Total Maximum Daily Load

Evaluation

for

Thirteen 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, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* (GA EPD, 2010 – 2011). This document is available on the Georgia Environmental Protection Division (EPD) website.

Some of the 305(b) 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 2012 303(d) listing, which is available on the 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.

Every water in the State has one or more designated uses, and each designated use has water quality criteria established to protect it. The State of Georgia has placed thirteen stream segments in the Chattahoochee River Basin on the 303(d) list of impaired waters because they were assessed as "not supporting" their designated use of "Fishing" due to violation of the fecal coliform water quality criteria. The water quality criteria for fecal coliform bacteria for a water with a designated use of fishing are as follows: For the months of May through October, when water contact recreation activities are expected to occur, fecal coliform counts are 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. For the months of November through April, fecal coliform counts are 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. A water is assessed as "not supporting" its use if more than 10% of the geometric means exceeded the water quality criteria cited above. If no geometric means are available, a water is assessed as "not supporting" its use if more than 10 percent of individual samples exceed the fecal coliform criteria.

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 bacteria delivered to a stream is difficult to determine. However, the use of these management practices should improve stream water quality, and future monitoring will provide a measurement 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)	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Bear Creek	1.38E+13	2.28E+09	6.64E+11	5.09E+12	6.40E+11	6.40E+12	54
Beech Creek	1.94E+12	-	-	1.36E+12	1.51E+11	1.51E+12	22
Bubbling Creek	9.61E+13	-	3.36E+11	2.40E+11	6.40E+10	6.40E+11	99
Cauley Creek	4.19E+14	1.22E+11	2.90E+13	5.67E+13	9.53E+12	9.53E+13	77
Chestatee River - Tate Creek to Tesnatee Creek	6.03E+14	-	-	1.09E+14	1.21E+13	1.21E+14	80
Chestatee River - Tesnatee Creek To Yahoola Creek	3.99E+13	9.32E+10	-	2.35E+13	2.62E+12	2.62E+13	34
Hillabahatchee Creek	1.68E+14	-	-	5.60E+13	6.23E+12	6.23E+13	63
Hodchodkee Creek	7.48E+12	-	-	4.76E+12	5.28E+11	5.28E+12	29
Hog Creek	1.07E+14	-	-	8.75E+12	9.72E+11	9.72E+12	91
Holanna Creek	4.66E+12	-	-	1.23E+12	1.36E+11	1.36E+12	71
Long Indian Creek	1.54E+15	-	4.53E+13	2.75E+13	8.09E+12	8.09E+13	95
South Fork Camp Creek	1.05E+13	-	2.33E+11	2.18E+11	5.01E+10	5.01E+11	95
Upatoi Creek	6.59E+13	-	4.82E+11	2.17E+13	2.47E+12	2.47E+13	63

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 depending on water quality assessment results: supporting designated use, not supporting designated use, or assessment pending. 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, 2010 – 2011). This document is available on the Georgia Environmental Protection Division (EPD) website.

A subset of the water bodies that do not meet designated uses, those in Category 5 on the 305(b) list are assigned to Georgia's 303(d) list, named after that section of the CWA. Water bodies included in 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 criteria. The TMDLs in this document are based on the 2012 303(d) listing, which is available on the 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 that are 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 thirteen streams in the Chattahoochee River Basin included on the 2012 303(d) list for exceedances of the fecal coliform standard criteria.

Table 1. Water Bodies Listed on the 2012 303(d) List for Fecal Coliform Bacteria in the Chattahoochee River Basin

Stream Segment	Location	Reach ID	Segment Length (miles)	Designated Use
Bear Creek	Little Bear Creek to Chattahoochee River	R031300020311	4	Fishing
Beech Creek	D/S Ross Keith Road	R031300020711	17	Fishing
Bubbling Creek	DeKalb County	R031300011210	2	Fishing
Cauley Creek	Headwaters to Chattahoochee River	R031300010914	2	Fishing
Chestatee River	Tate Creek to Tesnatee Creek	R031300010508	7	Fishing
Chestatee River	Tesnatee Creek To Yahoola Creek	R031300010608	10	Fishing
Hillabahatchee Creek	Tollieson Branch to West Point Lake (Formerly Tollieson Branch to Glovers Road)	R031300020608	3	Fishing
Hodchodkee Creek	Bladen Creek to Smithee Jack Creek	R031300031406	8	Fishing
Hog Creek	Headwaters to Cemochechobee Creek	R031300040102	9	Fishing
Holanna Creek	Hog Creek to Pataula Creek	R031300031505	7	Fishing
Long Indian Creek	Headwaters to Big Creek	R031300011007	4	Fishing
South Fork Camp Creek	College Park	R031300020317	3	Fishing
Upatoi Creek	U/S Chattahoochee River, Columbus	R031300030303	14	Fishing

1.2 Watershed Description

The Chattahoochee River Basin is located primarily in west Georgia and east Alabama, with a small portion 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 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 where it 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.

The Chattahoochee River basin includes four United States Geologic Survey (USGS) eight-digit hydrologic units, HUC 03130001 – 03130004. Figure 1 shows the locations of the four hydrologic units in the Chattahoochee River Basin. Figures 2 through 5 show the locations of the listed segments and associated counties in these HUCs.

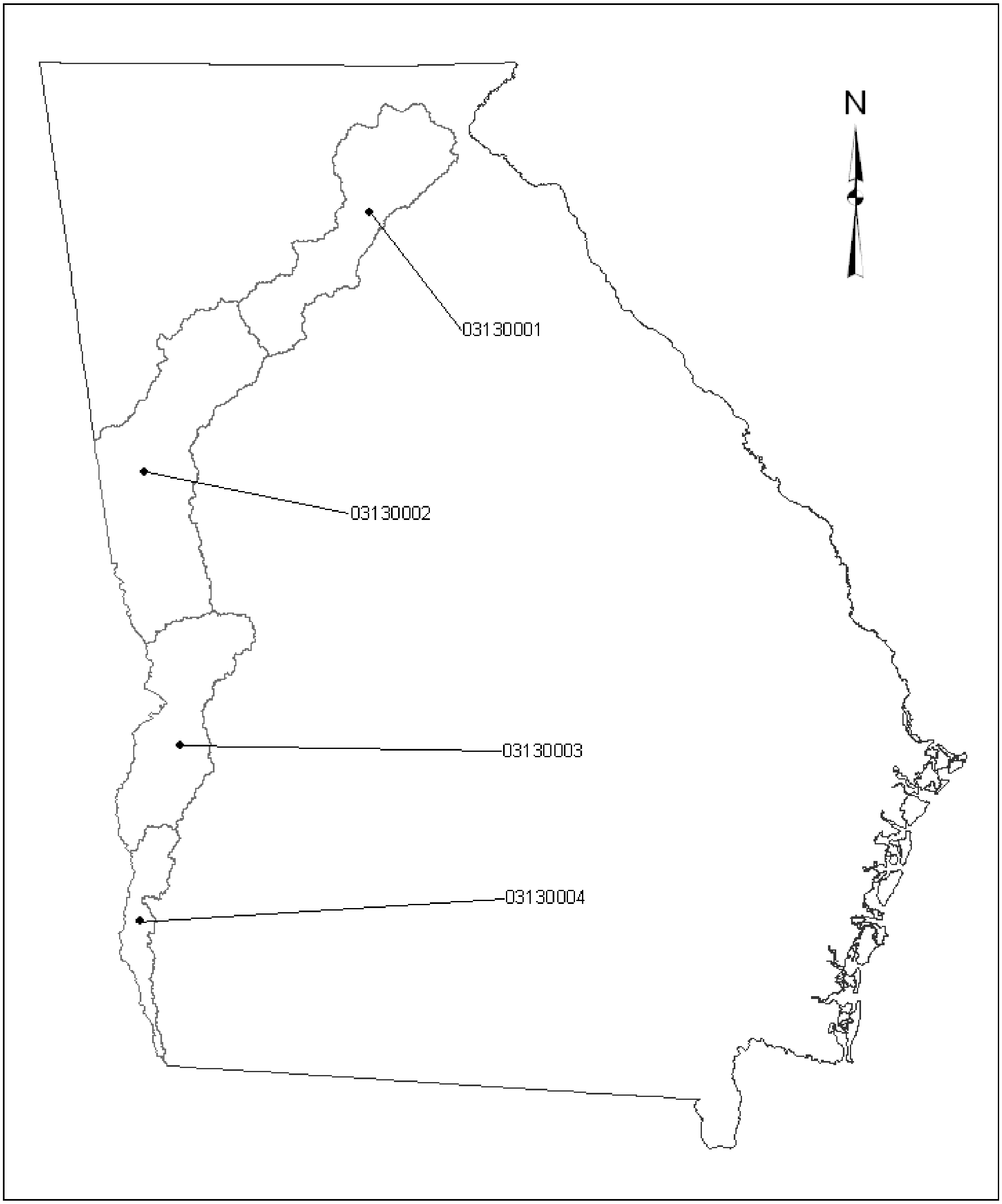
The land use characteristics of the Chattahoochee River Basin watersheds were determined using data from the Georgia Land Use Trends (GLUT) for Year 2008. This raster land use trend product was developed by the University of Georgia – Natural Resources Spatial Analysis Laboratory (NARSAL) and follows land use trends for years 1974, 1985, 1991, 1998, 2001, 2005 and 2008. The raster data sets were developed from Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+). Some of the NARSAL land use types were reclassified, aggregated into similar land use types, and used in the final watershed characterization. Table 2 lists the watershed land use distribution for the drainage areas of the thirteen stream segments.

1.3 Water Quality Standard

The water use classification for the listed stream segments in the Chattahoochee River Basin is Fishing. The criterion violated is listed as fecal coliform. The potential causes 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, 2011), are:

(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)



TMDL Evaluation - Fecal Coliform
Chattahoochee River Basin

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

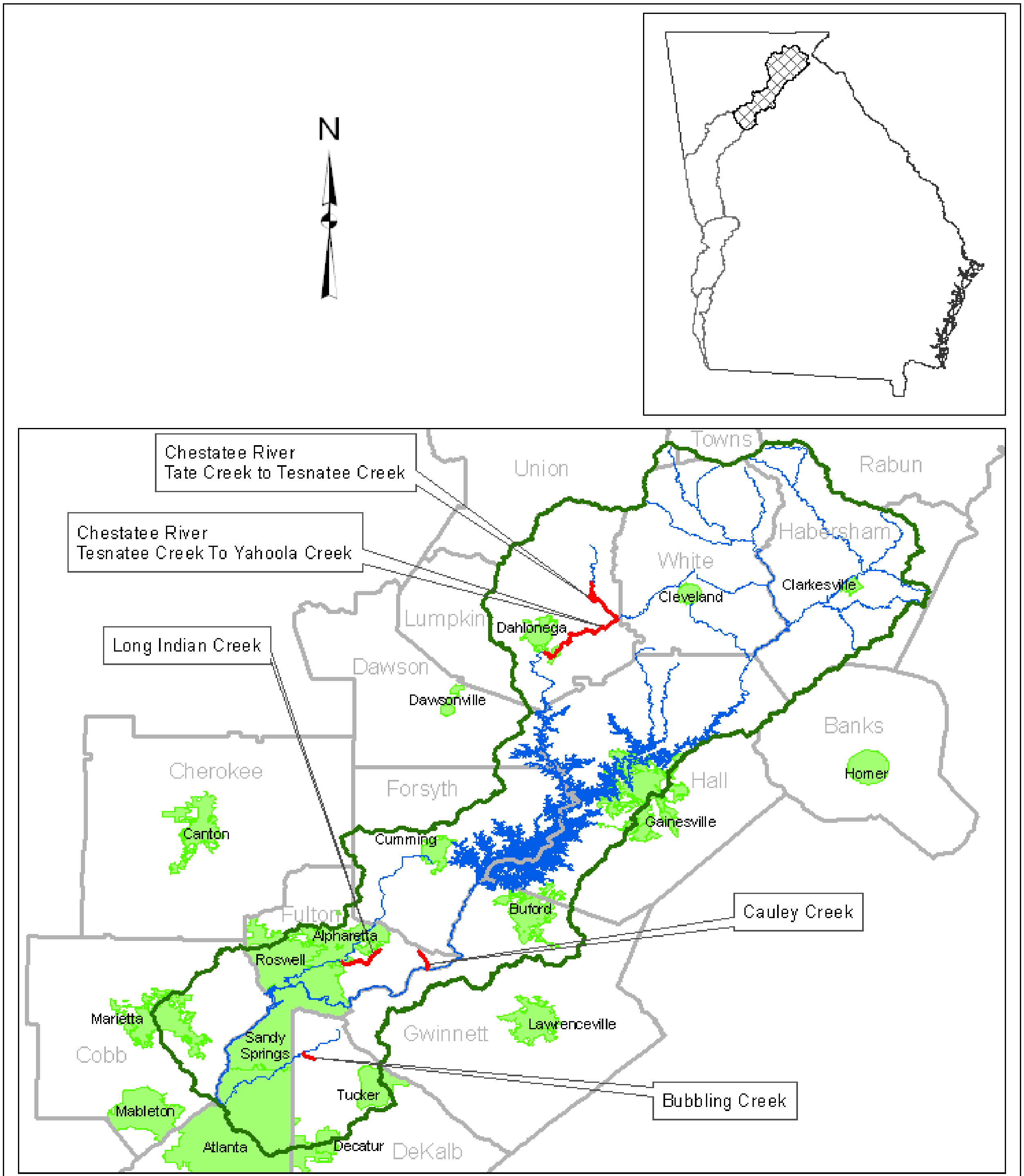


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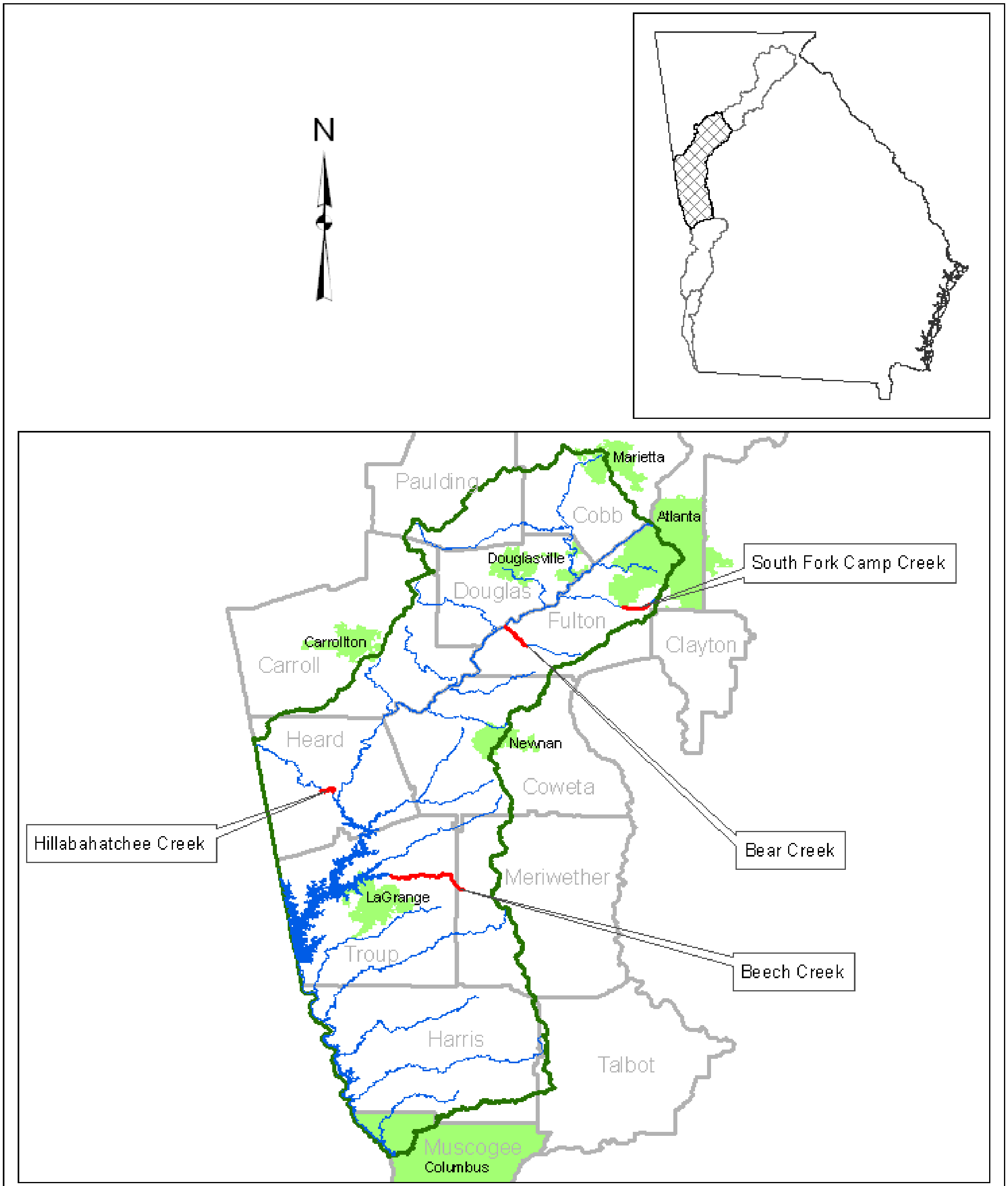
Figure 2. Impaired Stream Segments in HUC 03130001



