

Total Maximum Daily Load
Evaluation
for
Fifteen Stream Segments
in the
Suwannee River Basin
for
Fecal Coliform

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Region 4
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Table of Contents

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	iv
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Watershed Description	1
1.3 Water Quality Standard	3
2.0 WATER QUALITY ASSESSMENT	7
3.0 SOURCE ASSESSMENT	8
3.1 Point Source Assessment	8
3.2 Nonpoint Source Assessment	12
4.0 ANALYTICAL APPROACH	20
4.1 Loading Curve Approach	20
5.0 TOTAL MAXIMUM DAILY LOADS	23
5.1 Waste Load Allocations	23
5.2 Load Allocations	25
5.3 Seasonal Variation	25
5.4 Margin of Safety	26
5.5 Total Fecal Coliform Load	26
6.0 RECOMMENDATIONS	29
6.1 Monitoring	29
6.2 Fecal Coliform Management Practices	29
6.3 Reasonable Assurance	32
6.4 Public Participation	32
7.0 INITIAL TMDL IMPLEMENTATION PLAN	33
REFERENCES	37

List of Tables

1. Water Bodies Listed for Fecal Coliform Bacteria in the Suwannee River Basin
2. Suwannee River Basin Land Coverage
3. NPDES Facilities Discharging Fecal Coliform in the Suwannee River Basin
4. Registered CAFOs in the Suwannee River Basin
5. Deer Census Data in the Suwannee River Basin
6. Estimated Agricultural Livestock Populations in the Suwannee River Basin
7. Number of Septic Systems in the Suwannee River Basin
8. Permitted Land Application Systems in the Suwannee River Basin
9. Landfills in the Suwannee River Basin
10. Monitoring Stations with Estimated Flow
11. WLAs for the Suwannee River Basin
12. Fecal Coliform Loads and Required Fecal Coliform Load Reductions

List of Figures

1. Impaired Stream Segments in HUCs 03110202, 03110203, and 03110204

List of Appendixes

- A: 30-day Geometric Mean Fecal Coliform Monitoring Data
- B: Normalized Flows Versus Fecal Coliform Plots

EXECUTIVE SUMMARY

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

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDLs in this document are based on the draft 2004 303(d) listing, which is also available on the GA EPD website. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

The State of Georgia has identified fifteen (15) stream segments located in the Suwannee River Basin as water quality limited due to fecal coliform. A stream is placed on the partial support list if more than 10% of the samples exceed the fecal coliform criteria and on the not support list if more than 25% of the samples exceed the standard. Water quality samples collected within a 30-day period that have a geometric mean in excess of 200 counts per 100 milliliters during the period May through October, or in excess of 1,000 counts per 100 milliliters during the period November through April, are in violation of the bacteria water quality standard. There is also a single sample maximum criteria (4,000 counts per 100 milliliters) for the months of November through April. The water use classification of all of the impacted streams is Fishing.

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.

The process of developing fecal coliform TMDLs for the Suwannee 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.

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	WLA _{sw} (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Bear Creek	6.55E+12	2.68E+11		4.11E+12	4.87E+11	4.87E+12	26
Franks Creek	5.58E+13	7.74E+10		2.14E+13	2.39E+12	2.39E+13	57
Little Brushy Creek	1.48E+13			8.18E+12	9.09E+11	9.09E+12	38
Mud Creek	4.73E+13	5.92E+11	6.76E+12	1.08E+13	2.02E+12	2.02E+13	57
Negro Branch	5.55E+14			8.33E+13	9.26E+12	9.26E+13	83
New River - Reedy Creek to Gum Branch, near Lenox	3.50E+12			1.11E+14	1.24E+13	1.24E+14	0
New River - Westside Branch to Gum Creek, near Tifton	3.37E+13	1.62E+12		2.08E+13	2.50E+12	2.50E+13	26
Okapilco Creek	1.87E+13			1.44E+13	1.60E+12	1.60E+13	14
Sand Creek	3.43E+12			1.66E+12	1.84E+11	1.84E+12	46
Southside Branch	2.53E+13			1.94E+13	2.15E+12	2.15E+13	15
Turkey Branch	2.14E+15	9.78E+11		4.80E+14	5.35E+13	5.35E+14	75
Two Mile Branch	3.23E+11		4.88E+10	2.09E+10	7.75E+09	7.75E+10	76
Ty Ty Creek	1.06E+13			4.16E+12	4.62E+11	4.62E+12	56
Westside Branch	1.65E+17			3.00E+14	3.34E+13	3.34E+14	100
Withlacoochee River	1.61E+15			1.08E+15	1.19E+14	1.19E+15	26

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.

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

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

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

1.0 INTRODUCTION

1.1 Background

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

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDLs in this document are based on the draft 2004 303(d) listing, which is also available on the GA EPD website. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality based controls to be developed to reduce pollution and restore and maintain water quality.

The list identifies the waterbodies as either partially supporting or not supporting their designated use classifications, due to exceedances of water quality standards for fecal coliform bacteria. Fecal coliform bacteria are used as an indicator of the potential presence of pathogens in a stream. Table 1 presents the streams of the Suwannee River Basin included on the draft 2004 303(d) list for exceedances of the fecal coliform standard criteria. A total of eight stream segments were listed as partially supporting their designated use and seven stream segments were listed as not supporting their designated use.

1.2 Watershed Description

The Suwannee River Basin is located in the south-central part of Georgia, occupying an area of approximately 10,000 square miles with approximately 5,560 square miles of the basin within Georgia. The basin lies within the Coastal Plain physiographic province, which extends throughout the southeastern United States. The Suwannee River drains into the Gulf of Mexico.

Table 1. Water Bodies Listed for Fecal Coliform Bacteria in the Suwannee River Basin

Stream Segment	Location	Segment Length (miles)	Designated Use	Listing
Bear Creek	City of Adel Lake to Withlacoochee River (Cook Co.)	4	Fishing	PS
Franks Creek	St. Rt. S1780 to Little River near Hahira (Lowndes Co.)	9	Fishing	PS
Little Brushy Creek	Stump Cr. to Reedy Cr. S. of Ocilla (Irwin Co.)	4	Fishing	PS
Mud Creek	Downstream Valdosta Mud Creek WPCP to Alapahoochee River (Lowndes Co)	10	Fishing	NS
Negro Branch	Headwaters to Piscola Cr., Quitman (Brooks Co)	9	Fishing	NS
New River	Reedy Cr. to Gum Branch near Lenox (Cook Co.)	7	Fishing	PS
New River	Westside Branch to Gum Cr. downstream Tifton (Tift Co.)	5	Fishing	PS
Okapilco Creek	SR 76, Quitman to Withlacoochee River (Brooks Co)	5	Fishing	NS
Sand Creek	Headwaters east of Sycamore to Alapaha River (Turner/Irwin Co)	14	Fishing	PS
Southside Branch	Tributary to New River, Tifton (Tift Co)	1	Fishing	PS
Turkey Branch	Headwaters to Willacoochee River downstream from Fitzgerald (Ben Hill Co)	8	Fishing	NS
Two Mile Branch	Headwaters to Sugar Creek, Valdosta (Lowndes Co)	2	Fishing	NS
Ty Ty Creek	Little Creek near Ty Ty to Tucker Cr. Near Omega, GA (Colquitt Co.)	10	Fishing	PS
Westside Branch	Tributary to Little River, Tifton (Tift Co)	2	Fishing	NS
Withlacoochee River	Bay Branch to Little River	9	Fishing	NS

Notes:

PS = Partially Supporting designated uses

NS = Not Supporting designated uses

The USGS has divided the Suwannee River Basin into four sub-basins, or Hydrologic Unit Codes (HUCs). Figure 1 shows the locations of these sub-basins, the listed segments within each sub-basin, and the associated counties within each sub-basin.

The land use characteristics of the Suwannee River Basin watersheds were determined using data from the National Land Cover Dataset (NLCD) for Georgia. This coverage was produced from Landsat Thematic Mapper digital images developed in 1995. Land use classification is based on a modified Anderson level one and two system. Table 2 lists the watershed land coverage distribution of the 15 stream segments on the 303(d) list.

1.3 Water Quality Standard

The water use classification for the listed stream segments in the Suwannee River Basin is Fishing. The criterion violated is listed as fecal coliform. The potential cause(s) listed include urban runoff, nonpoint sources, and municipal facilities. The use classification water quality standards for fecal coliform bacteria, as stated in the *State of Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c)(iii) (GA EPD, 2004), are:

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).

Any interstate waters in the Ochlockonee watershed must also meet the Florida standard for fecal coliform:

Fecal Coliform Bacteria: Most Probable Number (MPN) or Membrane Filter(MF) counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages must be expressed as a geometric mean.

