02	80	290.1	96.9	292.8	2.08E+13	2.15E+14
5-Jun-02	500	236.4				
17-Jun-02	20	129.3				
19-Jun-02	90	120.7				
26-Jun-02	20	125.8	65.1	153.1	7.32E+12	2.25E+13
9-Sep-02	20	64.9				
16-Sep-02	5000	435.7				
23-Sep-02	500	309.9				
30-Sep-02	260	294.2	337.7	276.2	6.84E+13	4.05E+13
3-Dec-02	20	271.4				
10-Dec-02	300	372.8				
17-Dec-02	90	413.4				
19-Dec-02	80	380.9	81.1	359.6	2.14E+13	2.64E+14
20-Mar-03	**17500**	1303.5				
26-Mar-03	70	498.1				
9-Apr-03	230	603.6				
17-Apr-03	170	497.1	467.8	725.6	2.49E+14	5.33E+14
18-Jun-03	500	786.2				
25-Jun-03	80	459.0				
30-Jun-03	800	449.9				
9-Jul-03	230	618.8	292.9	578.5	1.24E+14	8.49E+13
15-Sep-03	110	297.2				
22-Sep-03	80	720.2				
1-Oct-03	500	266.3				
6-Oct-03	170	248.0	165.4	382.9	4.65E+13	5.62E+13
9-Dec-03	40	294.2				
15-Dec-03	230	435.2				
17-Dec-03	120	440.8				
22-Dec-03	50	336.3	86.2	376.6	2.38E+13	2.76E+14