TMDL Evaluation - Fecal Coliform Chattahoochee River Basin	Figure 3. Impaired Stream Segments in HUC 03130002

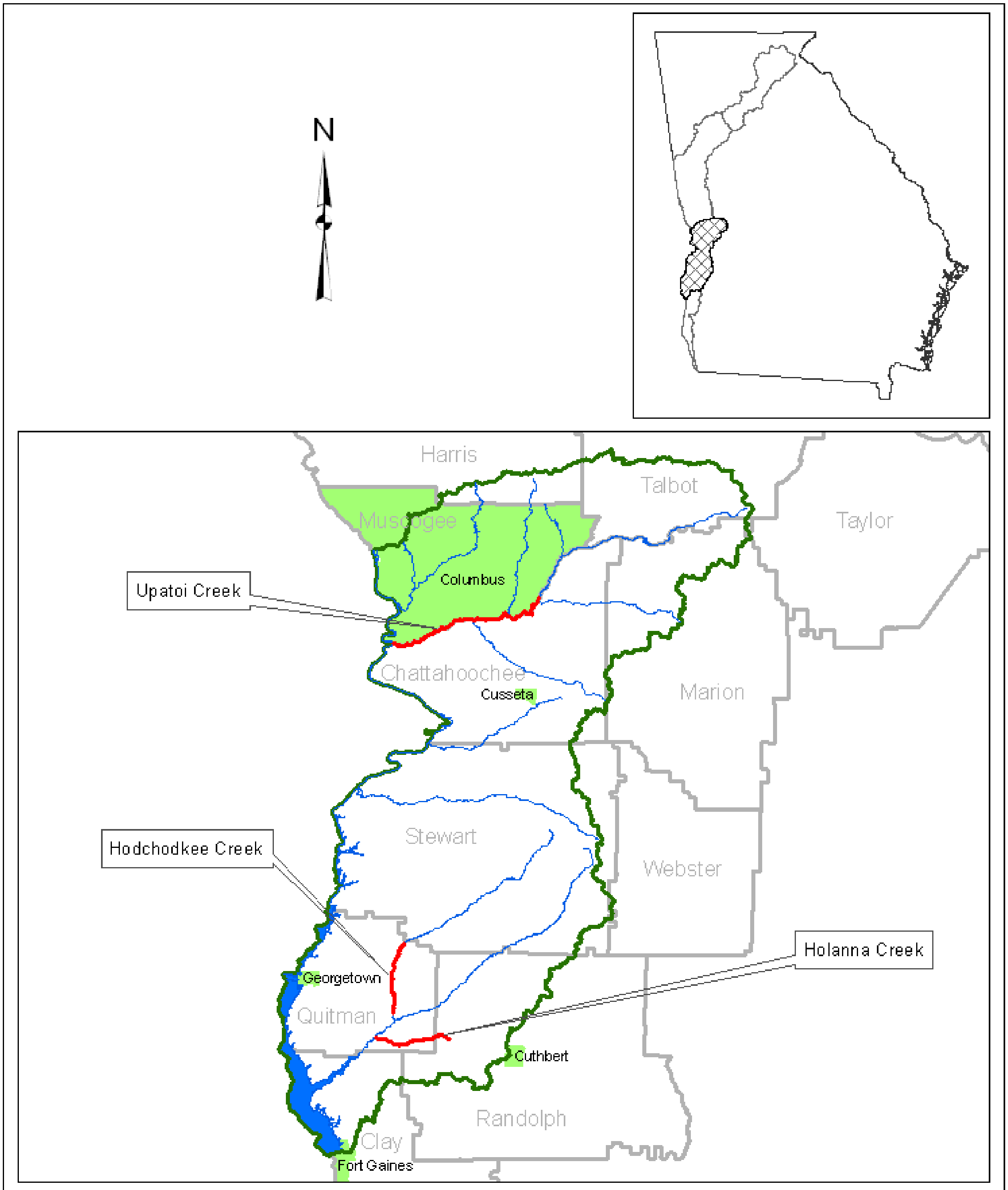


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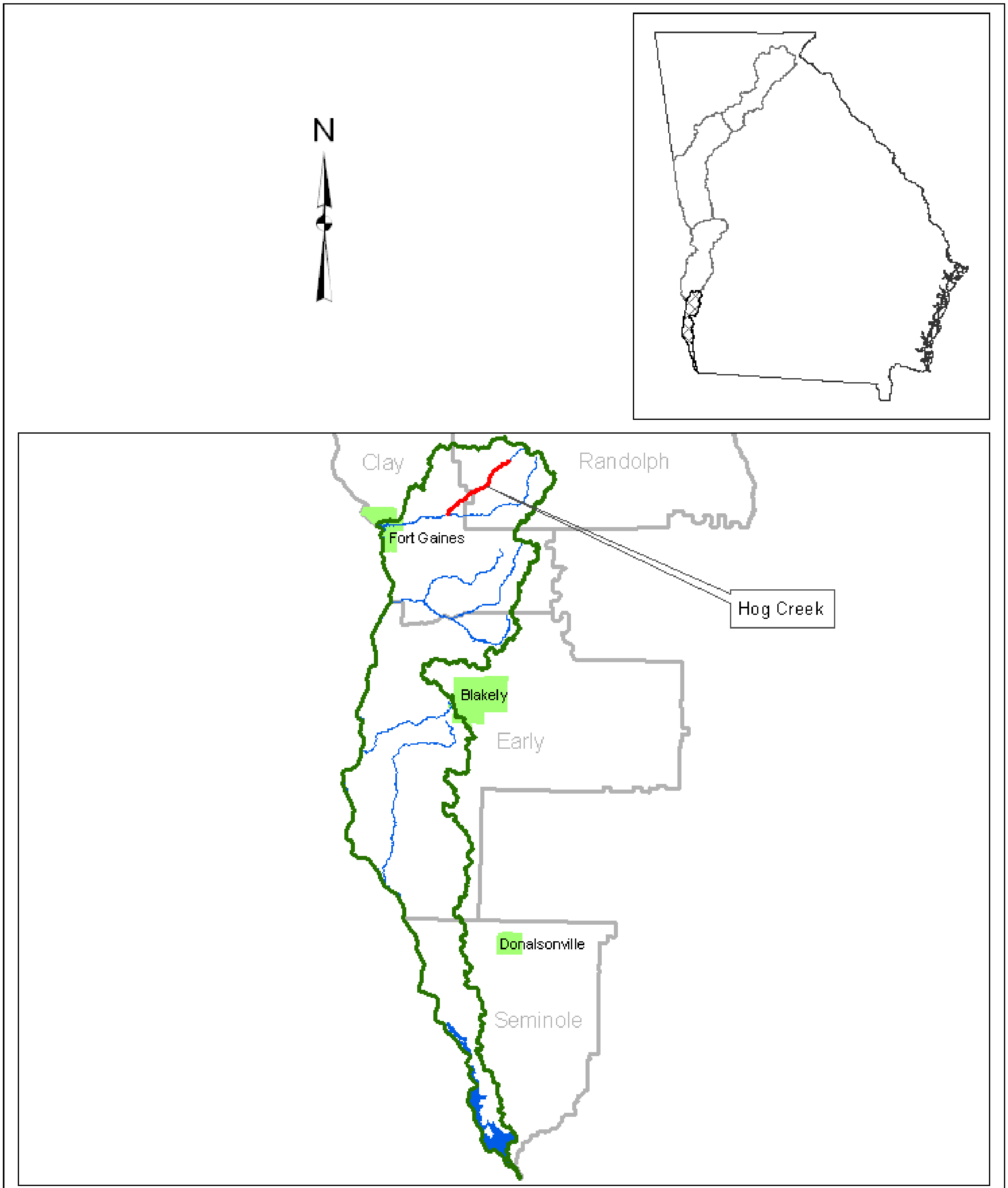
Figure 4. Impaired Stream Segments in HUC 03130003



TMDL Evaluation - Fecal Coliform
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Figure 5. Impaired Stream Segments in HUC 03130004

Table 2. Chattahoochee River Basin Land Coverage

Stream/Segment	Land Use 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	Transitional	Forest	Row Crops	Pasture, Hay	Other Grasses (Urban, recreational; e.g. parks, lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total
Bear Creek	107	1,378	436	102	10	0	719	11,755	0	1,555	2,652	938	5	19,657
	0.5%	7.0%	2.2%	0.5%	0.05%	0.0%	3.7%	59.8%	0.0%	7.9%	13.5%	4.8%	0.03%	100.0%
Beech Creek	210	650	46	2	34	0	3,145	22,891	0	4,236	958	3,081	43	35,295
	0.6%	1.8%	0.1%	0.01%	0.1%	0.0%	8.9%	64.9%	0.0%	12.0%	2.7%	8.7%	0.1%	100.0%
Bubbling Creek	0	164	102	164	57	0	0	78	0	6	278	0	0	850
	0.0%	19.3%	12.0%	19.3%	6.8%	0.0%	0.0%	9.2%	0.0%	0.7%	32.7%	0.0%	0.0%	100.0%
Cauley Creek	17	415	150	33	2	0	28	585	0	170	161	9	0	1,569
	1.1%	26.4%	9.6%	2.1%	0.1%	0.0%	1.8%	37.3%	0.0%	10.8%	10.2%	0.6%	0.0%	100.0%
Chestatee River - Tate Creek to Tesnatee Creek	42	155	18	3	137	0	253	35,776	1	1,931	1,801	25	0	40,141
	0.1%	0.4%	0.05%	0.01%	0.3%	0.0%	0.6%	89.1%	0.002%	4.8%	4.5%	0.1%	0.0%	100.0%
Chestatee River - Tesnatee Creek To Yahoola Creek	276	1,825	357	158	213	62	1,868	77,972	1	9,842	6,453	269	0	99,296
	0.3%	1.8%	0.4%	0.2%	0.2%	0.06%	1.9%	78.5%	0.001%	9.9%	6.5%	0.3%	0.0%	100.0%
Hillabahatchee Creek	109	852	47	52	188	0	3,854	36,471	0	5,067	1,386	840	14	48,881
	0.2%	1.7%	0.1%	0.1%	0.4%	0.0%	7.9%	74.6%	0.0%	10.4%	2.8%	1.7%	0.03%	100.0%
Hodchodkee Creek	88	460	67	16	29	17,633	6,369	37,699	6,562	1,441	1,839	6,076	13	78,292
	0.1%	0.6%	0.1%	0.02%	0.04%	22.5%	8.1%	48.2%	8.4%	1.8%	2.3%	7.8%	0.02%	100.0%
Hog Creek	7	66	4	4	2	0	2,141	12,983	808	129	262	902	2	17,308
	0.04%	0.4%	0.02%	0.02%	0.01%	0.0%	12.4%	75.0%	4.7%	0.7%	1.5%	5.2%	0.01%	100.0%
Holanna Creek	80	152	5	2	7	0	2,952	27,649	2,422	356	743	3,416	2	37,786
	0.2%	0.4%	0.01%	0.005%	0.02%	0.0%	7.8%	73.2%	6.4%	0.9%	2.0%	9.0%	0.004%	100.0%
Long Indian Creek	0	1,156	301	82	2	0	16	216	0	16	503	6	0	2,297
	0.0%	50.3%	13.1%	3.6%	0.08%	0.0%	0.7%	9.4%	0.0%	0.7%	21.9%	0.25%	0.0%	100.0%
South Fork Camp Creek	5	1,453	755	665	0	0	71	1,289	0	45	1,130	13	0	5,428
	0.09%	26.8%	13.9%	12.2%	0.0%	0.0%	1.3%	23.8%	0.0%	0.8%	20.8%	0.2%	0.0%	100.0%
Upatoi Creek	966	7,712	1,573	585	331	796	13,345	209,309	16,264	4,203	1,1470	23,134	216	289,902
	0.3%	2.7%	0.5%	0.2%	0.1%	0.3%	4.6%	72.2%	5.6%	1.4%	4.0%	8.0%	0.07%	100.0%

2.0 WATER QUALITY ASSESSMENT

Stream segments are placed on the 303(d) list as not supporting their water use classification based on water quality sampling data. A stream is placed on this list if more than 10% of the samples exceed the fecal coliform criteria. 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 used for TMDLs developed in this document were collected during calendar years 2010 and 2011 by EPD as part of the trend monitoring program. Additional data provided by Dekalb and Fulton Counties and the United States Geological Survey (USGS) were also assessed. These data 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. There are two basic kinds of NPDES permits: 1) municipal and industrial wastewater treatment facilities, and 2) regulated stormwater discharges.

3.1.1 Wastewater Treatment Facilities

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

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

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

Discharges from municipal and industrial wastewater treatment facilities can contribute fecal coliform to receiving waters. There are 3 NPDES permitted discharges with flows greater than 0.1 MGD identified in the Chattahoochee River Basin that discharge treated municipal wastewater and that could potentially impact streams on the 2012 303(d) list for fecal coliform bacteria. Table 3 provides the monthly average discharge flow and fecal coliform concentrations for these facilities. This data was obtained from calendar year 2011 Discharge Monitoring Reports (DMR). The permitted fecal coliform concentration is also included in this table.

Combined sewer systems convey a mixture of raw sewage and stormwater 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. In the Chattahoochee River Basin, four NPDES-permitted CSOs are located within the City of Atlanta and two NPDES-permitted CSOs are located in the City of Columbus. None of these CSO outfalls are upstream of the listed segments.

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

Facility Name	NPDES Permit No.	Receiving Stream	303(d) Listed Segment	Actual 2011 Discharge		NPDES Permit Limits		Number of Fecal Coliform/ Flow Violations 2007 –2009
				Average Monthly Flow (MGD)[a]	Average Monthly FC (No./100mL)	Average Monthly Flow (MGD)	Average Monthly FC (No./100mL)	
Fulton County - Little Bear Creek	GA0047104	Little Bear Creek	Bear Creek	0.018	8.17	0.1	200	0
Fulton County - Cauley Creek WRF	GA0038440	Cauley Creek	Cauley Creek	4.11	2.89	5	23	0
Cleveland WPCP	GA0036820	Tesnatee Creek	Chestatee River Tesnatee Creek To Yahoola Creek	0.325	8.92	0.75	200	0

Source: EPD

Notes: [a] Values shown are the annual average of the monthly average flows.

3.1.2 Regulated Stormwater Discharges

Some stormwater runoff is covered under the NPDES Permit Program as a point source. Regulated stormwater discharges that may contain fecal coliform bacteria consist of those associated with industrial activities and large, medium, and small municipal separate storm sewer systems (MS4s) that serve populations of 50,000 or more.

3.1.2.1 Industrial General Storm Water NPDES Permit

Stormwater discharges associated with industrial activities are currently covered under the 2012 General Storm Water NPDES Permit (GAR050000), also called the Industrial General Permit (IGP). This permit requires visual monitoring of stormwater discharges, site inspections, implementation of Best Management Practices (BMPs), and record keeping. The IGP requires that stormwater discharging into an impaired stream segment or within one linear mile upstream of, and within the same watershed as, any portion of an impaired stream segment identified as “not supporting” its designated use(s), must satisfy the requirements of Appendix C of the 2012 IGP if the pollutant(s) of concern for which the impaired stream segment has been listed may be exposed to stormwater as a result of industrial activity at the site. If a facility is covered under Appendix C of the IGP, then benchmark monitoring for the pollutant(s) of concern is required.

3.1.2.2 MS4 NPDES Permits

Stormwater 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 stormwater discharge under Phase I. This includes 58 permittees in Georgia.

Phase I MS4 permits require the prohibition of non-stormwater 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 Stormwater Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. There are 30 Phase I MS4s in the Chattahoochee River Basin (Table 4).