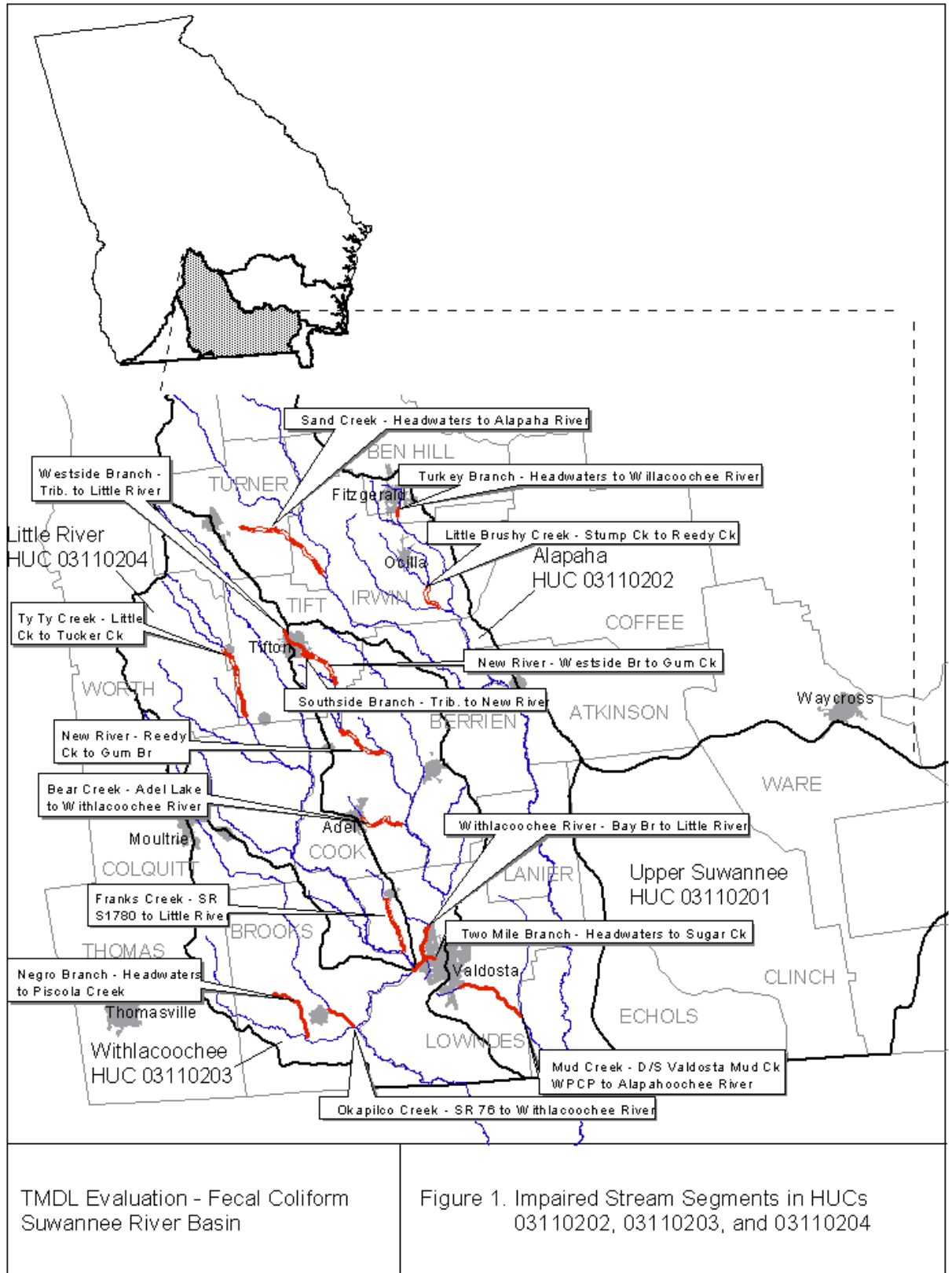


Table 2. Suwannee River Basin Land Coverage

Stream/Segment	Landuse Categories - Acres (Percent)												Total	Landuse Source
	Open Water	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		
Bear Creek	70 (0.3)	794 (3.6)	683 (3.1)	18 (0.1)	11 (0.0)	991 (4.5)	5,275 (23.8)	8,232 (37.1)	2,307 (10.4)	125 (0.6)	3,484 (15.7)	187 (0.8)	22,177	NLCD
Franks Creek	113 (0.4)	531 (1.8)	420 (1.4)	9 (0.0)	0 (0.0)	1,021 (3.4)	9,470 (31.8)	9,534 (32.0)	2,838 (9.5)	177 (0.6)	5,463 (18.3)	232 (0.8)	29,808	NLCD
Little Brushy Creek	274 (1.2)	449 (1.9)	274 (1.2)	22 (0.1)	233 (1.0)	1,113 (4.7)	4,148 (17.6)	11,357 (48.1)	3,657 (15.5)	47 (0.2)	1,892 (8.0)	132 (0.6)	23,597	NLCD
Mud Creek	110 (0.3)	4,167 (10.2)	992 (2.4)	14 (0.0)	0 (0.0)	3,307 (8.1)	10,028 (24.7)	8,589 (21.1)	1,209 (3.0)	677 (1.7)	9,878 (24.3)	1,700 (4.2)	40,671	NLCD
Negro Branch	63 (0.5)	800 (6.9)	76 (0.7)	0 (0.0)	0 (0.0)	601 (5.2)	1,662 (14.4)	5,439 (47.2)	584 (5.1)	0 (0.0)	2,002 (17.4)	302 (2.6)	11,529	NLCD
New River - Reedy Creek to Gum Branch	721 (1.1)	343 (0.5)	495 (0.8)	60 (0.1)	0 (0.0)	3,552 (5.5)	13,830 (21.3)	25,207 (38.8)	10,639 (16.4)	335 (0.5)	9,176 (14.1)	657 (1.0)	65,018	NLCD
New River - Westside Branch to Gum Creek	256 (1.1)	32 (0.1)	56 (0.2)	20 (0.1)	0 (0.0)	1,298 (5.4)	4,842 (20.2)	9,461 (39.6)	3,923 (16.4)	14 (0.1)	3,741 (15.6)	274 (1.1)	23,919	NLCD
Okapilco Creek	1,196 (0.7)	2,114 (1.2)	1,068 (0.6)	82 (0.0)	0 (0.0)	9,450 (5.2)	40,603 (22.2)	85,148 (46.5)	15,051 (8.2)	625 (0.3)	25,288 (13.8)	2,416 (1.3)	183,040	NLCD
Sand Creek	427 (1.9)	1 (0.0)	5 (0.0)	26 (0.1)	0 (0.0)	1,533 (6.8)	4,324 (19.1)	9,212 (40.7)	5,526 (24.4)	38 (0.2)	1,477 (6.5)	73 (0.3)	22,642	NLCD
Southside Branch	0 (0.0)	86 (16.4)	107 (20.5)	4 (0.8)	0 (0.0)	34 (6.5)	97 (18.5)	148 (28.3)	14 (2.7)	19 (3.6)	15 (2.9)	0 (0.0)	523	NLCD
Turkey Branch	111 (1.1)	1,468 (14.1)	719 (6.9)	22 (0.2)	0 (0.0)	469 (4.5)	1,531 (14.7)	4,320 (41.5)	1,140 (11.0)	100 (1.0)	487 (4.7)	39 (0.4)	10,408	NLCD
Two Mile Branch	20 (1.0)	1,360 (66.4)	139 (6.8)	0 (0.0)	0 (0.0)	5 (0.2)	80 (3.9)	64 (3.1)	1 (0.0)	102 (5.0)	259 (12.6)	20 (1.0)	2,048	NLCD

Stream/Segment	Landuse Categories - Acres (Percent)													Landuse Source
	Open Water	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	
Ty Ty Creek	430 (0.9)	89 (0.2)	104 (0.2)	47 (0.1)	0 (0.0)	2,246 (5.0)	9,357 (20.6)	17,988 (39.7)	11,268 (24.8)	13 (0.0)	3,747 (8.3)	62 (0.1)	45,351	NLCD
Westside Branch	2 (0.1)	892 (34.7)	257 (10.0)	4 (0.2)	0 (0.0)	154 (6.0)	632 (24.6)	324 (12.6)	220 (8.5)	80 (3.1)	10 (0.4)	0 (0.0)	2,574	NLCD
Withlacoochee River	2,787 (1.0)	9,055 (3.3)	2,267 (0.8)	141 (0.1)	189 (0.1)	13,348 (4.9)	76,294 (28.2)	92,807 (34.3)	25,238 (9.3)	964 (0.4)	43,266 (16.0)	3,957 (1.5)	270,317	NLCD

2.0 WATER QUALITY ASSESSMENT

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

Fecal coliform data were collected during calendar years 1992, 1993, 1998, and 2003. Sources of these data include the following:

- United States Geological Survey (USGS) basin water quality data, 1998 and 2003;
- Georgia Environmental Protection Division (GA EPD) Trend Monitoring data, 2003; and
- Tifton spill data, 1992 and 1993

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

3.0 SOURCE ASSESSMENT

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

3.1 Point Source Assessment

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

3.1.1 Wastewater Treatment Facilities

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

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

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

Municipal and industrial wastewater treatment facilities' discharges may contribute fecal coliform to receiving waters. There are twenty NPDES permitted discharges with flows greater than 0.1 MGD identified in the Suwannee River Basin that discharge treated municipal wastewater. Table 3 provides the monthly average discharge flows and fecal coliform concentrations for the municipal and industrial treatment facilities, obtained from calendar year 2003 Discharge Monitoring Report (DMR) data. The permitted flow and fecal coliform concentrations for these facilities are also included in this table.