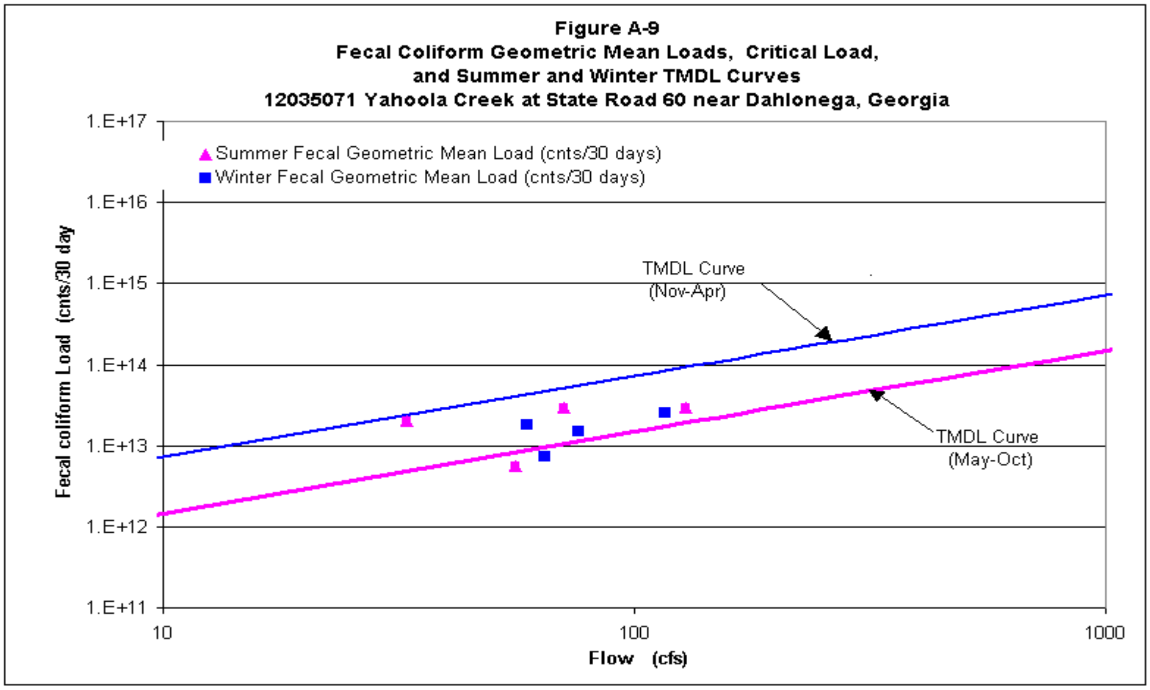


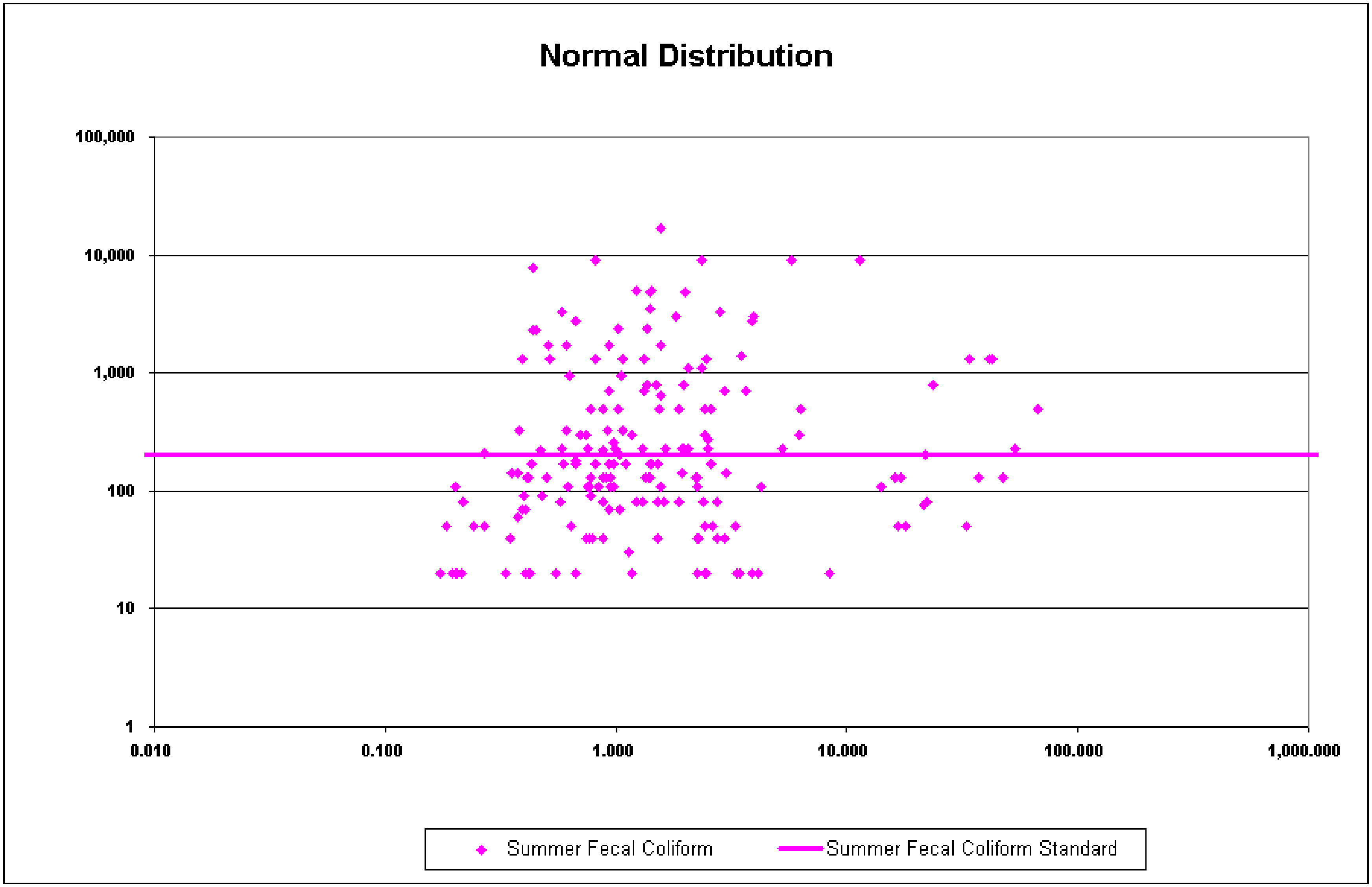
Table A-9. Data for Figure A-9

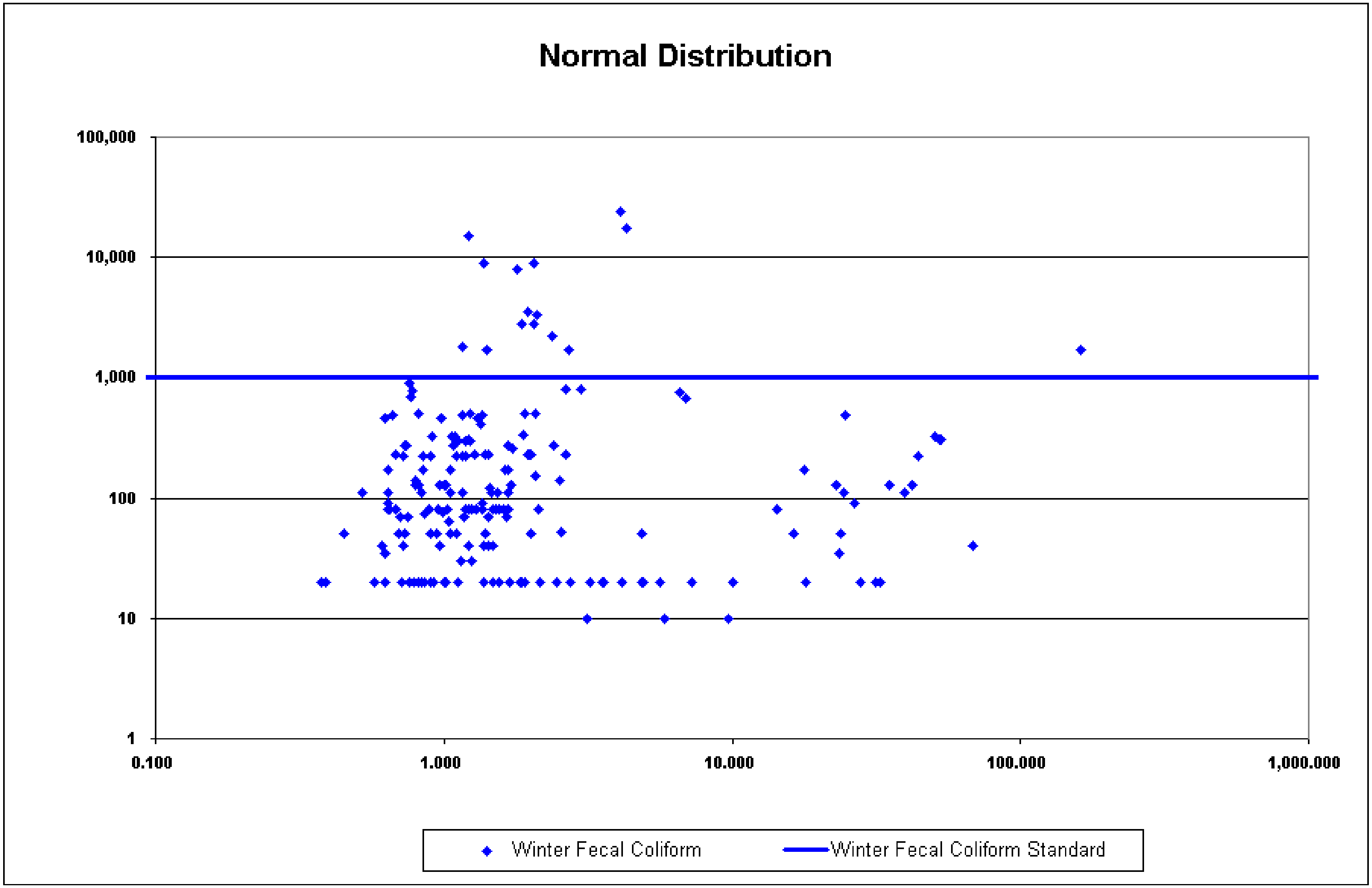
Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
6-Mar-02	790	50.9				
13-Mar-02	300	73.7				
20-Mar-02	900	49.6				
27-Mar-02	130	63.1	408.1	59.3	1.78E+13	4.35E+13
5-Jun-02	9000	53.4				
17-Jun-02	130	27.3				
19-Jun-02	1300	25.7				
26-Jun-02	330	24.8	841.7	32.8	2.03E+13	4.81E+12
9-Sep-02	20	11.3				
16-Sep-02	500	101.4				
23-Sep-02	200	67.6				
30-Sep-02	180	43.9	137.7	56.0	5.67E+12	8.23E+12
3-Dec-02	70	46.0				
10-Dec-02	130	65.8				
17-Dec-02	220	76.4				
19-Dec-02	275	70.3	153.2	64.6	7.26E+12	4.74E+13
20-Mar-03	1700	176.6				
26-Mar-03	40	89.7				
9-Apr-03	270	109.5				
17-Apr-03	410	87.6	294.6	115.9	2.50E+13	8.50E+13
18-Jun-03	1400	229.8				
25-Jun-03	130	90.3				
30-Jun-03	230	84.9				
9-Jul-03	230	107.2	313.2	128.1	2.94E+13	1.88E+13
15-Sep-03	1300	53.6				
22-Sep-03	1100	134.7				
1-Oct-03	230	49.3				
6-Oct-03	300	45.7	560.5	70.9	2.91E+13	1.04E+13
9-Dec-03	20	55.9				
15-Dec-03	230	91.5				
17-Dec-03	**9000**	90.6				
22-Dec-03	130	66.2	270.9	76.0	1.51E+13	5.58E+13

.

Appendix B

Normalized Flows Versus Fecal Coliform Plots


Normal Distribution
100,000
10,000
1,000
100
10
1
0.010
0.100
1.000
10.000
100.000
1,000.000
Summer Fecal Coliform
Summer Fecal Coliform Standard


Normal Distribution
100,000
10,000
1,000
100
10
1
0.100
1.000
10.000
100.000
1,000.000
Winter Fecal Coliform
Winter Fecal Coliform Standard