Table 4. Phase I Permitted MS4s in the Chattahoochee River Basin

Name	River Basins
Alpharetta	Chattahoochee
Atlanta	Chattahoochee, Flint, Ocmulgee
Austell	Chattahoochee
Avondale Estates	Chattahoochee, Ocmulgee
Berkley Lake	Chattahoochee
Buford	Chattahoochee
Chamblee	Chattahoochee
Clarkston	Chattahoochee, Ocmulgee
Clayton County	Chattahoochee, Flint, Ocmulgee
Cobb County	Chattahoochee, Coosa
College Park	Chattahoochee, Flint
Columbus Consolidated	Chattahoochee
Decatur	Chattahoochee, Ocmulgee
DeKalb County	Chattahoochee, Ocmulgee
Doraville	Chattahoochee
Duluth	Chattahoochee, Ocmulgee
East Point	Chattahoochee, Flint, Ocmulgee
Fairburn	Chattahoochee, Flint
Forsyth County	Chattahoochee, Coosa
Fulton County	Chattahoochee, Ocmulgee, Coosa, Flint
Gwinnett County	Chattahoochee, Ocmulgee, Oconee
Marietta	Chattahoochee, Coosa
Norcross	Chattahoochee, Ocmulgee
Palmetto	Chattahoochee, Flint
Powder Springs	Chattahoochee
Roswell	Chattahoochee, Coosa
Smyrna	Chattahoochee
Sugar Hill	Chattahoochee
Suwanee	Chattahoochee, Ocmulgee
Union City	Chattahoochee, Flint

Source: Nonpoint Source Program, EPD, 2012

Small MS4s serving urbanized areas are required to obtain a stormwater permit under the Phase II stormwater 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. Twenty-nine counties, 58 cities, and 5 Department of Defense facilities are permitted under the Phase II regulations in Georgia. There are 17 Phase II MS4s in the Chattahoochee River Basin (Table 5).

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

Name	Watershed
Cumming	Chattahoochee
Dallas	Chattahoochee, Coosa
Douglas County	Chattahoochee
Douglasville	Chattahoochee
Dunwoody	Chattahoochee
Flowery Branch	Chattahoochee
Fort Benning	Chattahoochee
Gainesville	Chattahoochee, Oconee
Hall County	Chattahoochee, Oconee
Hiram	Chattahoochee
Johns Creek	Chattahoochee
Milton	Chattahoochee
Mountain Park	Chattahoochee
Newnan	Chattahoochee, Flint
Oakwood	Chattahoochee, Oconee
Paulding County	Chattahoochee, Coosa, Tallapoosa
Sandy Springs	Chattahoochee

Source: Nonpoint Source Program, EPD, 2012

Table 6 lists the Phase I or Phase II MS4 city or county urbanized areas upstream of listed segments in the Chattahoochee River Basin. The table provides the total area of this watershed, and the percentage of the watershed that is MS4 city or county urbanized area.

Table 6. Percentage of MS4 City or County Urbanized Area Upstream of 303(d) Listed Segments in the Chattahoochee River Basin

Stream Segment	Location	Total Area (square miles)	% In MS4 Urbanized Area
Bear Creek	Little Bear Creek to Chattahoochee River	5.07	16.5
Bubbling Creek	Dekalb County	1.11	83.3
Cauley Creek	Headwaters to Chattahoochee River	1.19	48.3
Long Indian Creek	Headwaters to Big Creek	3.19	88.9
South Fork Camp Creek	College Park	6.26	73.8
Upatoi Creek	U/S Chattahoochee River, Columbus	14.04	3.1

3.1.3 Concentrated Animal Feeding Operations

Under the Clean Water Act, Concentrated Animal Feeding Units (CAFOs) are defined as point sources of pollution and are therefore subject to NPDES permit regulations. From 1999 through 2001, Georgia adopted rules for permitting swine and non-swine liquid manure animal feeding operations (AFOs). Georgia rules require medium size AFOs with more than 300 animal units (AU) but less than 1000 AU to apply for a non-discharge State land application system (LAS) waste disposal permit. Large operations with more than 1000 AU must apply for an NPDES permit (also non-discharge) as a CAFO. There are no swine or non-swine liquid manure CAFOs located upstream of the listed segments in the Chattahoochee River Basin that have permits.

In 2002, the USEPA promulgated expanded NPDES permit regulations for CAFOs that added dry manure poultry operations larger than 125,000 broilers or 82,000 layers. Georgia is consistently among the top three states in the U.S. in terms of poultry operations. The majority of poultry farms are dry manure operations where the manure is stored for a time and then land applied. Freshly stored litter can be a nonpoint source of fecal coliform. However, land applied litter that was previously stored for an extended length of time typically exhibits very low fecal coliform levels. Table 7 presents the dry manure poultry operations located upstream of the listed segments in the Chattahoochee River Basin that have submitted an application for the General NPDES Permit GAG930000.

Table 7. Registered Dry Manure Poultry Operations Upstream of 303(d) Listed Segments in the Chattahoochee River Basin

Name	303(d) Listed Stream Segment	County	Number of Animals (thousands)	Permit Status
T S Farms	Chestatee River - Tate Creek to Tesnatee Creek	Lumpkin	125	NAI
	Chestatee River - Tesnatee Creek to Yahoola Creek			
Amy Poultry	Upatoi Creek	Marion	188	P
Harris Poultry		Taylor	100	P

Source: GA Dept. of Agriculture, 2012
Notes: I = Issued
P = permit pending
NAI = needs additional information for application.

The USEPA CAFO regulations were successfully appealed in 2005 and revised to comply with the court decision. That decision limits permitting to actual discharges rather than those with a potential to discharge. Georgia's rules will be revised by the end of 2012 to incorporate the USEPA revisions. The NPDES permitted CAFO community is expected to be markedly reduced; however, the revised state rules will continue LAS permitting of medium size liquid manure AFOs and extend LAS permitting to large liquid manure AFOs with more than 1000 AU, unless they elect to obtain an NPDES permit.

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 stormwater 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 watersheds. 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 abundant throughout the Chattahoochee River Basin. Fecal coliform bacteria contributions to water bodies from deer are generally considered to be 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, 2007). However, feces deposited on the land surface can result in the introduction of fecal coliform to streams during runoff events. Between storm events, considerable decomposition of the fecal matter might occur, resulting in a decrease in the associated fecal coliform numbers.

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 then 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 8 provides the estimated number of beef cattle, dairy cattle, goats, horses, swine, sheep, and chickens reported by county. These data were provided by the Natural Resources Conservation Service (NRCS).

Table 8. 2009 Estimated Agricultural Livestock Populations in the Chattahoochee River Basin

County	Livestock								
	Beef Cattle	Dairy Cattle	Swine	Sheep	Horses	Goats	Chickens -Layers	Chickens-Broilers Sold	Chickens-Breeders
Banks	7,200	-	850	100	1,100	400	450,000	69,696,000	540,000
Calhoun	4,500	-	30	-	40	-	-	6,048,000	-
Carroll	17,500	200	-	40	750	6,000	200,000	47,190,000	240,000
Chattahoochee	-	-	-	-	-	-	-	-	-
Cherokee	4,200	-	-	-	300	1,000	-	12,441,000	-
Clay	5,000	-	20	-	40	60	-	-	-
Cobb	-	-	-	-	300	-	-	-	-
Coweta	3,750	350	-	25	500	200	-	-	-
Dawson	2,800	-	-	100	800	-	-	19,057,500	228,000
Dekalb	-	-	-	-	-	-	-	-	-
Douglas	650	-	-	-	55	-	-	286,000	-
Early	14,600	-	30	-	120	90	-	368,000	-
Forsyth	1,350	-	-	-	-	50	63,000	6,620,250	72,000
Fulton	6,000	-	-	50	-	150	-	-	-
Gwinnett	3,500	-	-	-	-	550	-	2,496,000	-
Habersham	10,000	-	-	50	500	4,000	800,000	84,480,000	1,800,000
Hall	8,700	425	-	-	400	3,700	80,000	69,273,600	1,040,000
Harris	2,100	-	50	250	200	300	-	-	-
Heard	3,145	-	-	50	500	750	260,000	16,302,000	372,000
Lumpkin	2,549	-	-	82	20	158	140,000	12,672,000	36,000
Marion	2,700	-	20	400	30	900	42,000	9,823,000	56,000
Meriwether	7,000	180	-	375	300	3,600	-	-	-
Muscogee	200	-	-	-	100	-	-	-	-
Paulding	2,800	-	-	250	400	650	-	5,005,000	-
Quitman	1,000	-	-	-	25	175	-	-	-
Randolph	2,300	190	60	-	50	75	-	-	-
Seminole	3,800	99	250	-	300	450	-	-	-
Stewart	1,000	-	20	-	150	200	-	1,292,500	-
Talbot	7,000	40	500	-	250	100	-	-	-
Taylor	4,000	-	100	-	300	500	-	7,762,500	-
Towns	4,500	-	-	25	900	300	-	-	-
Troup	5,500	300	-	450	250	1,700	-	-	-
Turner	7,500	-	-	60	200	2,500	-	4,400,000	-
Union	2,500	200	-	-	700	300	50,000	1,500,000	150,000
White	5,200	300	-	-	-	140	400,000	26,752,000	120,000

Source: NRCS, 2011

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 stormwater collection system and discharged through a discrete outlet structure. For large, medium, and small urban areas (populations greater than 50,000), the stormwater outlets are regulated under MS4 permits (see Section 3.1.2). For smaller urban areas, the stormwater 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 inflow and infiltration can cause sewer overflows.

3.2.3.1 Leaking Septic Systems

A portion of the fecal coliform contributions in the Chattahoochee River Basin may be attributed to failure of septic systems and illicit discharges of raw sewage. Table 9 presents the number of septic systems in each county of the Chattahoochee River Basin existing in 2006 and the number existing in 2011, based in part on U.S. Census data, and 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 2007 through 2011 is given. These data show an increase in the number of septic systems in all of the counties. Often, this is a reflection of population increases outpacing the expansion of sewage collection systems.

Table 9. Estimated Number of Septic Systems in the Chattahoochee River Basin

County	Existing Septic Systems (2006)[1]	Existing Septic Systems (2011)	Number of Septic Systems Installed (2007 to 2011)	Number of Septic Systems Repaired (2007 to 2011)
Banks	6,801	7,214	413	87
Calhoun	1,181	1,227	46	17
Carroll	31,034	32,197	1163	552
Chattahoochee	1,154	1,212	58	14
Cherokee	38,119	38,933	814	624
Clay	1,184	1,272	88	7
Cobb	33,774	34,141	367	975
Coweta	29,026	31,430	2404	645
Dawson	8,954	9,372	418	172
DeKalb	22,411	22,590	179	635
Douglas	25,671	26,163	492	571
Early	4,032	4,203	171	67
Forsyth	31,946	32,907	961	1173
Fulton	27,491	28,039	548	436
Gwinnett	64,702	65,192	490	1550
Habersham	14,507	15,259	752	245
Hall	47,108	48,489	1381	1377
Harris	13,642	14,531	889	251
Heard	4,650	4,867	217	25
Lumpkin	11,462	12,314	852	71
Marion	2,263	2,411	148	27
Meriwether	8,658	9,033	375	122
Muscogee	2,963	3,142	179	34
Paulding	37,843	39,232	1389	1053
Quitman	1,564	1,631	67	9
Randolph	1,681	1,771	90	7
Seminole	4,559	4,647	88	67
Stewart	1,018	1,084	66	11
Talbot	2,748	2,888	140	27
Taylor	2,678	2,855	177	8
Towns	8,538	9,179	641	43
Troup	16,386	17,535	1149	530
Turner	2,002	2,091	89	22
Union	13,390	14,198	808	182
White	10,717	11,276	559	217

Source: The Georgia Dept. of Human Resources, Division of Public Health, 2012
Notes: [1] Adjusted from State Water Plan values

3.2.3.2 Land Application Systems

Some communities and industries use land application systems (LAS) for their wastewater. These facilities are required through LAS permits to dispose of their treated wastewater by land application, and to operate as non-discharging systems, that do not contribute wastewater runoff to surface waters. However, sometimes these facilities exceed the ground percolation rate when applying the wastewater, or encounter unexpected precipitation, resulting in surface runoff from the field. This runoff could contribute fecal coliform bacteria to nearby surface waters. Runoff of stormwater might also carry surface residual containing fecal coliform bacteria. There are no permitted LAS system with flows greater than 0.1 MGD identified in the Chattahoochee River Basin that could potentially impact streams on the 2012 303(d) list for fecal coliform bacteria.

3.2.3.3 Landfills

Leachate from landfills may contain fecal coliform bacteria that could at some point reach 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 142 known landfills in the Chattahoochee River Basin. Of these, 18 are active landfills, one is under construction, 3 are in closure and 120 are inactive or closed. Table 10 presents the landfills that are upstream of the 303(d) listed stream segments.

Table 10. Landfills Upstream of 303(d) Listed Segments in the Chattahoochee River Basin

Name	303(d) Listed Stream Segment	County	Permit No.	Status
Price - Roosevelt Hwy.	Bear Creek	Fulton	060-075D(L)	Closed
Safeguard Landfill Mgt C&D		Fulton	060-088D(C&D)	Operating
Willow Oak C&D Landfill		Fulton	060-089D(C&D)	Operating
Chamblee-Keswick Dr.	Bubbling Creek	Dekalb	044-031D(L)	Closed
Duke's Creek	Chestatee River - Tesnatee Creek To Yahoola Creek	White	154-003D(SL)	Closed
CR 145S PH2	Hodchodkee Creek	Stewart	128-001D(SL)	Closed
East Point Landfill	South Fork Camp Creek	Fulton	060-017D(L)	Inactive
Columbus, Pine Grove MSWL	Upatoi Creek	Muscogee	106-016D(MSWL)	Operating
Columbus Sanitary Landfill		Muscogee	106-001D(SL)	Closed
Cusseta - Osteen St.		Chattahoochee	-	Inactive
Ft. Benning - 1st Division Road West		Chattahoochee	026-004D(SL)	Closed
Ft. Benning - US 27/ 280, Old Cu		Chattahoochee	026-003D(SL)	Inactive
Junction City		Talbot	-	Inactive
Tyler Buena Vista Road		Muscogee	106-004D(L)	Inactive

Source: Land Protection Branch, GA DNR, 2012

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.

The available field measurements and water quality data used to develop the TMDLs for this document did not include stream flow data for many of the sites. Therefore, stream flows for these sites were estimated using data from a nearby USGS 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 11 provides the USGS stream gages used to estimate the flows for each of the listed stream segments.

Table 11. Stream Segments with Estimated Flows and Corresponding USGS Flow Gages

Stream Segment	Location	USGS Station Name	Station No.
Bear Creek	Little Bear Creek to Chattahoochee River	Dog River at GA 5 near Fairplay, GA	02337410
Beech Creek	D/S Ross Keith Road	Yellowjacket Creek -Hammet Road below Hogansville, GA	02338840
Bubbling Creek	DeKalb County	Suwanee Creek at Suwanee, GA	02338840
Cauley Creek	Headwaters to Chattahoochee River	Dick Creek at Old Atlanta Road near Suwanee, GA	02334620
Chestatee River	Tate Creek to Tesnatee Creek	Chestatee River near Dahlonega, GA	02333500
Hillabahatchee Creek	Tollieson Branch to West Point Lake (Formerly Tollieson Branch to Glovers Road)	Hillabahatchee Creek at Thaxton Road near Franklin, GA	02338523
Hog Creek	Headwaters to Cemochechobee Creek	Spring Creek near Leary, GA	02354475
Long Indian Creek	Headwaters to Big Creek	Crooked Creek near Norcross, GA	02335350
South Fork Camp Creek	College Park	South River at Springdale Road at Atlanta, GA	02203603
Upatoi Creek	U/S Chattahoochee River, Columbus	Upatoi Creek near Columbus, GA	02341800

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 standard, 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

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 percent load reduction can be expressed as follows:

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

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. In this case it is the seasonal fecal coliform standard. 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:

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

The TMDL calculates the WLAs and LAs with a margin 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

5.1.1 Wastewater Treatment Facilities

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 with flows greater than 0.1 MGD from municipal and industrial wastewater treatment systems with NPDES effluent limits for fecal coliform bacteria. There are three of these facilities in the Chattahoochee River Basin watershed that discharge into or upstream of a listed segment. The maximum allocated fecal coliform loads for these wastewater treatment facilities are given in Table 12. These WLA loads were calculated from the permitted flows and permitted fecal coliform concentrations. These were expressed as an accumulated load 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 12. WLAs for the Chattahoochee River Basin

Facility Name	Permit No.	Receiving Stream	Listed Stream Segment	WLA (counts/30 days)
Fulton County - Little Bear Creek	GA0047104	Little Bear Creek	Bear Creek	2.28E+09
Fulton County - Cauley Creek	GA0038440	Cauley Creek	Cauley Creek	1.22E+11
Cleveland WPCP	GA0036820	Tesnatee Creek	Chestatee River - Tesnatee Creek To Yahoola Creek	9.32E+10

5.1.2 Regulated Stormwater Discharges

State and Federal Rules define stormwater discharges covered by NPDES permits as point sources. However, stormwater discharges are from diffuse sources and there are multiple stormwater outfalls. Stormwater 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 stormwater NPDES permits is not to treat the water after collection, but to reduce the exposure of stormwater to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to control pollutant discharges from each stormwater outfall. Therefore, stormwater NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment.