Combined sewer systems convey a mixture of raw sewage and storm water in the same conveyance structure to the wastewater treatment plant. These are considered a component of municipal wastewater treatment facilities. When the combined sewage exceeds the capacity of the wastewater treatment plant, the excess is diverted to a combined sewage overflow (CSO) discharge point. There are no permitted CSO outfalls in the Suwannee River Basin.

Table 3. NPDES Facilities Discharging Fecal Coliform in the Suwannee River Basin

Facility Name	NPDES Permit No.	Receiving Stream	Actual 2003 Discharge		NPDES Permit Limits		Number of Violations July 1998-June 2002
			Average Monthly Flow (MGD) ¹	Geometric Mean (No./ 100 mL) ²	Average Monthly Flow (MGD)	Average Monthly FC (No./ 100mL)	
Adel WPCP	GA0024911	Bear Creek	1.18	956.9	0.95	200	0
Alapaha Pond	GA0033596	Alapaha River	0.13	Not measured	0.1	No FC permit limit	0
Ashburn-Airport	GA0025852	Hat Cr Trib. to Alapaha River	1.08	17.02	1.16	200	0
Fitzgerald C.A. Newcomer	GA0047236	Turkey Creek	3.53	53.8	6.0	200	0
Hahira	GA0037974	Unnamed Trib. to Franks Creek	0.06	127	0.275	No FC permit limit	0
Homerville Ind. Park	GA0037460	Tatum Creek	0.1	Not measured	0.25	200	0
Homerville WPCP	GA0031828	Gallows Branch Trib.	0.31	4.2	0.5	200	0
Lakeland Pond	GA0021296	Big Creek	0.14	Not measured	0.2	200	0
Lenox Pond	GA0031950	Trib. to Little River	0.06	Not measured	0.17	No FC permit limit	0
Moultrie Spence Field	GA0025879	Little Indian Creek	0.16	Not measured	0.2	No FC permit limit	0
Norman Park WPCP	GA0033600	Reedy Creek	0.11	30.3	0.2	200	0
Oak Street S/D-Pineridge Water Supply	GA0030104	Cherry Creek	0.05	<5	0.1	200	0
Ray City Pond	GA0033553	Cat Creek	0.09	Not measured	0.1	No FC permit limit	0
Rochelle Northwest	GA0024244	Mill Creek	0.17	Not measured	0.34	No FC permit limit	0
Sparks WPCP	GA0021563	Bear Creek	0.34	0.5	0.23	200	0
Tifton New River WPCP	GA0048470	New River	6.09	8.0	8.0	200	0
Union Camp Valdosta (Arizona Chemical Co.)	GA0000205	Trib. to Knight's Creek	Not measured	Not measured	No flow limit	No FC permit limit	0
USAF Moody AFB	GA0020001	Beatty Branch	0.44	Not measured	0.75	200	0

Facility Name	NPDES Permit No.	Receiving Stream	Actual 2003 Discharge		NPDES Permit Limits		Number of Violations July 1998-June 2002
			Average Monthly Flow (MGD) ¹	Geometric Mean (No./ 100 mL) ²	Average Monthly Flow (MGD)	Average Monthly FC (No./ 100mL)	
Valdosta Mud CR	GA0020222	Mud Creek	2.33	3.1	3.22	200	1
Valdosta Withlacoochee	GA0033235	Withlacoochee River	6.76	20	12	200	1

Source: GA EPD Regional Offices

Notes: ¹ Values shown are the annual average of the monthly average flows.
² Values shown are the annual average of the monthly geometric means.

3.1.2 Regulated Storm Water Discharges

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

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

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

Phase I MS4 permits require the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990). A site-specific Storm Water Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. There are no Phase I MS4s in the Suwannee River Basin.

As of March 10, 2003, small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty counties and 56 communities are permitted under the Phase II regulations in Georgia. The cities of Remerton and Valdosta in Lowndes County are the only communities located in the Suwannee River Basin that are covered by the Phase II General Storm Water Permit, GAG610000.

3.1.3 Confined Animal Feeding Operations

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

In 1990, the State of Georgia began registering CAFOs. Many of the CAFOs were issued land application or NPDES permits for treatment of wastewaters generated from their operations. The type of permit issued depends on the operation size (i.e., number of animal units). Table 4 presents the swine and non-swine (primarily dairies) CAFOs located in the Suwannee River Basin that are registered or have land application permits.

Table 4. Registered CAFOs in the Suwannee River Basin

Name	County	Animal Type	Total No. of Animals	Permit No.
Brooksco Dairy	Brooks	Dairy	4,200	GAG930000
Brooksco Farms, Inc.(Lamon Farm)	Brooks	Swine	-	GAU700000
Danforth Hog Farm	Cook	Swine	7,250	GA0038270
Donald Stodghill	Berrien	Swine	1,800	GAU700000
Green Hill Dairy-Sweet Grass Dairy	Brooks	Swine	500	GAU700000
Hambone Farms, Sowega Swine	Crisp	Swine	4,280	GA0038253
Herbert Price Hog Operation	Brooks	Swine	2,200	GAU700000
Jackson & Wortman Dairy	Brooks	Dairy	1,500	GAG930000
Lazy S Dairy	Worth	Dairy	210	GAU700000
Messer Dairy Inc.	Thomas	Dairy	600	GAU700000
Steve Williams Farm	Irwin	Swine	-	GAU700000
Tifton Campus Dairy	Tift	Dairy	-	GAU700000
Wynn Swine Farm (Darbyshire Unit)	Colquitt	Swine	1,000	GAU700000
Wynn Swine Farm (Levi)	Colquitt	Swine	1,205	GAU700000

Sources: Permitting Compliance and Enforcement Program, EPD, GA EPD, 2004
 GA Dept. of Agriculture, 2005

3.2 Nonpoint Source Assessment

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

- Wildlife
- Agricultural Livestock
 - Animal grazing
 - Animal access to streams
 - Application of manure to pastureland and cropland

- Urban Development
 - Leaking sanitary sewer lines
 - Leaking septic systems
 - Land Application Systems
 - Landfills

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

3.2.1 Wildlife

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

White-tailed deer have a significant presence throughout the Suwannee River Basin. The average deer population for years 1995 through 2003 for counties in the Suwannee River Basin are presented in Table 5.

Fecal coliform bacteria contributions from deer to water bodies are generally considered less significant than that of waterfowl, racoons, and beavers. This is because a greater portion of their time is spent in terrestrial habitats. This also holds true for other terrestrial mammals such as squirrels and rabbits, and terrestrial birds (GA WRD, 2002). However, feces deposited on the land surface can result in the introduction of fecal coliform to streams during runoff events. It should be noted that between storm events, considerable decomposition of the fecal matter might occur, resulting in a decrease in the associated fecal coliform numbers. This is especially true in the warm, humid environments typical of the southeast.

3.2.2 Agricultural Livestock

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

Table 5. Deer Census Data in the Suwannee River Basin

County	1995-2003 Average Population (number/sq mi)
Atkinson	26
Ben Hill	26
Berrien	26
Brantley	39
Brooks	21
Charlton	39
Clinch	39
Coffee	26
Colquitt	21
Cook	21
Crisp	21
Dooly	21
Echols	39
Irwin	26
Lanier	39
Lowndes	21
Thomas	21
Tift	21
Turner	21
Ware	39
Wilcox	26
Worth	21

Source: Wildlife Resources Division, GA DNR, 2005

Table 6 provides the estimated number of beef cattle, dairy cattle, goats, horse, swine, sheep, and chickens by category reported by county. These data were provided by the Natural Resources Conservation Service (NRCS) and are based on 2003 data.

Table 6. Estimated Agricultural Livestock Populations in the Suwannee River Basin

County	Livestock								
	Beef Cattle	Dairy Cattle	Swine	Sheep	Horses	Goats	Chickens-Layers	Chickens-Broilers Sold	Chickens-Breeders
Atkinson	7,000	-	315	-	312	5,000	50,000	3,859,200	-
Ben Hill	5,000	-	100	-	1,150	1,300	-	50,000	-
Berrien	19,306	1,100	1,236	-	505	1,275	68,330	15,000	-
Brantley	3,000	-	30	-	280	300	834,993	-	-
Brooks	10,000	5,700	2,800	100	500	500	-	216,000	-
Charlton	1,500	-	125	-	225	375	689,000	107,200	96,000
Clinch	1,450	-	-	-	115	200	60,000	78,000	-
Coffee	12,550	200	2,600	-	325	500	90,000	7,925,000	161,000
Colquitt	14,559	485	1,650	24	956	884	240,000	2,162,000	140,000
Cook	5,950	90	-	50	40	700	-	-	-
Crisp	5,850	-	3,600	-	175	1,250	-	450,000	-
Dooly	2,700	420	2,100	-	70	200	-	1,100,000	-
Echols	500	-	-	-	-	-	-	-	-
Irwin	15,500	-	1,300	-	125	1,700	20,000	230,000	-
Lanier	4,500	-	220	-	325	750	45,000	-	-
Lowndes	7,000	-	-	-	1,975	3,000	-	-	-
Thomas	15,764	685	618	-	1,430	65	40,000	506,000	-
Tift	12,000	325	450	30	650	3,800	33,000	-	-
Turner	15,000	-	40	100	270	2,000	-	750,000	-
Ware	600	875	2,550	-	175	-	106,000	495,000	90,000
Wilcox	6,010	750	170	15	154	450	-	3,360,000	-
Worth	22,500	400	-	-	480	-	-	322,000	-

Source: NRCS, 2003

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 enter streams by direct washoff from the land surface, or the runoff may be diverted to a storm water collection system and discharged through a discrete outlet

structure. For large, medium, and small urban areas (populations greater than 50,000), the storm water outlets are regulated under MS4 permits (see Section 3.1.2). For smaller urban areas, the storm water discharge outlets currently remain unregulated.

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

3.2.3.1 Leaking Septic Systems

A portion of the fecal coliform in the Suwannee River Basin may be attributed to failure of septic systems and illicit discharges of raw sewage. Table 7 presents the number of septic systems in each county of the Suwannee River Basin existing in 1990, based on U.S. 1990 Census Data, and the number existing in 2002, based on the Georgia Department of Human Resources, Division of Public Health data. In addition, an estimate of the number of septic systems installed and repaired during the thirteen-year period from 1990 to 2003 is given.

Table 7. Number of Septic Systems in the Suwannee River Basin

County	Existing Septic Systems (1990)	Existing Septic Systems (2003)	No. of Septic Systems Installed (1990 to 2003)	No. of Septic Systems Repaired (1990 to 2003)
Atkinson	1,450	2,400	950	24
Ben Hill	2,557	4,000	1,443	*
Berrien	3,004	4,512	1,508	171
Brantley	3,343	7,621	4,278	353
Brooks	3,858	6,258	2,400	*
Charlton	2,116	3,439	1,323	133
Clinch	1,200	1,770	570	44
Coffee	6,376	12,219	5,843	363
Colquitt	6,327	9,531	3,204	283
Cook	2,424	4,124	1,700	*
Crisp	3,817	4,078	261	*
Dooly	1,984	2,460	476	38
Echols	881	*	*	*
Irwin	2,097	3,197	1,100	*
Lanier	1,260	3,060	1,800	*
Lowndes	9,723	17,423	7,700	*
Thomas	5,350	7,495	2,145	715
Tift	5,032	8,532	3,500	*
Turner	1,558	2,318	760	*
Ware	6,354	9,569	3,215	949
Wilcox	2,631	3,035	404	42
Worth	4,292	7,433	3,141	596

Source: 1990 Census Data, and the Georgia Dept. of Human Resources, Div. of Public Health, 2004 (* data not available)

These data show that a substantial increase in the number of septic systems has occurred in several counties. This may be a reflection of population increases outpacing the expansion of sewage collection systems during this period. Hence, a large number of septic systems are installed to contain and treat the sanitary waste. It is estimated that there are approximately 2.37 people per household on septic systems (EPA, personal communication).

3.2.3.2 Land Application Systems

Many smaller communities use land application systems (LAS) for treatment of their sanitary wastewaters. These facilities are required through LAS permits to treat all their wastewater by land application and are to be properly operated as non-discharging systems that contribute no runoff to nearby surface waters. However, runoff during storm events may carry surface residual containing fecal coliform bacteria to nearby surface waters. Some of these facilities may also exceed the ground percolation rate when applying the wastewater, resulting in surface runoff from the field. If not properly bermed, this runoff, which probably contains fecal coliform bacteria, may discharge to nearby surface waters. There are twelve permitted LAS systems located in the Suwannee River Basin (Table 8).

Table 8. Permitted Land Application Systems in the Suwannee River Basin

LAS Name	County	Permit No.	Type	Flow (MGD)
Danforth Hog Farm	Cook	GA01-414	Industrial	0.019
Fitzgerald Water, Light, Bond	Ben Hill	GA02-240	Municipal	0.3
Hamilton Point S/D- Stoker Dev	Lowndes	GA02-030	Private	0.065
Lowndes Co Board Of Com	Lowndes	GA02-294	Municipal	2.0
Nashville	Berrien	GA02-049	Municipal	1.0
Ocilla	Irwin	GA02-180	Municipal	0.85
Omega	Tift	GA02-219	Municipal	0.13
Quitman	Brooks	GA02-022	Municipal	1.5
Sanderson Farms Inc	Colquitt	GA01-333	Industrial	1.7
Sycamore LAS	Turner	GA02-067	Municipal	0.082
Sylvester LAS	Worth	GA02-132	Municipal	1.18
Tenneco Packaging	Lowndes	GA01-451	Industrial	12.0

Source: Permitting Compliance and Enforcement Program, GA EPD, 2004

3.2.3.3 Landfills

Leachate from landfills may contain fecal coliform bacteria that may at some point discharge into surface waters. Sanitary (or municipal) landfills are the most likely to serve as a source of fecal coliform bacteria. These types of landfills receive household wastes, animal manure, offal, hatchery and poultry processing plant wastes, dead animals, and other types of wastes. Older sanitary landfills were not lined and most have been closed. Those that remain active and have not been lined operate as construction/demolition landfills. Currently active sanitary landfills are lined and have leachate collection systems. All landfills, excluding inert landfills, are now required to install environmental monitoring systems for groundwater and methane sampling.

There are 77 known landfills in the Suwannee River Basin (Table 9). Of these, five are active landfills and 72 are inactive or closed. As shown in Table 9, many of the older, inactive landfills were never permitted.

Table 9. Landfills in the Suwannee River Basin

Name	County	Permit No.	Type	Status
Fitzgerald	Ben Hill		Not Applicable	Inactive
Alapaha	Berrien		Not Applicable	Inactive
Berrien Co. - CR48/CR28 Nashville	Berrien	010-009P(RM)(CO)	Not Applicable	Inactive
Berrien Co. - SR168	Berrien		Not Applicable	Inactive
Berrien Co. - SR547	Berrien		Not Applicable	Inactive
Berrien Co-Brogdon Rd	Berrien	010-007D(L)	Dry Trash Landfill	Closed
Berrien Co-CR 48/CR 28 PH 1	Berrien	010-008D(L)	Construction And Demolition Landfil	Closed
Berrien Co-SR 76 W Nashville	Berrien	010-004D(SL)	Sanitary Landfill	Closed
Nashville	Berrien		Not Applicable	Inactive
Ray City Landfill	Berrien	010-003D(L)	Dry Trash Landfill	Inactive
Barwick	Brooks		Not Applicable	Inactive
Brooks Co. - Quitman	Brooks	014-004P(INC)	Not Applicable	Inactive
Morven	Brooks		Not Applicable	Inactive
Quitman-Sr 33 PH 1	Brooks	014-003D(SL)	Sanitary Landfill	Closed
Argyle	Clinch		Not Applicable	Inactive
Clinch Co - Smith Road Phase 1	Clinch	032-004D(SL)	Sanitary Landfill	Closed
Clinch Co. - US 441 N	Clinch		Not Applicable	Inactive
DuPont	Clinch		Not Applicable	Inactive
Fargo	Clinch		Not Applicable	Inactive
Homerville	Clinch		Not Applicable	Inactive
Homerville - Clinch County	Clinch	032-002D(SL)	Sanitary Landfill	Inactive
Berlin	Colquitt		Not Applicable	Inactive
Cool Springs	Colquitt		Not Applicable	Inactive
Crosland	Colquitt		Not Applicable	Inactive
Ellenton	Colquitt		Not Applicable	Inactive
Hopewell Church	Colquitt		Not Applicable	Inactive
Industrial Park	Colquitt		Not Applicable	Inactive
Moultrie - 1st Street	Colquitt	035-003D(SL)	Sanitary Landfill	Inactive
Moultrie west side N/S Runway Spence Field	Colquitt	035-013D(L)	Not Applicable	Inactive
Norman Park	Colquitt		Not Applicable	Inactive
Omega	Colquitt		Not Applicable	Inactive
Adel - Cook Co.	Cook		Not Applicable	Inactive
Cecil	Cook		Not Applicable	Inactive
Cook Co.	Cook		Not Applicable	Inactive
Cook Co. - Taylor Rd., Site 2	Cook	037-010D(MSWL)	Municipal Solid Waste Landfill	Operating
Cook Co-Taylor Rd Adel	Cook	037-008D(L)	Construction And Demolition Landfil	Operating