The waste load allocations from stormwater discharges associated with MS4s (WLAsw) are estimated based on the percentage of urban area in each watershed covered by the MS4 stormwater 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 stormwater runoff from the regulated urban area is collected by the municipal separate storm sewer systems.

5.1.3 Confined Animal Feeding Operations

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

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 stormwater (non-permitted).

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

$$LA = TMDL - (\Sigma\, WLA + \Sigma\, WLAsw + MOS)$$

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, leaking sewer system collection lines, and 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 13 presents the total load allocation expressed as counts per 30 days 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. The TMDL and percent reduction given in Table 13 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 (Carter, 1982), and the appropriate drainage area. 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 13.

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 counts (as a 30-day geometric mean)/100 mL x Q

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

$TMDL_{winter}$ = 4,000 counts (instantaneous)/100 mL x 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 (WLA and WLA_{sw}) and nonpoint (LA) 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 the permitted facility to the WLA was not the maximum presented in Table 12, 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 13.

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. 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 13. 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)	
Bear Creek	1.38E+13	2.28E+09	6.64E+11	5.09E+12	6.40E+11	6.40E+12	54
Beech Creek	1.94E+12	-	-	1.36E+12	1.51E+11	1.51E+12	22
Bubbling Creek	9.61E+13	-	3.36E+11	2.40E+11	6.40E+10	6.40E+11	99
Cauley Creek	4.19E+14	1.22E+11	2.90E+13	5.67E+13	9.53E+12	9.53E+13	77
Chestatee River – Tate Creek to Tesnatee Creek	6.03E+14	-	-	1.09E+14	1.21E+13	1.21E+14	80
Chestatee River - Tesnatee Creek to Yahoola Creek	3.99E+13	9.32E+10	-	2.35E+13	2.62E+12	2.62E+13	34
Hillababatchee Creek	1.68E+14	-	-	5.60E+13	6.23E+12	6.23E+13	63
Hodchodkee Creek	7.48E+12	-	-	4.76E+12	5.28E+11	5.28E+12	29
Hog Creek	1.07E+14	-	-	8.75E+12	9.72E+11	9.72E+12	91
Holanna Creek	4.66E+12	-	-	1.23E+12	1.36E+11	1.36E+12	71
Long Indian Creek	1.54E+15	-	4.53E+13	2.75E+13	8.09E+12	8.09E+13	95
South Fork Camp Creek	1.05E+13	-	2.33E+11	2.18E+11	5.01E+10	5.01E+11	95
Upatoi Creek	6.59E+13	-	4.82E+11	2.17E+13	2.47E+12	2.47E+13	63

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 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. Sampling is conducted statewide by EPD personnel in Atlanta, Brunswick, Cartersville and Tifton. Additional sites are added as necessary.

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 limited 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 usually 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. 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 stormwater into rivers and streams at discrete locations. The NPDES permit program provides a basis for municipal, industrial, and stormwater permits, monitoring and compliance with limitations, and appropriate enforcement actions for violations.

In accordance with 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 fecal coliform in their discharge will be given end-of-pipe limits to meet the applicable water quality standard. 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

EPD is responsible for administering and enforcing laws to protect the waters of the State. 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

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 such as livestock populations by subwatershed, animal access to streams, manure storage and application practices 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.

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 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;
- maintain compliance with stormwater 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, EPD will determine whether a new or existing discharger has a reasonable potential of discharging fecal coliform levels equal to or greater than the total 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, EPD will use its USEPA approved 2003 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

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

6.4 Public Participation

A thirty-day public notice 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

7.1 Initial TMDL Implementation Plan

This plan identifies applicable State-wide programs and activities that may be employed to manage point and nonpoint sources of bacteria loads for thirteen segments in the Chattahoochee River Basin. Local watershed planning and management initiatives will be fostered, supported, or developed through a variety of mechanisms. Implementation may be addressed by watershed improvement projects, assessments for Section 319 (h) grants, the local development of watershed protection plans, or "Targeted Outreach" initiated by EPD. These initiatives will supplement or possibly replace this initial implementation plan.

7.2 Impaired Segments

This initial plan is applicable to the following waterbodies that were added to Georgia's 303(d) list available on the EPD website (www.gaepd.org):

Water Bodies Listed on the 2012 303(d) List for Fecal Coliform Bacteria in the Chattahoochee River Basin

Stream Segment	Location	Reach ID	Segment Length (miles)	Designated Use
Bear Creek	Little Bear Creek to Chattahoochee River	R031300020311	4	Fishing
Beech Creek	D/S Ross Keith Road	R031300020711	17	Fishing
Bubbling Creek	DeKalb County	R031300011210	2	Fishing
Cauley Creek	Headwaters to Chattahoochee River	R031300010914	2	Fishing
Chestatee River	Tate Creek to Tesnatee Creek	R031300010508	7	Fishing
Chestatee River	Tesnatee Creek To Yahoola Creek	R031300010608	10	Fishing
Hillabahatchee Creek	Tollieson Branch to West Point Lake (Formerly Tollieson Branch to Glovers Road)	R031300020608	3	Fishing
Hodchodkee Creek	Bladen Creek to Smithee Jack Creek	R031300031406	8	Fishing
Hog Creek	Headwaters to Cemochechobee Creek	R031300040102	9	Fishing
Holanna Creek	Hog Creek to Pataula Creek	R031300031505	7	Fishing
Long Indian Creek	Headwaters to Big Creek	R031300011007	4	Fishing
South Fork Camp Creek	College Park	R031300020317	3	Fishing
Upatoi Creek	U/S Chattahoochee River, Columbus	R031300030303	14	Fishing

Fecal coliform bacteria are used as an indicator of the potential presence of pathogens in a stream. The current water quality standard [*State of Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c)(iii) (GA EPD, 2011)] states that four or more water samples collected within a 30-day period that have a geometric mean for fecal coliform either in excess of 200 Colony Forming Units (CFU) per 100 milliliters from May through October, or in excess of 1000 (CFU) per 100 milliliters from November through April are in violation of the bacteria water quality standard. In addition, a single sample in excess of 4000 (CFU) per 100 milliliters from November through April can also provide a basis for adding a stream segment to the 303(d) listing.

7.3 Potential Sources

An important part of the TMDL analysis is the identification of potential source categories. A source assessment characterizes the known and suspected bacteria sources in the watershed.

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. Point sources of bacteria include NPDES permittees discharging treated wastewater or through stormwater systems. Nonpoint sources of bacteria are diffuse sources that cannot be identified as entering the water body at a single location. These sources generally involve land use activities that contribute bacteria to streams during rainfall events.

NPDES point source fecal coliform loads from wastewater treatment facilities usually do not contribute to impairments. This is because these facilities are required to treat to levels corresponding to instream water quality criteria. However, point sources can and do fail, which may contribute to bacteria loads through leaks and overflows from sanitary sewer systems, CAFOs, or leachate from operational landfills.

Nonpoint sources of fecal coliform in urban areas include wastes that are attributable to domestic animals, illicit discharges of sanitary waste, leaking septic systems, runoff from improper disposal of waste materials, and leachate from closed landfills. In non-urban areas, potential sources of fecal coliform may include 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.

7.4 Management Practices and Activities

EPD is responsible for administering and enforcing laws to protect the waters of the State and is the lead agency for implementing the State's Nonpoint Source Management Program. Georgia is working with local governments, agricultural and forestry agencies such as the Georgia Department of Agriculture, the Natural Resource Conservation Service (NRCS), the Georgia Soil and Water Conservation Commission (GSWCC), and the Georgia Forestry Commission (GFC) to foster implementation of BMPs that address nonpoint source pollution. The following management practices are recommended to reduce fecal coliform loads to stream segments:

- Sustained compliance with NPDES permit limits and requirements where applicable;
- Adoption of NRCS Conservation Practices for primarily agricultural lands;
- Application of BMPs appropriate to specific non-urban and urban land uses;
- Further development and streamlining of local jurisdictional mechanisms for identifying, reporting, and correcting illicit connections, breaks, and other sanitary sewer system problems;
- Adoption of local ordinances (i.e. septic tanks, stormwater, etc.) that address local water quality; and
- Ongoing public education efforts on the sources of fecal coliform and common sense approaches to lessen the impact of this contaminant on surface waters.

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

7.5 Monitoring

EPD encourages local governments and municipalities to develop water quality monitoring programs. These programs can help pinpoint various fecal coliform sources, as well as verify the 303(d) stream segment listings. This will be particularly valuable for those segments where listing was based on limited data. In addition, regularly scheduled sampling will determine if there has been some improvement in the water quality of the listed stream segments. EPD is available to assist in completing a monitoring plan, preparing a Sampling Quality Assurance Plan (SQAP), and/or providing necessary training as needed.

7.6 Future Action

This Initial TMDL Implementation Plan includes a general approach to pollutant source identification as well as management practices to address pollutants. In the future, EPD will continue to determine and assess the appropriate point and non-point source management measures needed to achieve the TMDLs and also to protect and restore water quality in impaired waterbodies.

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

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

Any Watershed Management Plan that specifically address waterbodies contained within this TMDL will supersede the Initial TMDL Implementation Plan once EPD accepts the plan. Future Watershed Management Plans intended to address this TMDL and other water quality concerns, written by EPD and for which EPD and/or the EPD Contractor are responsible, will contain at a minimum the USEPA's 9 Elements of Watershed Planning:

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

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

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

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

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

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

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

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

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

The public will be provided an opportunity to participate in the development of Watershed Management Plans that address impaired waters and to comment on them before they are finalized.

EPD will continue to offer technical and financial assistance (when and where available) to complete Watershed Management Plans that address the impaired waterbodies listed in this and other TMDL documents. Assistance may include but will not be limited to:

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

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

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Appendix A

30-day Geometric Mean Fecal Coliform Monitoring Data

Water Quality Monitoring Stations

Stream Segment	Location	EPD Monitoring Station No.	Monitoring Station Description
Bear Creek	Little Bear Creek to Chattahoochee River	1202030701	Bear Creek at State Road 70 near Rico, Ga.
Beech Creek	D/S Ross Keith Road	1202070501	Beech Creek at Hammett Road near LaGrange, Ga.
Bubbling Creek	DeKalb County	N/A	Bubbling Creek at Hartsmill Road
Cauley Creek	Headwaters to Chattahoochee River	N/A	Cauley Creek D/S of Cauley Creek discharge
Chestatee River	Tate Creek to Tesnatee Creek	1201050205	Chestatee River - 0.3 Mile U/S Tesnatee Creek near Dahlonega, Ga.
Chestatee River	Tesnatee Creek To Yahoola Creek	1201060103	Chestatee River at Georgia Highway 52 near Dahlonega, Ga.
Hillabahatchee Creek	Tollieson Branch to West Point Lake (Formerly Tollieson Branch to Glovers Road)	1202060501	Hillabahatchee Creek at State Road 34 near Franklin, Ga.
Hodchodkee Creek	Bladen Creek to Smithee Jack Creek	1203140501	Hodghodkee Creek at Lower Lumpkin Road near Georget, GA
Hog Creek	Headwaters to Cemochechobee Creek	1204010301	Hog Creek at CR 15 nr Cuthbert, GA
Holanna Creek	Hog Creek to Pataula Creek	1203150701	Holanna Creek at CR 31 near Springdale, GA
Long Indian Creek	Headwaters to Big Creek	N/A	Long Indian Creek at Waters Road
South Fork Camp Creek	College Park	N/A	Upstream end of Camp Creek
Upatoi Creek	U/S Chattahoochee River, Columbus	1203030801	Upatoi Creek at Fort Benning Rd (Fort Benning) near Columbus, Ga.

Figure A-1
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
1202030701 Bear Creek at State Road 70 near Rico, Georgia

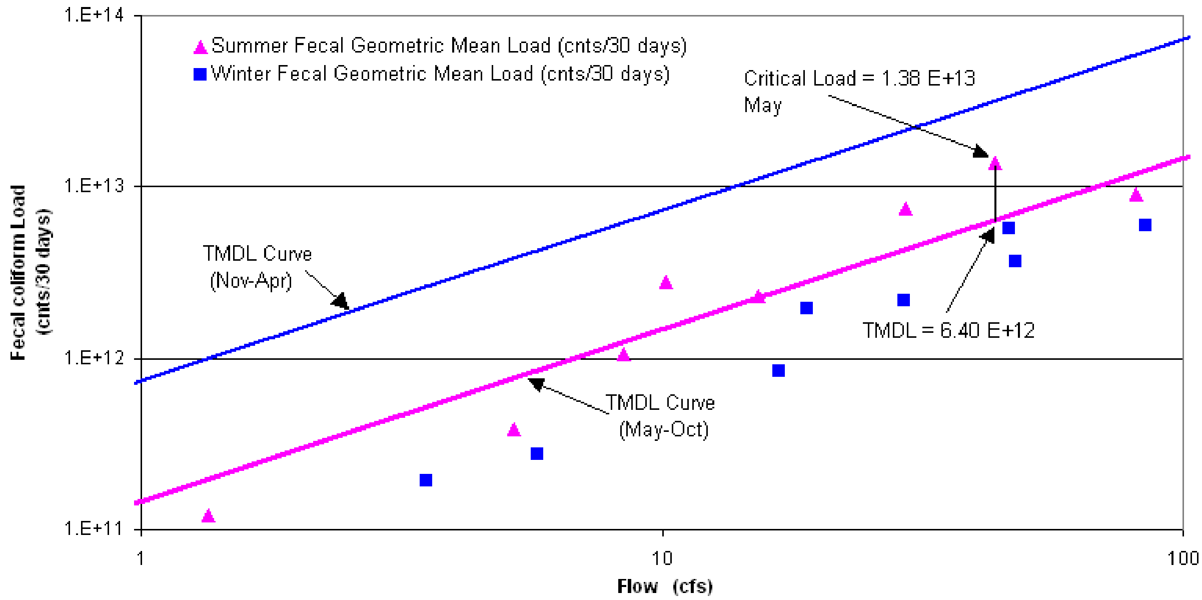


Table A-1. Data for Figure A-1

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
6/20/2007	1000	2.9				
6/27/2007	50	3.0				
7/5/2007	20	2.4				
7/11/2007	100	12.6	100.0	5.2	3.82E+11	7.64E+11
8/7/2007	150	1.5				
8/14/2007	190	0.8				
8/21/2007	130	0.5				
8/28/2007	60	2.6	122.1	1.4	1.21E+11	1.98E+11
11/6/2007	20	1.8				
11/13/2007	50	2.4				
11/19/2007	80	3.1				
11/27/2007	380	6.7	74.3	3.5	1.92E+11	2.58E+12
2/7/2008	80	16.8				
2/14/2008	90	11.7				
2/21/2008	210	51.5				
2/28/2008	70	36.4	101.4	29.1	2.17E+12	2.14E+13
5/2/2008	410	19.7				
5/9/2008	160	15.5				
5/16/2008	800	52.4				
5/23/2008	280	30.2	348.2	29.4	7.52E+12	4.32E+12
8/5/2008	280	7.1				
8/12/2008	160	3.5				
8/21/2008	250	2.4				
8/27/2008	1700	27.6	371.5	10.2	2.77E+12	1.49E+12
11/4/2008	50	4.6				
11/11/2008	50	5.0				
11/18/2008	90	6.7				
11/25/2008	80	6.7	65.1	5.8	2.75E+11	4.23E+12
2/3/2009	40	17.6				
2/12/2009	80	14.7				
2/18/2009	170	19.3				
2/25/2009	40	15.5	68.3	16.8	8.40E+11	1.23E+13
5/5/2009	530	54.5				
5/12/2009	200	28.1				
5/19/2009	180	32.3				
5/27/2009	1800	59.5	**430.5**	**43.6**	**1.38E+13**	**6.40E+12**
8/4/2009	130	8.0				
8/11/2009	70	4.1				
8/18/2009	800	11.7				
8/26/2009	120	10.1	171.9	8.5	1.07E+12	1.24E+12
11/2/2009	130	43.6				
11/9/2009	260	30.6				
11/17/2009	130	56.5				
11/24/2009	180	55.3	167.7	46.5	5.72E+12	3.41E+13
2/2/2010	110	83.4				
2/9/2010	59	101.4				
2/16/2010	80	73.7				
2/23/2010	160	80.4	95.5	84.7	5.94E+12	6.22E+13
5/4/2010	250	212.8				
5/11/2010	110	44.8				
5/18/2010	100	33.5				
5/26/2010	190	33.9	151.2	81.3	9.02E+12	1.19E+13
8/2/2010	120	23.5				
8/9/2010	270	13.0				
8/17/2010	250	11.3				
8/24/2010	220	13.4	205.5	15.3	2.31E+12	2.24E+12
11/3/2010	210	9.6				
11/11/2010	70	8.0				
11/23/2010	90	12.1				
11/30/2010	290	46.1	140.0	19.0	1.95E+12	1.39E+13
2/2/2011	1000	119.4				
2/9/2011	40	31.0				
2/17/2011	50	21.4				
2/22/2011	60	19.3	104.7	47.8	3.67E+12	3.51E+13