Name	County	Permit No.	Type	Status
Cook Co-Taylor Rd Adel PH 1	Cook	037-006D(SL)	Sanitary Landfill	Closed
Lenox	Cook		Not Applicable	Inactive
Sparks	Cook		Not Applicable	Inactive
Arabi	Crisp		Not Applicable	Inactive
Echols Co-Carter St	Echols	050-003D(L)	Dry Trash Landfill	Closed
Echols Co-CR 135	Echols	050-002D(L)	Dry Trash Landfill	Closed
City Of Ocilla SR 32	Irwin	077-002D(SL)	Sanitary Landfill	Inactive
Ocilla	Irwin		Not Applicable	Inactive
Lanier Co-Studstill Rd PH 1	Lanier	086-004D(SL)	Sanitary Landfill	Closed
Lanier County - Big Creek Road #2	Lanier	086-003D(SL)	Sanitary Landfill	Inactive
Lanier County - Big Creek Road	Lanier	086-001D(SL)	Sanitary Landfill	Inactive
Clyattville	Lowndes	092-009D(SL)	Not Applicable	Inactive
Hahira	Lowndes		Not Applicable	Inactive
Hahira-Friendship Church Rd	Lowndes	092-003D(SL)	Sanitary Landfill	Closed
Lowndes Co. Deep South Regional	Lowndes	092-022D(MSWL)	Municipal Solid Waste Landfill	Inactive
Lowndes Co-SR 31 Clyattville PH 3 A1	Lowndes	092-015D(SL)	Sanitary Landfill	Closed
Lowndes County SL at Lake Park	Lowndes	092-008D(SL)	Sanitary Landfill	Inactive
Moody Air Force Base	Lowndes		Not Applicable	Inactive
Naylor	Lowndes		Not Applicable	Inactive
Packaging Corp Of America	Lowndes	092-016D(L)(I)	Industrial Landfill	Operating
Pecan Row	Lowndes	092-019D(MSWL)	Municipal Solid Waste Landfill	Operating
Valdosta-SR 94	Lowndes	092-001D(SL)	Sanitary Landfill	Closed
Valdosta-Wetherington Lane	Lowndes	092-014D(SL)	Sanitary Landfill	Closed
Pavo	Thomas		Not Applicable	Inactive
Garrison's Dump	Tift		Not Applicable	Inactive
Tift Co. - Omega - Eldorado Rd.	Tift	137-013P(INC)	Not Applicable	Inactive
Tifton - Ferry Lake Rd.	Tift		Not Applicable	Inactive
Tifton - Tift County US 82 East	Tift	137-001D(SL)	Sanitary Landfill	Inactive
Tifton-Maple St (L)	Tift	137-014D(L)	Dry Trash Landfill	Closed
Tifton-Omega/Eldorado Rd PH 1	Tift	137-007D(SL)	Sanitary Landfill	Closed
Tifton-Omega/Eldorado Rd PH 3	Tift	137-007D(SL)(3)	Municipal Solid Waste Landfill	Operating
Tifton-Us 82 E/E 2nd St (L)	Tift	137-008D(L)	Dry Trash Landfill	Closed
Old Ashburn Dump	Turner		Not Applicable	Inactive
Rebecca	Turner		Not Applicable	Inactive
Sycamore	Turner		Not Applicable	Inactive
Turner Co. - SR 112	Turner	142-005P(INC)	Not Applicable	Inactive
Turner Co-Sr 112 Ashburn PH 1 & 2	Turner	142-001D(SL)	Sanitary Landfill	Closed
Turner Co-Sr 112 Ashburn PH 3	Turner	142-004D(SL)	Sanitary Landfill	Closed
Pitts	Wilcox		Not Applicable	Inactive
Wilcox Co-County Farm Rochelle PH 1	Wilcox	156-001D(SL)	Sanitary Landfill	Closed
Worth Co-Sr 112 Sylvester PH 1	Worth	159-004D(SL)	Sanitary Landfill	Closed

Source: Land Protection Branch, GA DNR, 2005

4.0 ANALYTICAL APPROACH

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

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

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

4.1 Loading Curve Approach

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

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

In cases where no stream flow measurements were available, flow on the day the fecal coliform samples were collected was estimated using data from a nearby gaged stream. The nearby stream had relatively similar watershed characteristics, including landuse, slope, and drainage area. The stream flows were estimated by multiplying the gaged flow by the ratio of the listed stream drainage area to the gaged stream drainage area. Table 10 lists those segments for which no flow data were available and indicates the gaged station that was used to estimate the flow.

Table 10. Monitoring Stations with Estimated Flow

Monitoring Station	USGS Station Name	Station No.
Little Brushy Creek at Orchid Road, Near Ocilla	Withlacoochee River at McMillian Road, near Bemiss	023177483
New River at Lenox-Brookfield Road, Near Lenox	Withlacoochee River at McMillian Road, near Bemiss	023177483
Sand Creek at GA Hwy 125, Near Irwinville	Withlacoochee River at McMillian Road, near Bemiss	023177483
Turkey Branch at Edward Road, Near Fitzgerald	Withlacoochee River at McMillian Road, near Bemiss	023177483
Ty Ty Creek at US Highway 82, at Ty Ty	Withlacoochee River at McMillian Road, near Bemiss	023177483
Withlacoochee River at GA Hwy 94, near Valdosta	Withlacoochee River at McMillian Road, near Bemiss	023177483

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:

$$L_{\text{critical}} = C_{\text{geomean}} * Q_{\text{mean}}$$

Where:

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

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

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

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

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

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:

$$\text{TMDL}_{\text{critical}} = C_{\text{standard}} * Q_{\text{mean}}$$

Where:

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

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

$$\text{Load Reduction} = \frac{L_{\text{critical}} - \text{TMDL}_{\text{critical}}}{L_{\text{critical}}} * 100$$

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, the seasonal fecal coliform standards. A TMDL is the sum of the individual waste load allocations (WLAs) from point sources and load allocations (LAs) for nonpoint sources, as well as natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For fecal coliform bacteria, the TMDLs are expressed as counts per 30 days as a geometric mean.

A TMDL is expressed as follows:

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

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

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

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

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

5.1 Waste Load Allocations

The waste load allocation is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. WLAs are provided to the point sources from municipal and industrial wastewater treatment systems with NPDES effluent limits. There are six active NPDES permitted facilities with fecal coliform permit limits in the Suwannee River Basin

watershed that discharge into listed segments or have permit violations upstream of a listed segment. The maximum allocated fecal coliform loads for these municipal wastewater treatment facilities are given in Table 11. These WLA loads were calculated from the permitted or design flows and permitted fecal coliform concentrations. If the permit had no fecal coliform limit, a concentration of 200 counts/100 mL was used. These were expressed as accumulated loads over a 30-day period, and presented in units of counts per 30 days. If a facility expands its capacity and the permitted flow increases, the wasteload allocation for the facility would increase in proportion to the flow.

Table 11. WLAs for the Suwannee River Basin

Facility Name	Permit No.	Receiving Stream	Listed Stream Segment	WLA (counts/30 days)
Adel WPCP	GA0024911	Bear Creek	Bear Creek – City of Adel Lake to Withlacoochee River	2.16E+11
Fitzgerald C. A. Newcomer	GA0047236	Turkey Creeks	Turkey Branch - Headwaters to Willacoochee River downstream from Fitzgerald	1.37E+12
Hahira	GA0037974	Unnamed trib to Franks Creek	Franks Creek -St. Rt. A1780 to Little River near Hahira	6.26E+10
Sparks WPCP	GA0021563	Bear Creek	Bear Creek – City of Adel Lake to Withlacoochee River	5.23+10
Tifton New River WPCP	GA0048470	New River	Reedy Cr. To Gum Branch near Lenox	1.82E+12
Valdosta Mud Cr	GA0020222	Mud Creek	Downstream Valdosta Mud Creek WPCP to Alapahoochee River	7.33E+11

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

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

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

CAFOs are located within the Suwannee River Basin (see Section 3.1.3). These facilities are

either included under an LAS General Permit or an NPDES General Permit. A small number have an individual NPDES permit. However, presently no CAFOs discharge wastewater and therefore, they were not provided a WLA.

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

5.2 Load Allocations

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

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

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

$$\sum LA = TMDL - (\sum WLA + \sum WLA_{sw} + \sum MOS)$$

As described above, there are two types of load allocations: loads to the stream independent of precipitation, including sources such as failing septic systems, leachate from landfills, animals in the stream, and leaking sewer system collection lines, or background loads; and loads associated with fecal coliform accumulation on land surfaces that is washed off during storm events, including runoff from saturated LAS fields. At this time, it is not possible to partition the various sources of load allocations. Table 12 presents the total load allocation expressed as counts per 30 days, or as winter instantaneous maximum counts for the 303(d) listed streams located in the Suwannee River Basin for the current critical condition. In the future, after additional data has been collected, it may be possible to partition the load allocation by source.