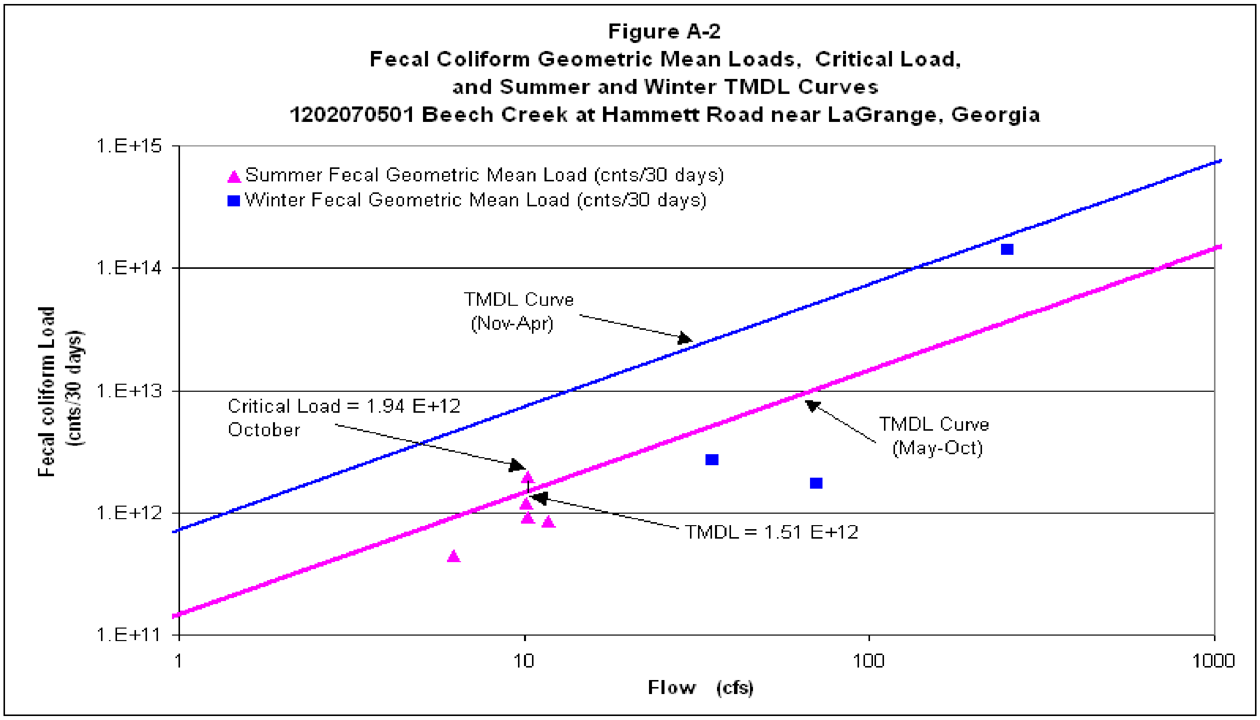


Table A-2. Data for Figure A-2

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
1/20/2000	210	52.0				
3/14/2000	130	53.0				
3/21/2000	790	581.0				
3/28/2000	1400	81.0				
4/4/2000	2400	294.0	766.4	252.3	1.42E+14	1.85E+14
5/30/2000	50	17.0				
6/12/2000	330	11.0				
6/19/2000	70	10.0				
6/26/2000	80	8.9	98.0	11.7	8.44E+11	1.72E+12
7/19/2000	80	4.2				
8/2/2000	110	7.0				
8/7/2000	490	8.6				
8/14/2000	20	5.3	96.4	6.3	4.44E+11	9.21E+11
9/18/2000	490	9.4				
9/27/2000	20	11.0				
10/10/2000	110	11.0				
10/12/2000	220	9.4	124.1	10.2	9.29E+11	1.50E+12
2/4/2010	40	63.5				
2/9/2010	80	89.4				
2/11/2010	20	71.9				
2/25/2010	20	57.1	33.6	70.5	1.74E+12	5.17E+13
4/7/2010	170	36.3				
4/12/2010	90	35.9				
4/20/2010	110	32.7				
4/28/2010	70	35.5	104.2	35.1	2.69E+12	2.58E+13
7/5/2010	130	6.0				
7/7/2010	270	5.2				
7/12/2010	170	12.4				
7/20/2010	110	17.2	160.1	10.2	1.20E+12	1.49E+12
10/7/2010	300	2.4				
10/26/2010	210	16.0				
10/28/2010	300	17.6				
11/3/2010	230	5.2	**256.8**	**10.3**	**1.94E+12**	**1.51E+12**

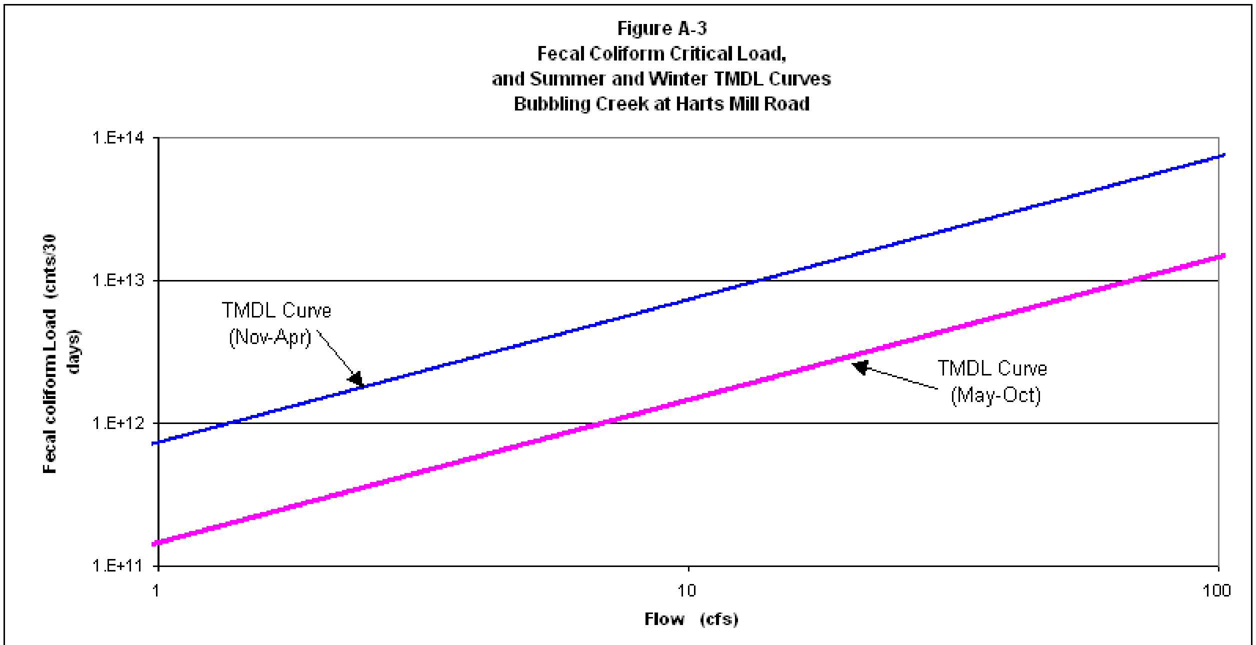


Table A-3. Data for Figure A-3

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Fecal Coliform Loading (counts/30 days)	TMDL Fecal Coliform Loading (counts/30 days)
Date	Fecal	Q	Current TMDL	TMDL
10/25/1993	170	2.1	2.64E+11	3.11E+11
11/17/1993	**30000**	**4.4**	**9.61E+13**	**6.40E+11**
1/12/1994	2200	23.5	3.80E+13	1.73E+13
2/9/1994	1300	12.8	1.22E+13	9.41E+12
3/8/1994	500	9.0	3.30E+12	6.60E+12
4/12/1994	300	8.1	1.78E+12	5.92E+12
5/10/1994	130	5.6	5.30E+11	8.15E+11
6/28/1994	700	9.0	4.62E+12	1.32E+12
7/26/1994	800	6.3	3.73E+12	9.32E+11
8/11/1994	1100	4.8	3.84E+12	6.99E+11
9/13/1994	220	4.1	6.62E+11	6.02E+11
10/25/1994	800	7.4	4.35E+12	1.09E+12
11/29/1994	700	15.9	8.15E+12	2.33E+12
12/13/1994	220	8.2	1.32E+12	1.20E+12
1/24/1995	2300	7.5	1.27E+13	5.53E+12
2/8/1995	800	6.5	3.80E+12	4.75E+12
3/28/1995	7000	7.7	3.94E+13	5.63E+12
4/25/1995	800	7.9	4.66E+12	5.82E+12
5/10/1995	210	5.4	8.35E+11	7.96E+11
6/28/1995	170	5.7	7.09E+11	8.34E+11
7/25/1995	1300	1.7	1.64E+12	2.52E+11
8/22/1995	200	2.4	3.49E+11	3.49E+11
9/26/1995	800	3.4	2.02E+12	5.05E+11

No Geomeans. All based on single samples.

Figure A-4
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
01201090501 Cauley Creek at Bell Road Near Duluth, Georgia

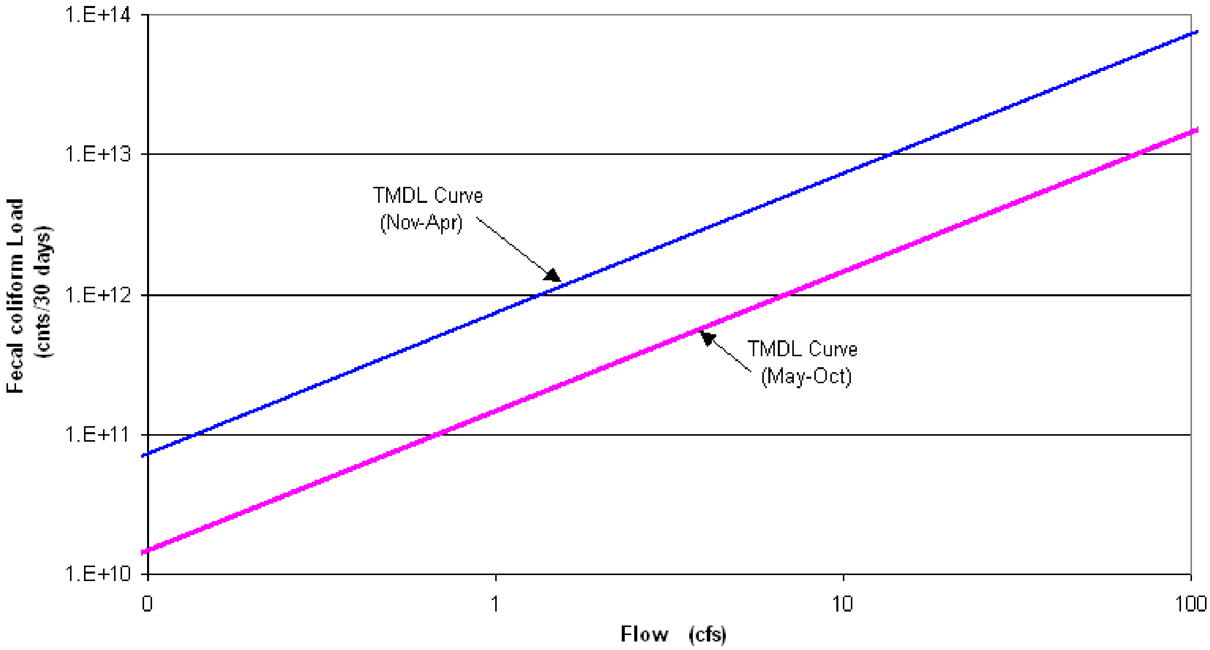


Table A-4. Data for Figure A-4

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
6/19/2007	440	1.1				
6/26/2007	1300	0.7				
7/2/2007	1200	3.4				
7/10/2007	190	3.7	600.9	2.2	9.81E+11	3.26E+11
8/6/2007	410	0.7				
8/13/2007	2100	0.6				
8/20/2007	330	0.3				
8/27/2007	1300	1.5	779.6	0.8	4.53E+11	1.16E+11
11/5/2007	370	0.6				
11/14/2007	150	0.6				
11/20/2007	60	0.5				
11/26/2007	1200	7.1	251.4	2.2	4.05E+11	1.61E+12
2/6/2008	130	4.9				
2/13/2008	190	5.8				
2/20/2008	200	2.9				
2/27/2008	30	3.4	110.3	4.3	3.44E+11	3.12E+12
5/1/2008	160	1.2				
5/8/2008	470	0.9				
5/14/2008	800	1.2				
5/22/2008	460	1.1	407.9	1.1	3.27E+11	1.60E+11
8/4/2008	510	0.3				
8/11/2008	260	0.2				
8/20/2008	200	0.2				
8/25/2008	2600	11.4	512.4	3.0	1.14E+12	4.45E+11
11/3/2008	310	0.5				
11/10/2008	170	0.5				
11/17/2008	260	0.8				
11/24/2008	90	1.7	187.4	0.9	1.21E+11	6.44E+11
2/2/2009	13	1.1				
2/11/2009	60	1.1				
2/16/2009	30	1.0				
2/24/2009	110	1.0	40.1	1.0	3.05E+10	7.62E+11
5/4/2009	3500	13.5				
5/11/2009	170	4.3				
5/18/2009	190	3.0				
5/26/2009	410	2.4	464.0	5.8	1.98E+12	8.55E+11
8/3/2009	350	1.7				
8/10/2009	280	0.9				
8/17/2009	2300	1.7				
8/27/2009	600	5.2	606.4	2.4	1.06E+12	3.49E+11
11/3/2009	70	2.3				
11/10/2009	4400	129.8				
11/16/2009	90	2.3				
11/23/2009	300	5.2	302.0	34.9	7.74E+12	2.56E+13
2/1/2010	30	4.6				
2/8/2010	100	6.8				
2/15/2010	70	4.6				
2/22/2010	330	18.8	91.2	8.7	5.82E+11	6.38E+12
5/4/2010	700	10.5				
5/11/2010	90	2.0				
5/18/2010	270	1.9				
5/26/2010	110	3.0	208.0	4.3	6.62E+11	6.37E+11
8/2/2010	400	0.5				
8/9/2010	510	0.3				
8/16/2010	130	0.7				
8/23/2010	240	1.1	282.5	0.7	1.37E+11	9.71E+10
11/2/2010	110	0.3				
11/10/2010	310	0.4				
11/22/2010	30	0.5				
11/29/2010	120	3.1	105.3	1.1	8.26E+10	7.85E+11
2/1/2011	90	25.8				
2/7/2011	90	3.4				
2/16/2011	38	1.5				
2/21/2011	92	1.4	72.9	8.0	4.30E+11	5.90E+12
11/10/2009	4400	129.8	**4400.0**	**129.8**	**4.19E+14**	**9.53E+13**

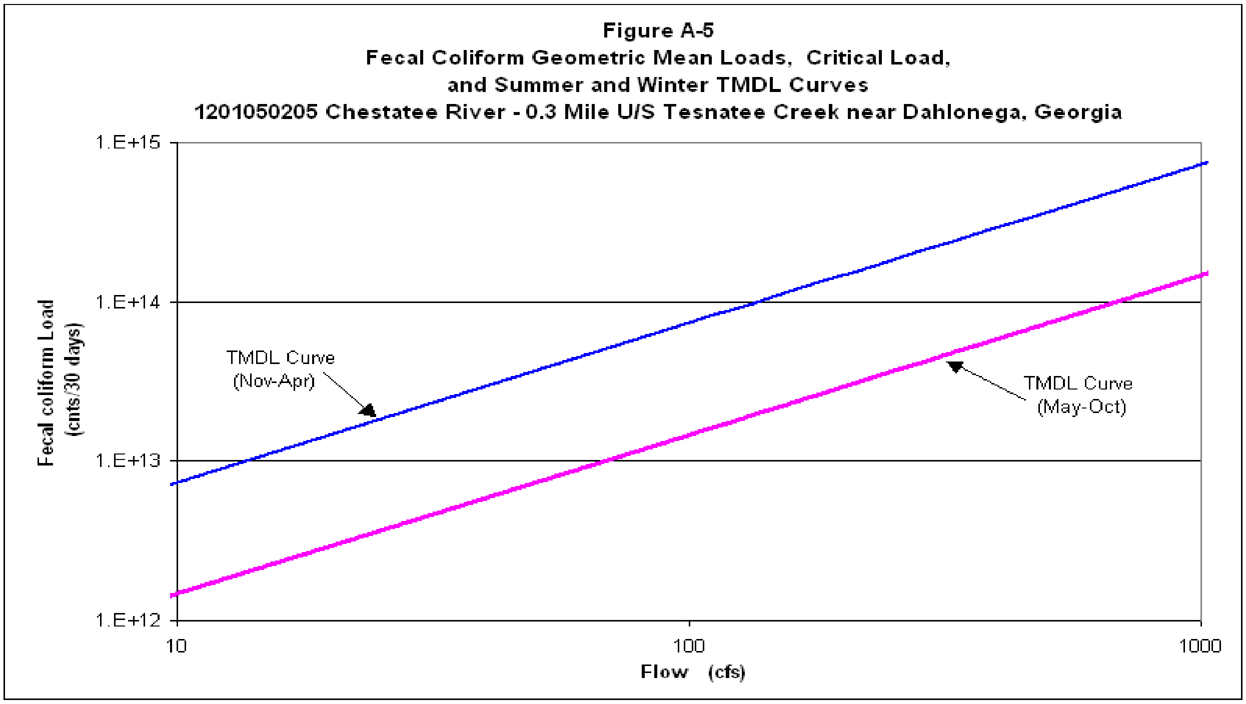


Table A-5. Data for Figure A-5

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
3/6/2002	20	92.4				
3/13/2002	800	133.7				
3/20/2002	40	89.9				
3/27/2002	700	114.4	145.5	107.6	1.15E+13	7.90E+13
6/5/2002	16000	96.9				
6/17/2002	70	49.5				
6/19/2002	90	46.6				
6/26/2002	20	45.0	211.9	59.5	9.25E+12	8.73E+12
9/9/2002	20	20.4				
9/16/2002	300	183.9				
9/23/2002	230	122.6				
9/30/2002	170	79.7	123.8	101.7	9.24E+12	1.49E+13
12/3/2002	20	83.4				
12/10/2002	20	119.4				
12/17/2002	20	138.6				
12/19/2002	50	127.5	25.1	117.2	2.16E+12	8.60E+13
3/20/2003	790	320.4				
3/26/2003	20	162.7				
4/9/2003	40	198.6				
4/17/2003	130	159.0	95.2	210.2	1.47E+13	1.54E+14
6/18/2003	230	416.9				
6/25/2003	70	163.9				
6/30/2003	300	154.1				
7/9/2003	80	194.6	140.2	232.4	2.39E+13	3.41E+13
9/15/2003	90	97.3				
9/22/2003	300	244.4				
10/1/2003	110	89.5				
10/6/2003	130	83.0	140.2	128.5	1.32E+13	1.89E+13
12/9/2003	20	101.4				
12/15/2003	80	165.9				
12/17/2003	5000	164.3				
12/22/2003	65	120.2	151.0	137.9	1.53E+13	1.01E+14
12/17/2003	5000	164.3	**5000.0**	**164.3**	**6.03E+14**	**1.21E+14**

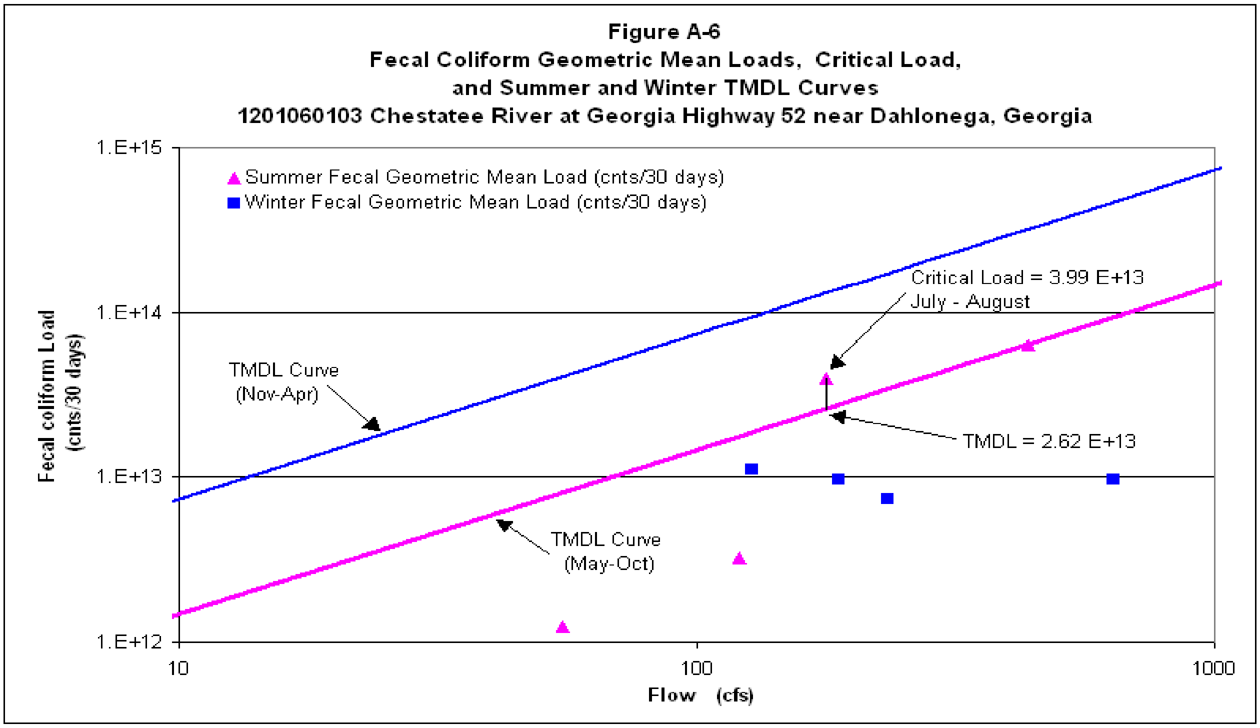


Table A-6. Data for Figure A-6

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
1/27/2000	20	265.0				
2/2/2000	20	253.0				
2/8/2000	20	207.0				
2/24/2000	20	212.0	20.0	234.3	3.44E+12	1.72E+14
5/17/2000	20	146.0				
5/23/2000	210	146.0				
6/8/2000	20	104.0				
6/14/2000	20	89.0	36.0	121.3	3.20E+12	1.78E+13
8/16/2000	20	61.0				
8/23/2000	20	50.0				
8/30/2000	20	61.0				
9/13/2000	110	48.0	30.6	55.0	1.24E+12	8.07E+12
11/7/2000	130	65.0				
11/13/2000	130	132.0				
11/28/2000	50	165.0				
11/29/2000	130	150.0	102.4	128.0	9.62E+12	9.40E+13
2/8/2010	20	813.0				
2/9/2010	40	757.0				
2/16/2010	20	568.0				
3/8/2010	20	421.0	23.8	639.8	1.12E+13	4.70E+14
4/21/2010	110	322.0				
5/4/2010	1700	703.0				
5/13/2010	80	368.0				
5/18/2010	100	348.0	196.7	435.3	6.28E+13	6.39E+13
7/26/2010	80	128.0				
8/2/2010	900	201.0				
8/4/2010	240	188.0				
8/26/2010	500	196.0	**304.9**	**178.3**	**3.99E+13**	**2.62E+13**
10/20/2010	40	126.0				
11/9/2010	20	152.0				
11/16/2010	110	245.0				
11/17/2010	90	227.0	53.0	187.5	7.30E+12	1.38E+14

Figure A-7
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
1202060501 Hillabahatchee Creek at State Road 34 near Franklin, Georgia

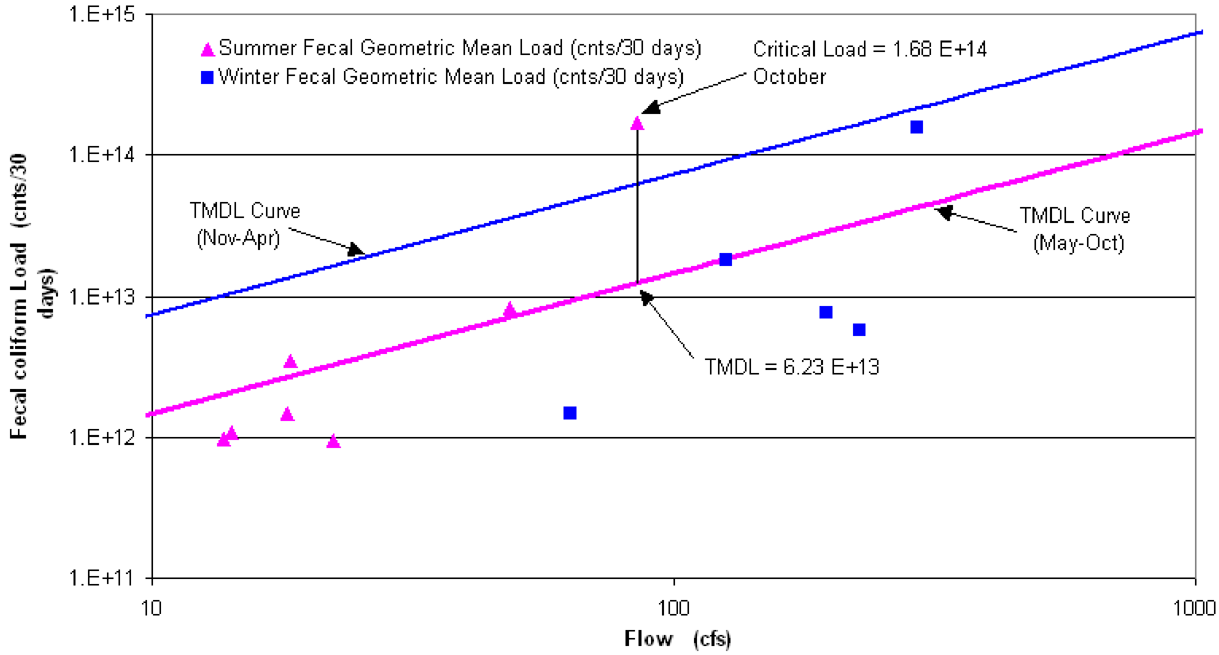


Table A-7. Data for Figure A-7

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
1/19/2000	80	54.0				
3/20/2000	13000	511.0	13000.0	511.0	4.88E+15	3.75E+14
3/22/2000	220	107.0				
3/27/2000	80	66.0				
4/3/2000	1300	485.0	738.5	292.3	1.58E+14	2.15E+14
5/30/2000	20	26.0				
6/12/2000	70	19.0				
6/19/2000	70	21.0				
6/27/2000	110	23.0	57.3	22.3	9.36E+11	3.27E+12
7/31/2000	60	7.4				
8/10/2000	110	11.0				
8/14/2000	80	8.3				
8/28/2000	220	30.0	103.8	14.2	1.08E+12	2.08E+12
9/20/2000	20	8.8				
9/26/2000	230	24.0				
10/16/2000	130	11.0				
10/18/2000	140	11.0	95.7	13.7	9.62E+11	2.01E+12
2/4/2010	30	221.4				
2/9/2010	110	275.6				
2/11/2010	20	230.4				
2/25/2010	20	185.2	33.9	228.2	5.68E+12	1.67E+14
4/7/2010	40	203.3				
4/12/2010	20	185.2				
4/20/2010	40	198.8				
4/28/2010	230	198.8	52.1	196.5	7.51E+12	1.44E+14
7/5/2010	170	54.2				
7/7/2010	230	49.7				
7/12/2010	230	49.7				
7/20/2010	300	41.1	227.9	48.7	8.14E+12	7.15E+12
10/7/2010	700	22.6				
10/26/2010	5000	35.7				
10/28/2010	50000	239.4				
11/3/2010	300	41.6	**2691.8**	**84.8**	**1.68E+14**	**6.23E+13**
1/18/2011	20	33.4				
1/19/2011	60	32.1				
1/20/2011	20	29.4				
2/1/2011	40	158.1	31.3	63.3	1.45E+12	4.64E+13
4/11/2011	170	176.2				
4/12/2011	70	180.7				
4/19/2011	500	85.8				
4/28/2011	230	63.3	192.3	126.5	1.79E+13	9.29E+13
7/12/2011	300	24.8				
7/14/2011	230	18.5				
7/26/2011	500	18.5				
8/2/2011	130	11.7	258.8	18.4	3.50E+12	2.70E+12
10/3/2011	300	14.9				
10/13/2011	195	19.9				
10/19/2011	60	20.3				
10/24/2011	40	17.6	108.9	18.2	1.45E+12	2.67E+12

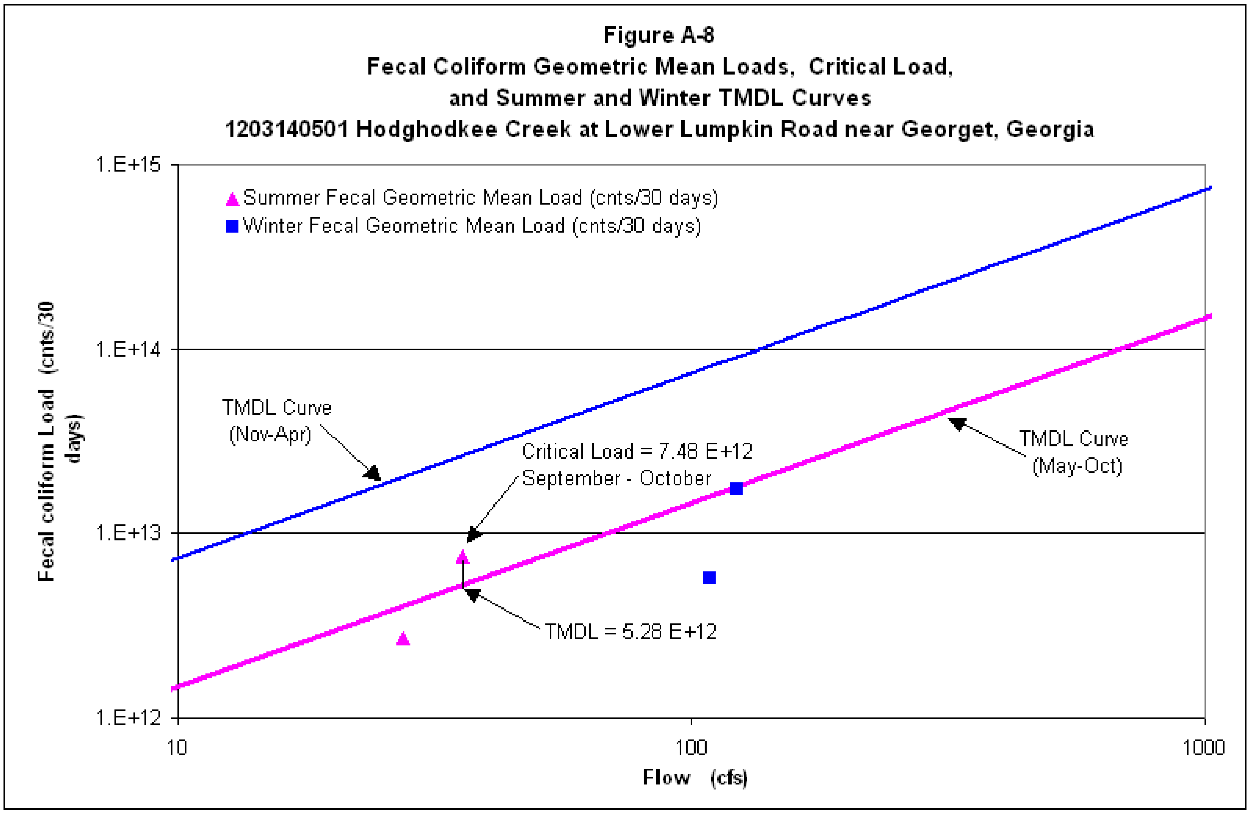


Table A-8. Data for Figure A-8

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
1/15/2008	70	79.0				
1/29/2008	40	88.0				
2/7/2008	130	179.0				
2/12/2008	70	88.0	71.0	108.5	5.66E+12	7.96E+13
3/10/2008	80	93.0				
4/1/2008	80	67.0				
4/7/2008	800	263.0				
4/14/2008	130	102.0				
4/24/2008	170	57.0	193.9	122.3	1.74E+13	8.97E+13
7/8/2008	230	36.0				
7/14/2008	230	28.0				
7/28/2008	20	29.0				
8/4/2008	300	17.0	133.5	27.5	2.69E+12	4.04E+12
9/9/2008	170	41.0				
9/15/2008	210	41.0				
9/22/2008	500	36.0				
10/6/2008	360	26.0	**283.1**	**36.0**	**7.48E+12**	**5.28E+12**