5.3 Seasonal Variation

The Georgia fecal coliform criteria are seasonal. One set of criteria applies to the summer season, while a different set applies to the winter season. To account for seasonal variations, the critical loads for each listed segment were determined from sampling data obtained during both summer and winter seasons, when possible. However, in some cases, the available data was limited to a single season for the calculation of the critical load. The TMDL and percent reduction given in Table 12 for each listed segment was based on the season in which the critical load occurred. The TMDLs for each season, for any given flow, are presented as equations in Section 5.5.

Analyses of the available fecal coliform data and corresponding flows were performed to determine if the fecal coliform violations occurred during wet weather (high flow) or dry weather (low flow) conditions. The flow data from each sampling site were normalized by dividing the measured flow by the product of the average annual runoff (cfs/sq mile), published in Open-File Report 82-577, and the appropriate drainage area (Carter, 1982). Plots of the normalized flows (Q/Q_0) 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 12.

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. No listed stream segments are interstate waters.

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

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

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

$$\text{TMDL}_{\text{winter}} = 4,000 \text{ counts (instantaneous)}/100 \text{ mL} * Q$$

For purposes of determining necessary load reductions required to meet the instream water quality criteria, the current critical TMDL was determined. This load is the product of the applicable seasonal fecal coliform standard and the mean flow used to calculate the current critical load. It represents the sum of the allocated loads from point and nonpoint sources located within the immediate drainage area of the listed segment, the NPDES-permitted point discharges with recorded fecal coliform violations from the nearest upstream subwatersheds, and a margin of safety (MOS). For these calculations, the fecal load contributed by each facility to the WLA was not the maximum presented in Table 11, 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, LAs, MOSs, and percent load reductions for the Suwannee River Basin 303(d) listed stream segments are presented in Table 12.

The relationships of the current critical loads to the TMDLs are shown graphically in Appendix A. The vertical distance between the two values represents the load reductions necessary to achieve the TMDLs. If no TMDL or Critical Load is given on the graphs in Appendix A, the TMDL given in Table 14 is based on the instantaneous maximum standard. As a consequence of the localized nature of the load evaluations, the calculated fecal coliform load reductions pertain to point and nonpoint sources occurring within the immediate drainage area of the listed

segment. These current critical values represent a worst-case scenario for the limited set of data. Thus, the load reductions required are conservative estimates, and should be sufficient to prevent exceedances of the instream fecal coliform standard for a wide range of conditions.

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

Table 12. 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	WLA _{sw} (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Bear Creek	6.55E+12	2.68E+11		4.11E+12	4.87E+11	4.87E+12	26
Franks Creek	5.58E+13	7.74E+10		2.14E+13	2.39E+12	2.39E+13	57
Little Brushy Creek	1.48E+13			8.18E+12	9.09E+11	9.09E+12	38
Mud Creek	4.73E+13	5.92E+11	6.76E+12	1.08E+13	2.02E+12	2.02E+13	57
Negro Branch	5.55E+14			8.33E+13	9.26E+12	9.26E+13	26
New River - Reedy Creek to Gum Branch, near Lenox	3.50E+12			1.11E+14	1.24E+13	1.24E+14	0
New River - Westside Branch to Gum Creek, near Tifton	3.37E+13	1.62E+12		2.08E+13	2.50E+12	2.50E+13	26
Okapilco Creek	1.87E+13			1.44E+13	1.60E+12	1.60E+13	14
Sand Creek	3.43E+12			1.66E+12	1.84E+11	1.84E+12	46
Southside Branch	2.53E+13			1.94E+13	2.15E+12	2.15E+13	15
Turkey Branch	2.14E+15	9.78E+11		4.80E+14	5.35E+13	5.35E+14	75
Two Mile Branch	3.23E+11		4.88E+10	2.09E+10	7.75E+09	7.75E+10	76
Ty Ty Creek	1.06E+13			4.16E+12	4.62E+11	4.62E+12	56
Westside Branch	1.65E+17			3.00E+14	3.34E+13	3.34E+14	100
Withlacoochee River	1.61E+15			1.08E+15	1.19E+14	1.19E+15	26

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

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

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the state each year. The GA EPD has adopted a basin approach to water quality management that divides Georgia's major river basins into five groups. This approach provides for additional sampling work to be focused on one of the five basin groups each year and offers a five-year planning and assessment cycle. The Ochlockonee, Satilla, St. Marys and Suwannee River Basins were the subjects of focused monitoring in 2003 and will again receive focused monitoring in 2008.

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

6.2 Fecal Coliform Management Practices

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

6.2.1 Point Source Approaches

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

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

6.2.2 Nonpoint Source Approaches

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

6.2.2.1 Agricultural Sources

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

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

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

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

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

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

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

6.2.2.2 Urban Sources

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

- Uphold requirements that all new and replacement sanitary sewage systems be designed to minimize discharges into storm sewer systems;
- Further develop and streamline mechanisms for reporting and correcting illicit connections, breaks, surcharges, and general sanitary sewer system problems;
- Sustained compliance with storm water NPDES permit requirements; and
- Continue efforts to increase public awareness and education towards the impact of human activities in urban settings on water quality, ranging from the consequences of industrial and municipal discharges to the activities of individuals in residential neighborhoods.

6.3 Reasonable Assurance

Permitted discharges will be regulated through the NPDES permitting process described in this report. Georgia is working with both federal and state agencies, such as the NRCS and the GSWCC, and with local governments, to foster the implementation of BMPs to address nonpoint sources. In addition, public education efforts will be targeted at individual stakeholders to provide information regarding the use of BMPs to protect water quality.

6.4 Public Participation

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

7.0 INITIAL TMDL IMPLEMENTATION PLAN

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

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

1. EPA has identified a number of management strategies for the control of nonpoint sources of pollutants, representing some best management practices. The "Management Measure Selector Table" shown below identifies these management strategies by source category and pollutant. Nonpoint sources are the primary cause of excessive pollutant loading in most cases. Any wasteload allocations for wastewater treatment plant facilities will be implemented in the form of water-quality based effluent limitations in NPDES permits. Any wasteload allocations for regulated storm water will be implemented in the form of best management practices in the NPDES permits. NPDES permit discharges are a secondary source of excessive pollutant loading, where they are a factor, in most cases.
2. GA EPD and the GA EPD Contractor will select and implement one or more BMP demonstration projects for each River Basin. The purpose of the demonstration projects will be to evaluate by River Basin and pollutant parameter the site-specific effectiveness of one or more of the BMPs chosen. GA EPD intends that the BMP demonstration project be completed before the Revised TMDL Implementation Plan is issued. The BMP demonstration project will address the major pollutant categories of concern for the respective River Basin as identified in the TMDLs. The demonstration project need not be of a large scale, and may consist of one or more measures from the Table or equivalent BMP measures proposed by the GA EPD Contractor and approved by GA EPD. Other such measures may include those found in EPA's "*Best Management Practices Handbook*," the "*NRCS National Handbook of Conservation Practices*," or any similar reference, or measures that the volunteers, etc., devise that GA EPD approves. If for any reason the GA EPD Contractor does not complete the BMP demonstration project, GA EPD will take responsibility for doing so.
3. As part of the Initial TMDL Implementation Plan, the GA EPD brochure entitled "*Watershed Wisdom -- Georgia's TMDL Program*" will be distributed by GA EPD to the GA EPD Contractor for use with appropriate stakeholders for this TMDL. Also, a copy of the video of that same title will be provided to the GA EPD Contractor for its use in making presentations to appropriate stakeholders on TMDL Implementation Plan development.

4. If for any reason the GA EPD Contractor does not complete one or more elements of a Revised TMDL Implementation Plan, GA EPD will be responsible for getting that (those) element(s) completed, either directly or through another contractor.
5. The deadline for development of a Revised TMDL Implementation Plan is the end of December 2007.
6. The GA EPD Contractor helping to develop the Revised TMDL Implementation Plan, in coordination with GA EPD, will work on the following tasks involved in converting the Initial TMDL Implementation Plan to a Revised TMDL Implementation Plan:
 - A. Generally characterize the watershed;
 - B. Identify stakeholders;
 - C. Verify the present problem to the extent feasible and appropriate (e.g., local monitoring);
 - D. Identify probable sources of pollutant(s);
 - E. For the purpose of assisting in the implementation of the load allocations of this TMDL, identify potential regulatory or voluntary actions to control pollutant(s) from the relevant nonpoint sources;
 - F. Determine measurable milestones of progress;
 - G. Develop a monitoring plan, taking into account available resources, to measure effectiveness; and
 - H. Complete and submit to GA EPD the Revised TMDL Implementation Plan.
7. The public will be provided an opportunity to participate in the development of the Revised TMDL Implementation Plan and to comment on it before it is finalized.
8. The Revised TMDL Implementation Plan will supersede this Initial TMDL Implementation Plan once GA EPD approves the Revised TMDL Implementation Plan.