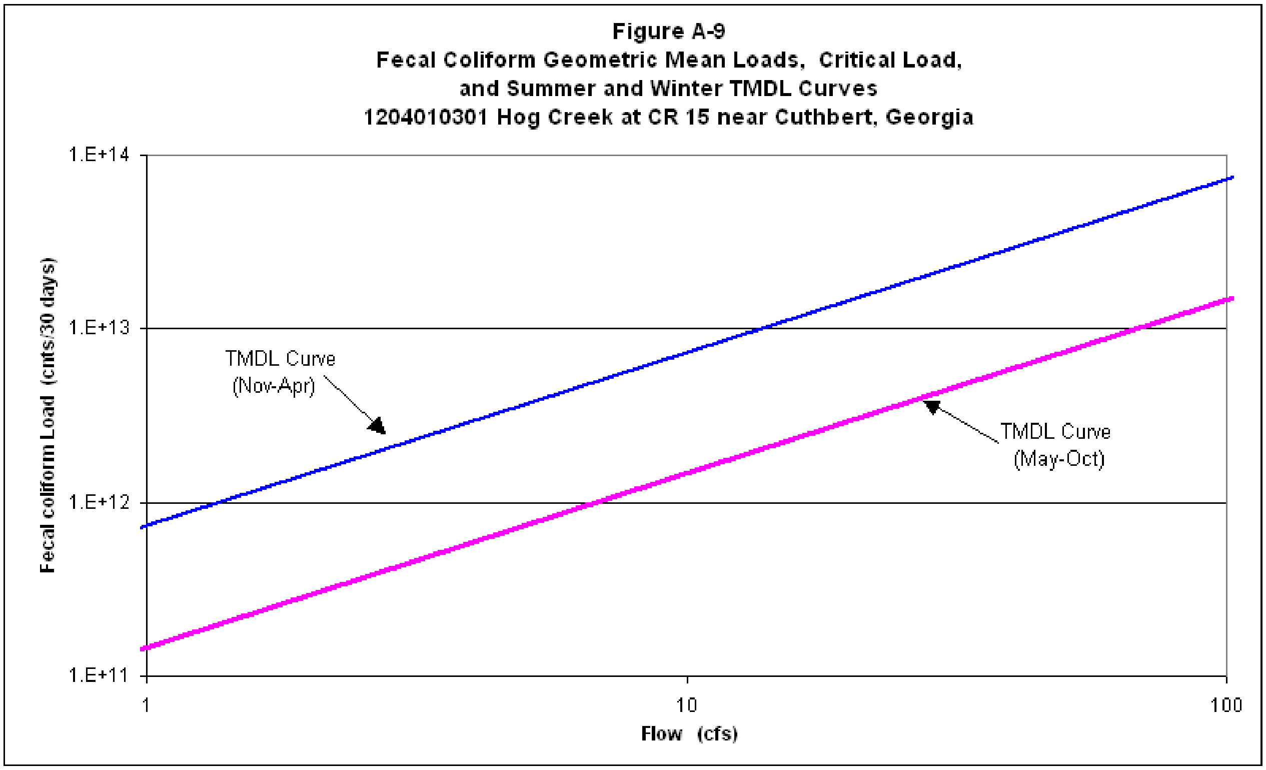


Table A-9. Data for Figure A-9

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
3/4/2010	130	44.5				
3/10/2010	80	36.1				
3/23/2010	230	31.3				
3/25/2010	220	28.9	151.5	35.2	3.91E+12	2.58E+13
5/4/2010	1100	46.9				
5/6/2010	1300	50.6				
5/13/2010	500	22.9				
5/24/2010	1100	11.1	941.7	32.9	2.27E+13	4.82E+12
9/1/2010	1300	6.7				
9/21/2010	1300	0.1				
9/22/2010	500	0.1				
9/29/2010	1300	0.1	1023.8	1.7	1.31E+12	2.57E+11
12/1/2010	11000	13.2				
12/6/2010	300	9.4				
12/13/2010	1300	8.5				
12/27/2010	80	3.1	765.4	8.6	4.82E+12	6.29E+12
12/1/2010	11000	13.2	**11000.0**	**13.2**	**1.07E+14**	**9.72E+12**

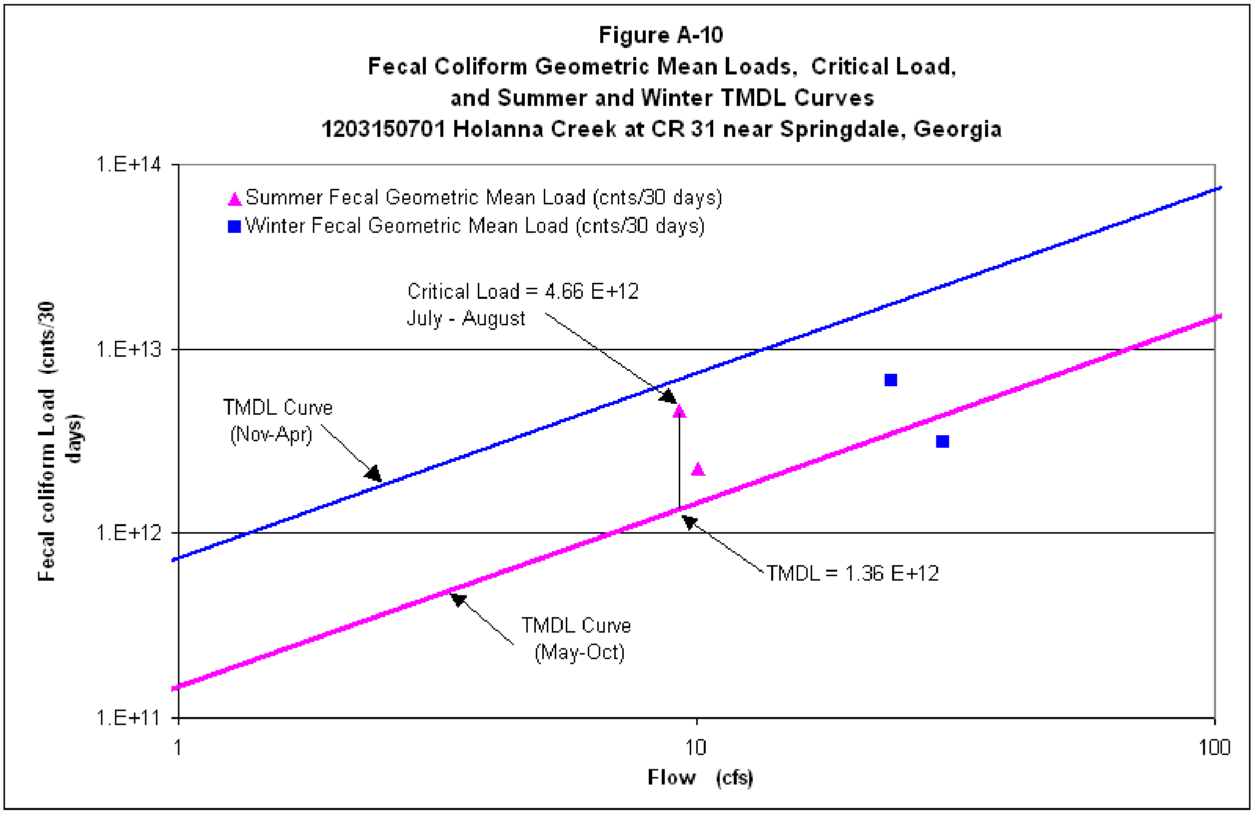


Table A-10. Data for Figure A-10

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
1/15/2008	130	14.0				
1/29/2008	110	22.0				
2/7/2008	170	61.0				
2/12/2008	170	23.0	142.6	30.0	3.14E+12	2.20E+13
3/10/2008	110	31.0				
4/1/2008	300	18.0				
4/7/2008	700	42.0				
4/14/2008	210	21.0				
4/24/2008	490	14.0	383.4	23.8	6.68E+12	1.74E+13
7/8/2008	800	11.0				
7/14/2008	1700	11.0				
7/28/2008	700	8.3				
8/4/2008	230	6.8	**684.1**	**9.3**	**4.66E+12**	**1.36E+12**
9/9/2008	130	13.0				
9/15/2008	170	11.0				
9/22/2008	750	9.3				
10/6/2008	500	7.0	301.7	10.1	2.23E+12	1.48E+12

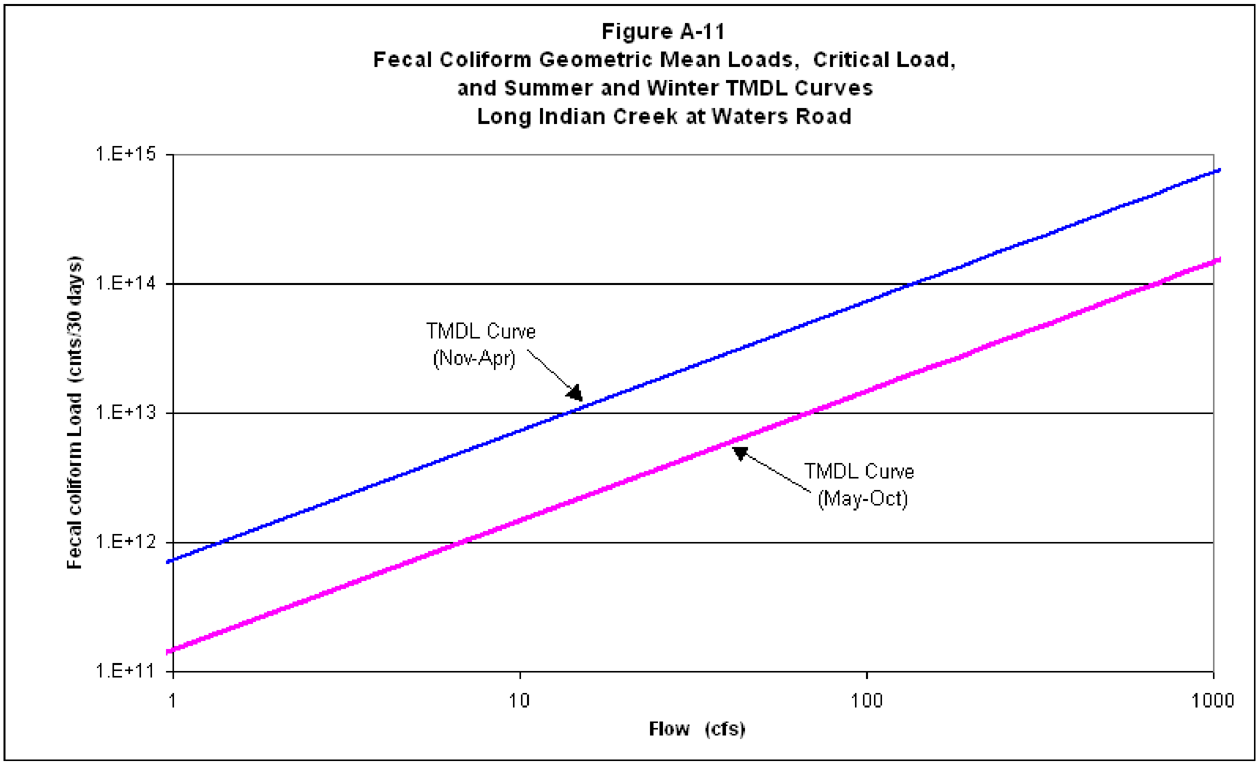


Figure A-11
Fecal Coliform Geometric Mean Loads, Critical Load,
and Summer and Winter TMDL Curves
Long Indian Creek at Waters Road
Fecal coliform Load (cnts/30 days)
1.E+15
1.E+14
1.E+13
1.E+12
1.E+11
1
10
100
1000
Flow (cfs)
TMDL Curve
(Nov-Apr)
TMDL Curve
(May-Oct)

Table A-11. Data for Figure A-11

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
6/19/2007	60	0.9				
6/26/2007	2200	0.6				
7/2/2007	800	2.9				
7/10/2007	600	3.1	962.0	1.9	1.33E+12	2.77E+11
8/6/2007	530	0.6				
8/13/2007	2800	0.5				
8/20/2007	220	0.3				
8/27/2007	2000	1.3	215.4	0.7	1.06E+11	9.87E+10
11/5/2007	100	0.5				
11/14/2007	50	0.5				
11/20/2007	190	0.4				
11/26/2007	900	6.0	506.1	1.9	6.91E+11	1.37E+12
2/6/2008	90	4.2				
2/13/2008	1600	5.0				
2/20/2008	120	2.4				
2/27/2008	240	2.9	342.9	3.6	9.08E+11	2.65E+12
5/1/2008	600	1.0				
5/8/2008	800	0.8				
5/14/2008	1300	1.0				
5/22/2008	1100	0.9	1007.3	0.9	6.85E+11	1.36E+11
8/4/2008	400	0.3				
8/11/2008	1800	0.2				
8/20/2008	2300	0.2				
8/25/2008	12000	9.7	902.2	2.6	1.70E+12	3.78E+11
11/3/2008	160	0.4				
11/10/2008	150	0.4				
11/17/2008	420	0.7				
11/24/2008	300	1.4	421.3	0.7	2.30E+11	5.46E+11
2/2/2009	1000	0.9				
2/11/2009	250	0.9				
2/16/2009	240	0.9				
2/24/2009	40	0.8	288.9	0.9	1.87E+11	6.47E+11
5/4/2009	3300	11.5				
5/11/2009	220	3.7				
5/18/2009	900	2.6				
5/26/2009	220	2.0	277.6	4.9	1.01E+12	7.25E+11
8/3/2009	300	1.4				
8/10/2009	100	0.8				
8/17/2009	300	1.4				
8/27/2009	340	4.4	721.7	2.0	1.07E+12	2.96E+11
11/3/2009	140	2.0				
11/10/2009	19000	110.2				
11/16/2009	170	2.0				
11/23/2009	1400	4.4	361.8	29.6	7.87E+12	2.18E+13
2/1/2010	400	3.9				
2/8/2010	180	5.7				
2/15/2010	130	3.9				
2/22/2010	700	15.9	307.3	7.4	1.66E+12	5.41E+12
5/4/2010	1400	8.9				
5/11/2010	70	1.7				
5/18/2010	520	1.6				
5/26/2010	180	2.6	209.8	3.7	5.67E+11	5.40E+11
8/2/2010	230	0.4				
8/9/2010	90	0.3				
8/16/2010	1200	0.6				
8/23/2010	100	0.9	358.6	0.6	1.48E+11	8.24E+10
11/2/2010	530	0.3				
11/10/2010	260	0.3				
11/22/2010	190	0.4				
11/29/2010	110	2.6	122.6	0.9	8.16E+10	6.66E+11
2/1/2011	180	21.9				
2/7/2011	60	2.9				
2/16/2011	580	1.3				
2/21/2011	180	1.2	1256.5	6.8	6.29E+12	5.01E+12
11/10/2009	19000	110.2	**19000.0**	**110.2**	**1.54E+15**	**8.09E+13**

Figure A-12
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
South Fork Camp Creek