Management Measure Selector Table

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

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

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Appendix A

30-day Geometric Mean Fecal Coliform Monitoring Data

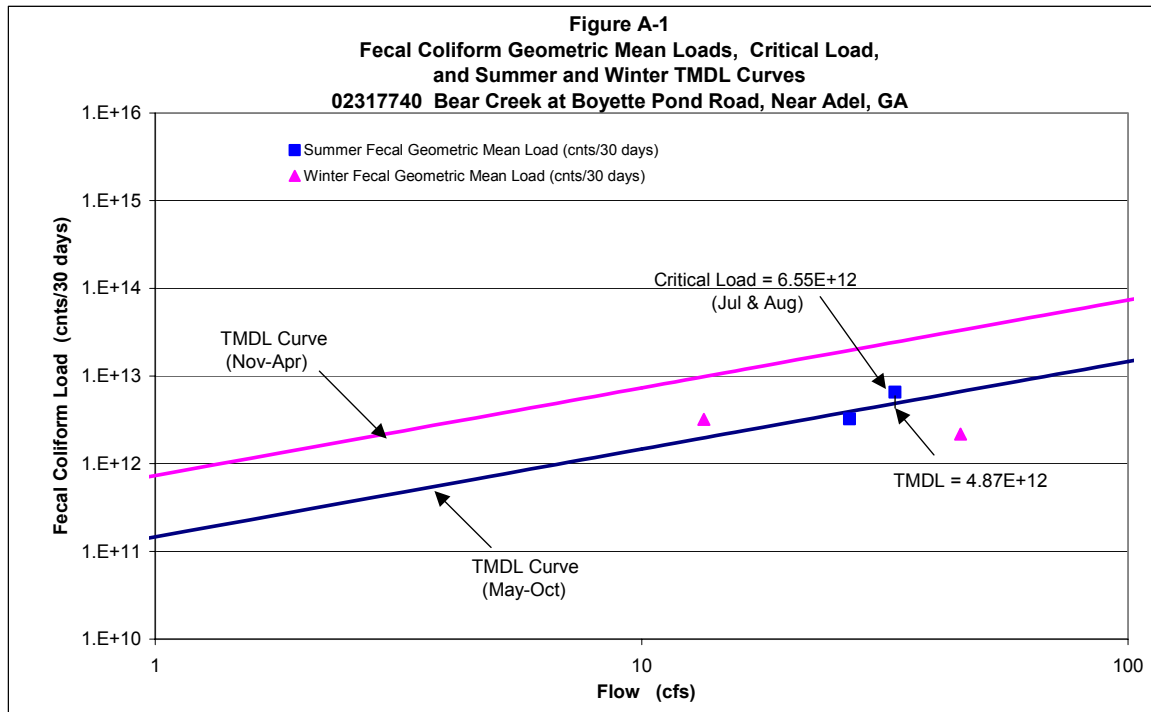


Table A-1. Data for Figure A-1

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)
16-Jan-03	70	18.0				
27-Jan-03	40	10.0				
5-Feb-03	20	16.0				
13-Feb-03	330	137.0	66	45.3	2.18E+12	3.32E+13
13-May-03	50	6.3				
19-May-03	1,300	16.0				
2-Jun-03	50	3.7				
9-Jun-03	230	81.0	165	26.8	3.25E+12	3.93E+12
7-Jul-03	5,400	31.0				
21-Jul-03	20	9.7				
28-Jul-03	220	43.0				
4-Aug-03	220	49.0	269	33.2	6.55E+12	4.87E+12
17-Nov-03	130	10.0				
1-Dec-03	460	12.0				
8-Dec-03	110	9.7				
15-Dec-03	1,700	22.0	325	13.4	3.20E+12	9.85E+12

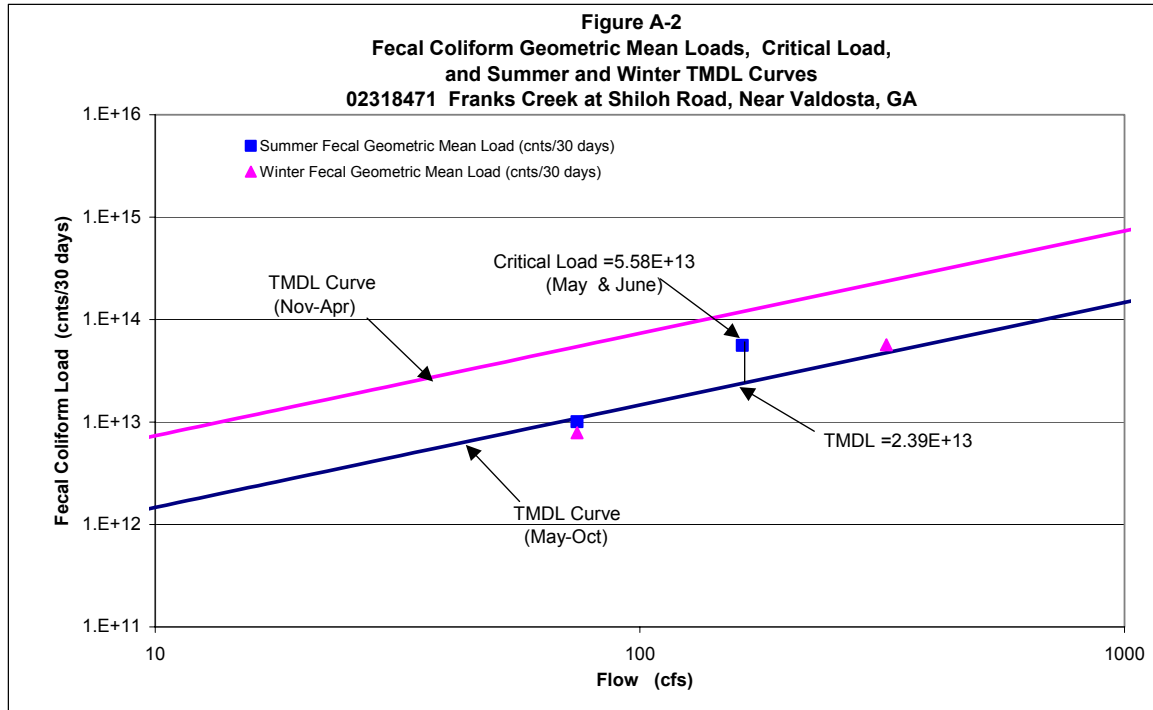


Table A-2. Data for Figure A-2

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)
27-Feb-03	3,500	180.6				
5-Mar-03	40	328.9				
10-Mar-03	140	187.0				
20-Mar-03	170	593.4	240	322.5	$5.69E+13$	$2.37E+14$
20-May-03	17,000	40.0				
3-Jun-03	330	36.8				
10-Jun-03	170	148.3				
17-Jun-03	50	425.7	467	162.7	$5.58E+13$	$2.39E+13$
15-Jul-03	80	70.9				
29-Jul-03	230	83.8				
5-Aug-03	130	64.5				
12-Aug-03	490	77.4	185	74.2	$1.01E+13$	$1.09E+13$
18-Nov-03	70	83.8				
2-Dec-03	170	70.9				
9-Dec-03	110	70.9				
16-Dec-03	330	70.9	144	74.2	$7.85E+12$	$5.44E+13$