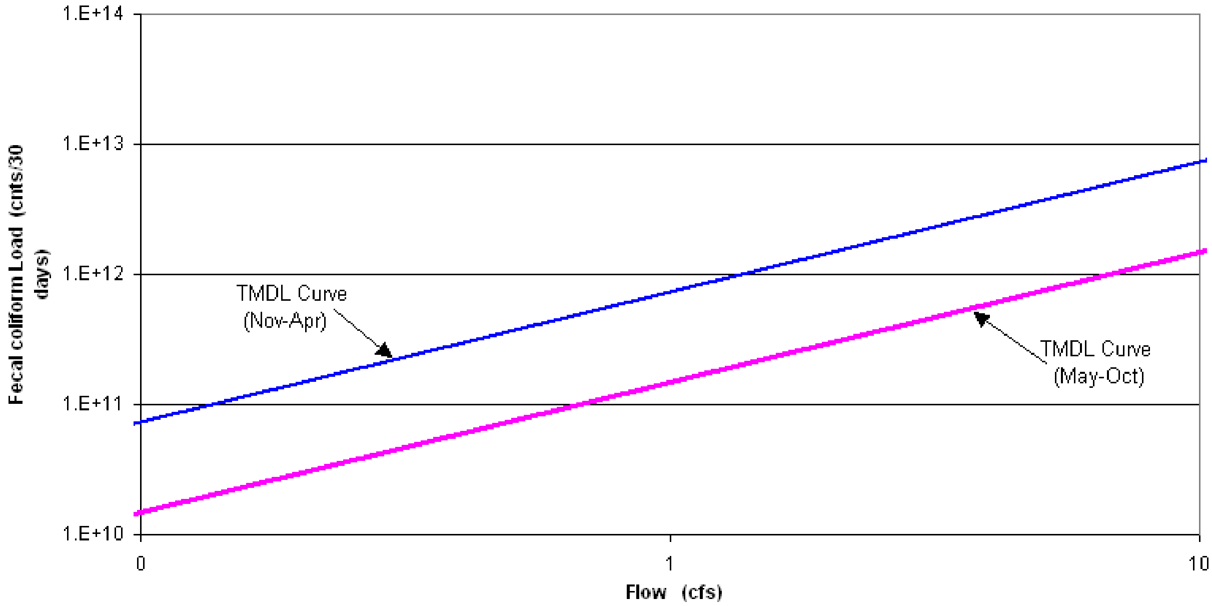


Table A-12. Data for Figure A-12

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)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
6/20/2007	390	2.4				
6/27/2007	210	2.7				
7/5/2007	1000	1.3				
7/11/2007	420	4.4	430.7	2.7	8.62E+11	4.00E+11
8/7/2007	350	1.9				
8/14/2007	280	1.8				
8/21/2007	600	2.0				
8/28/2007	5800	5.5	764.2	2.8	1.56E+12	4.09E+11
11/6/2007	120	1.6				
11/13/2007	170	1.6				
11/19/2007	140	1.4				
11/27/2007	360	1.3	179.1	1.5	1.96E+11	1.09E+12
2/7/2008	330	1.5				
2/14/2008	520	0.9				
2/21/2008	570	21.2				
2/28/2008	70	1.3	287.7	6.2	1.31E+12	4.56E+12
5/2/2008	220	0.9				
5/9/2008	2600	1.3				
5/16/2008	2200	2.0				
5/23/2008	420	2.4	852.6	1.7	1.04E+12	2.45E+11
8/5/2008	700	0.5				
8/12/2008	900	2.0				
8/21/2008	240	0.4				
8/27/2008	500	0.9	524.4	1.0	3.68E+11	1.40E+11
11/4/2008	280	0.5				
11/11/2008	180	0.7				
11/18/2008	2300	0.7				
11/25/2008	330	0.9	442.3	0.7	2.30E+11	5.20E+11
2/3/2009	280	0.5				
2/12/2009	150	0.6				
2/18/2009	2400	7.8				
2/25/2009	90	0.9	308.6	2.5	5.55E+11	1.80E+12
5/5/2009	560	1.4				
5/12/2009	520	1.3				
5/19/2009	500	0.9				
5/27/2009	2200	1.1	752.3	1.2	6.39E+11	1.70E+11
8/4/2009	410	0.7				
8/11/2009	240	0.2				
8/18/2009	230	0.8				
8/26/2009	1300	0.8	414.2	0.6	1.90E+11	9.16E+10
11/2/2009	130	1.8				
11/9/2009	120	1.6				
11/17/2009	90	1.3				
11/24/2009	150	0.9	120.5	1.4	1.23E+11	1.02E+12
2/2/2010	190	4.3				
2/9/2010	53	3.8				
2/16/2010	90	1.6				
2/23/2010	80	1.7	92.3	2.9	1.94E+11	2.10E+12
5/4/2010	700	2.0				
5/11/2010	1400	0.8				
5/18/2010	1100	0.5				
5/26/2010	800	0.4	963.7	0.9	6.45E+11	1.34E+11
8/2/2010	700	1.0				
8/9/2010	500	0.9				
8/17/2010	2300	1.4				
8/24/2010	600	0.6	833.7	1.0	6.12E+11	1.47E+11
11/3/2010	3400	3.5				
11/11/2010	50	0.3				
11/23/2010	90	0.8				
11/30/2010	1500	33.0	389.2	9.4	2.68E+12	6.89E+12
2/2/2011	3800	2.4				
2/9/2011	21000	0.7				
2/17/2011	80	0.6				
2/22/2011	100	0.7	893.9	1.1	7.05E+11	7.89E+11
2/9/2011	21000	0.7	**21000.0**	**0.7**	**1.05E+13**	**5.01E+11**

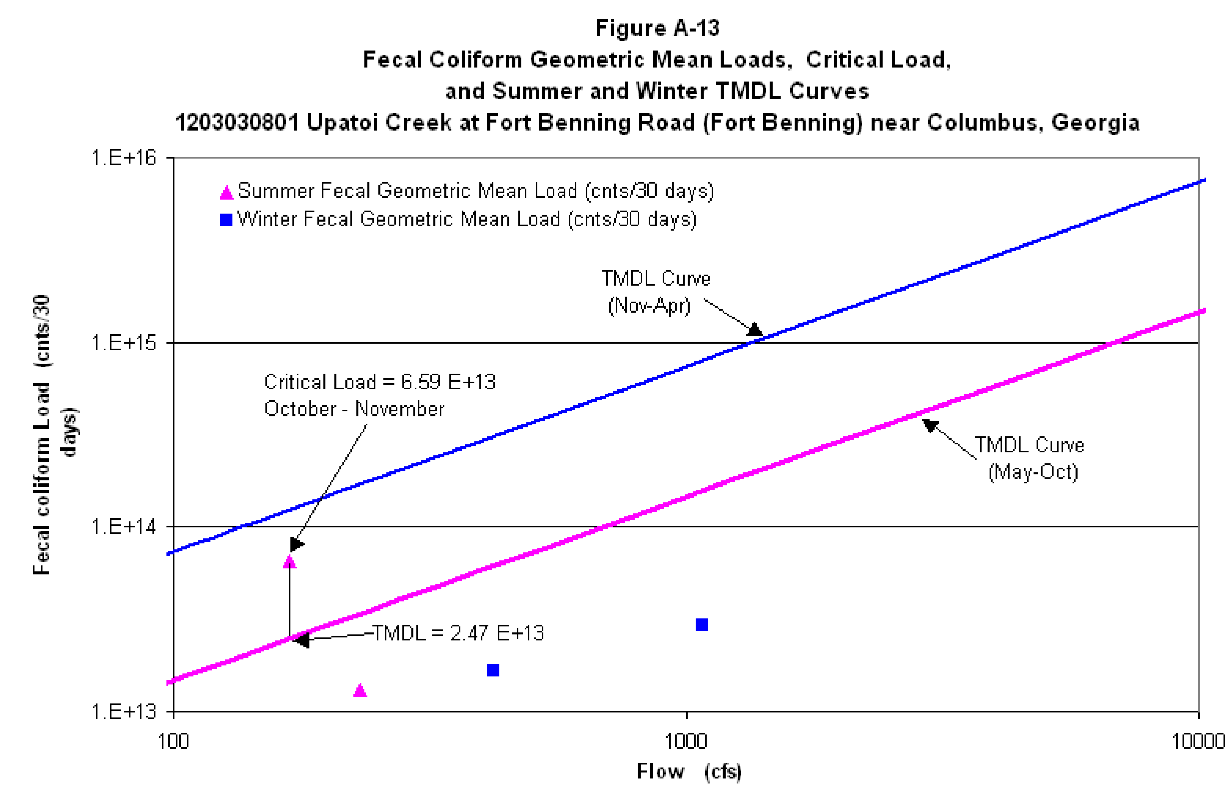


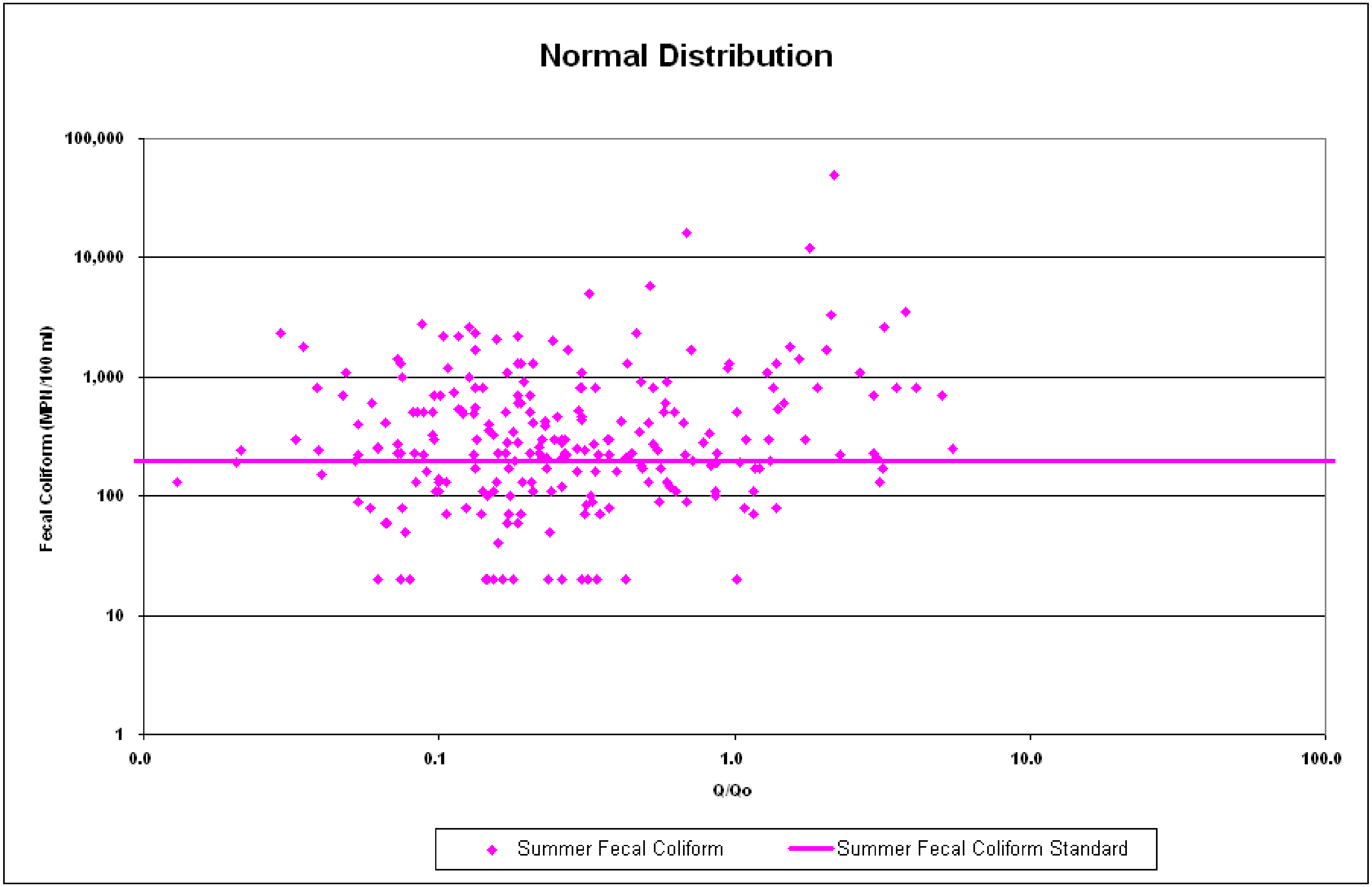
Table A-12. Data for Figure A-13

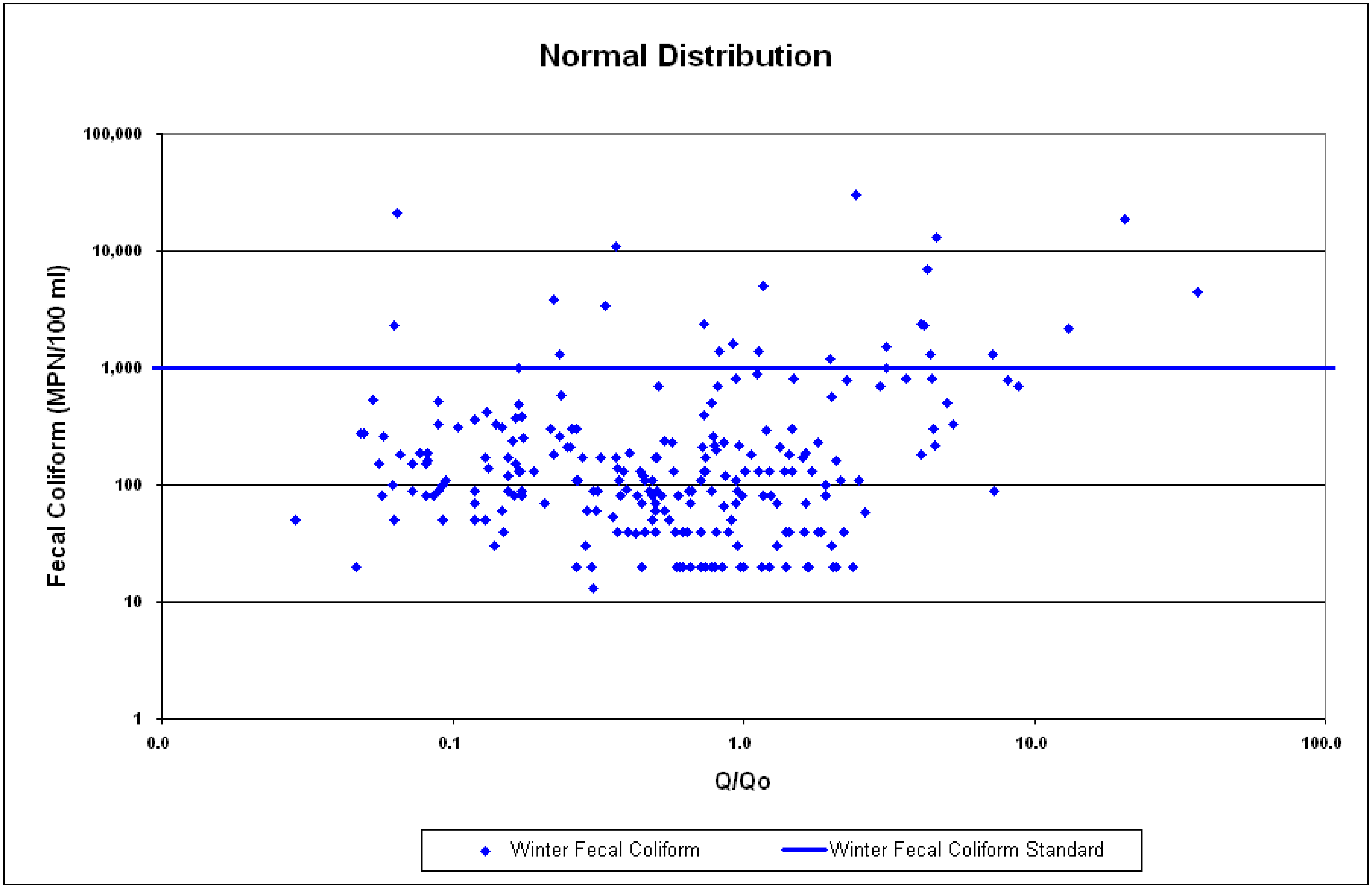
Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
Date	Fecal	Q	Geomean	Mean Flow	Current TMDL	TMDL
2/4/2010	40	1025.1				
2/9/2010	20	1295.2				
2/11/2010	130	1093.9				
2/25/2010	20	892.6	37.3	1076.7	2.95E+13	7.90E+14
4/7/2010	130	464.9				
4/12/2010	40	455.6				
4/20/2010	40	370.8				
4/28/2010	40	393.3	53.7	421.2	1.66E+13	3.09E+14
7/5/2010	85	198.7				
7/7/2010	160	186.7				
7/12/2010	130	324.5				
7/20/2010	20	217.2	77.1	231.8	1.31E+13	3.40E+13
10/7/2010	260	139.1				
10/26/2010	1700	173.5				
10/28/2010	800	190.7				
11/3/2010	230	169.5	**534.0**	**168.2**	**6.59E+13**	**2.47E+13**

.

Appendix B

Normalized Flows Versus Fecal Coliform Plots


Normal Distribution
100,000
10,000
1,000
100
10
1
Fecal Coliform (MPN/100 ml)
0.0
0.1
1.0
10.0
100.0
Q/Qo
Summer Fecal Coliform
Summer Fecal Coliform Standard


Normal Distribution
Fecal Coliform (MPN/100 ml)
100,000
10,000
1,000
100
10
1
0.0
0.1
1.0
10.0
100.0
Q/Qo
Winter Fecal Coliform
Winter Fecal Coliform Standard