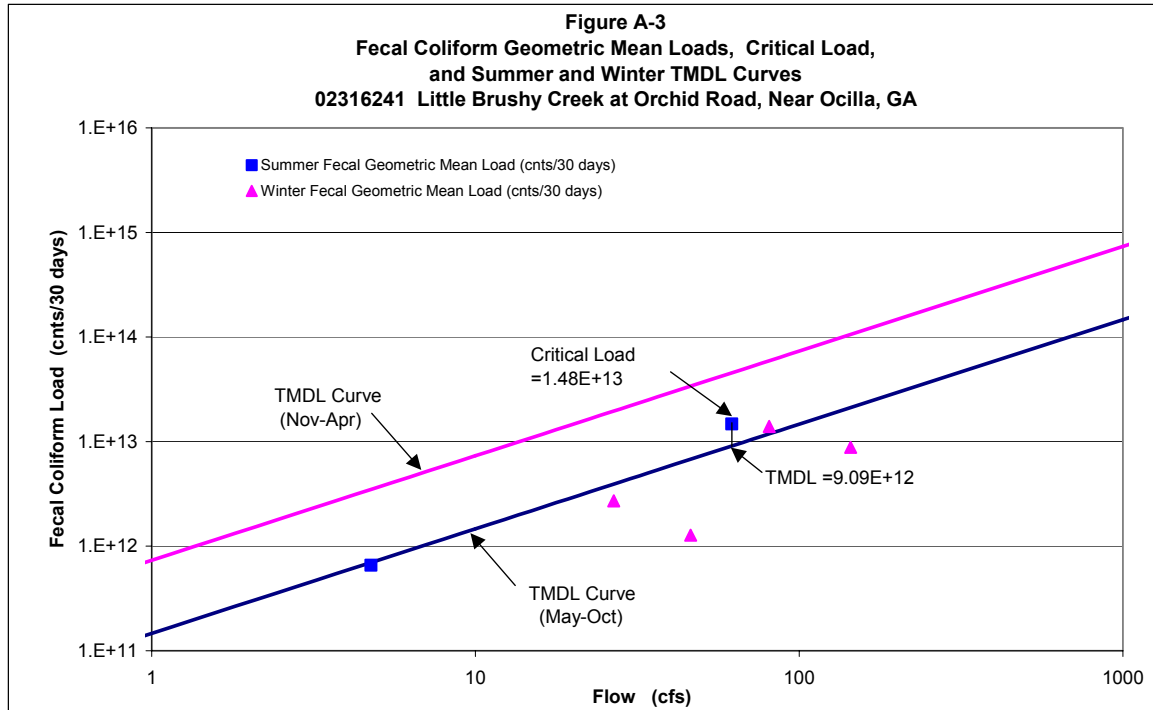


Table A-3. Data for Figure A-3

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
25-Feb-98	230	198.5				
4-Mar-98	20	77.2				
18-Mar-98	80	86.0				
24-Mar-98	130	215.4	83	144.3	$8.81E+12$	$1.06E+14$
24-Mar-98	130	215.4				
8-Apr-98	330	21.2				
15-Apr-98	330	70.6				
22-Apr-98	220	15.8	236	80.8	$1.40E+13$	$5.93E+13$
5-Aug-98	130	1.9				
11-Aug-98	50	5.1				
26-Aug-98	80	3.9				
3-Sep-98	2,400	8.1	188	4.8	$6.57E+11$	$6.99E+11$
1-Oct-98	130	183.0				
8-Oct-98	330	52.9				
22-Oct-98	330	7.5				
29-Oct-98	790	4.4	325	61.9	$1.48E+13$	$9.09E+12$
15-Jan-03	330	29.0				
28-Jan-03	170	18.0				
6-Feb-03	50	24.0				
12-Feb-03	130	36.0	138	26.8	$2.71E+12$	$1.96E+13$
26-Mar-03	40	85.0				
2-Apr-03	50	36.0				
8-Apr-03	20	29.0				
16-Apr-03	50	35.0	38	46.3	$1.28E+12$	$3.39E+13$

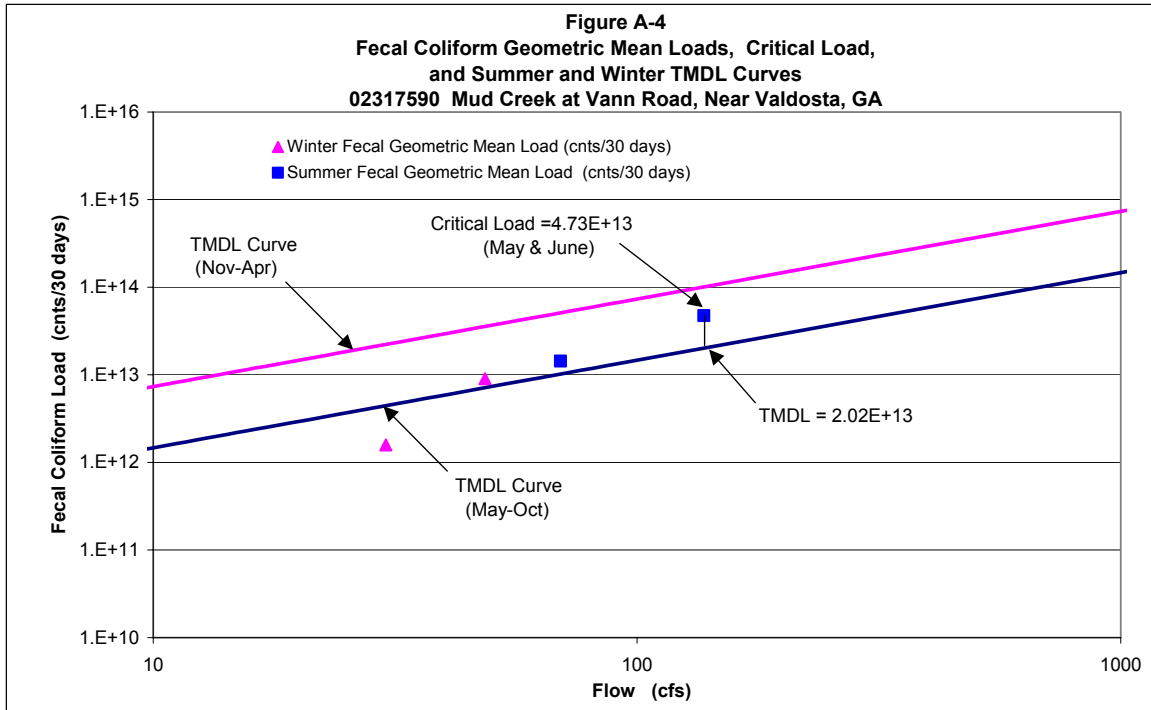


Table A-4. Data for Figure A-4

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)
15-Jan-03	170	49.0				
23-Jan-03	20	28.0				
29-Jan-03	110	18.0				
6-Feb-03	70	26.0	72	30.3	1.59E+12	2.22E+13
20-May-03	24,000	134.0				
4-Jun-03	50	9.0				
10-Jun-03	130	161.0				
18-Jun-03	310	246.0	469	137.5	4.73E+13	2.02E+13
16-Jul-03	230	21.0				
30-Jul-03	790	57.0				
6-Aug-03	260	122.0				
13-Aug-03	130	78.0	280	69.5	1.43E+13	1.02E+13
19-Nov-03	1,300	36.0				
3-Dec-03	50	29.0				
10-Dec-03	130	21.0				
16-Dec-03	490	108.0	254	48.5	9.03E+12	3.56E+13

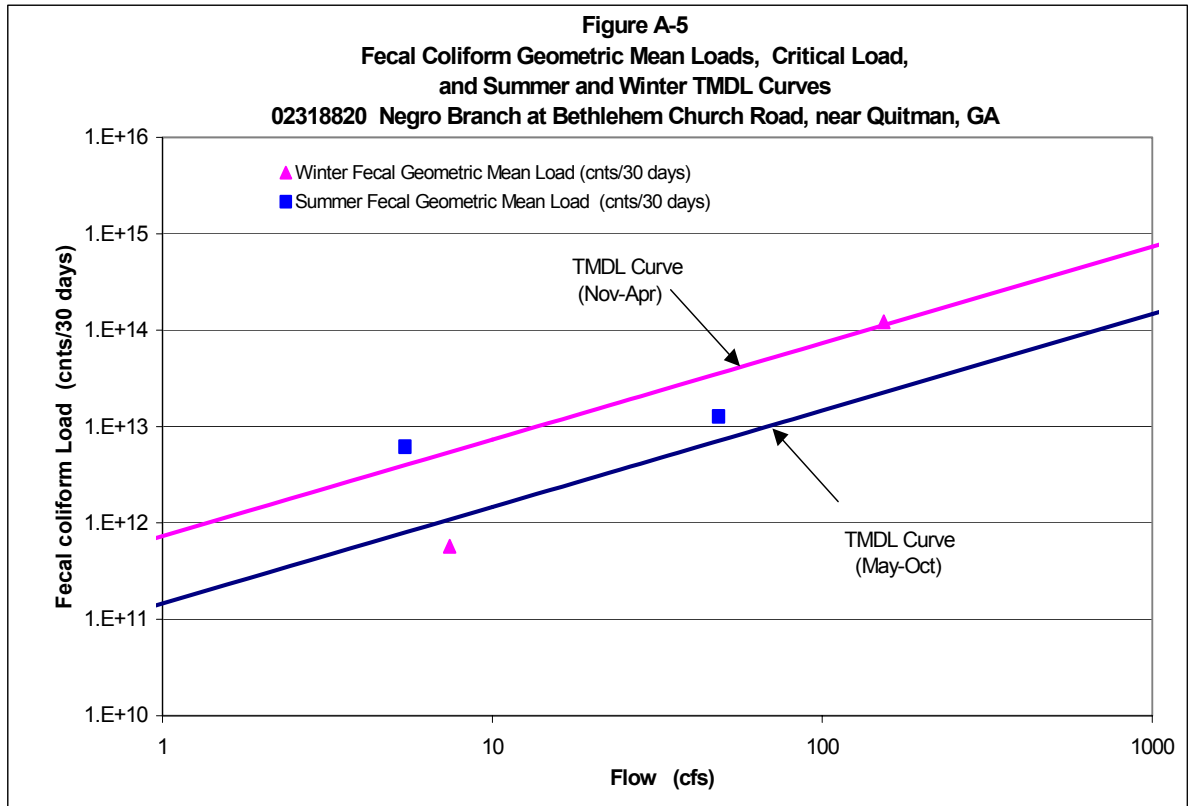


Table A-5. Data for Figure A-5

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)
27-Feb-03	24000	31.5				
5-Mar-03	790	219.1				
11-Mar-03	330	275.9				
20-Mar-03	220	87.8	1083	153.6	1.22E+14	1.13E+14
20-May-03	24000	1.6				
3-Jun-03	700	1.6				
10-Jun-03	700	10.2				
17-Jun-03	490	8.3	1549	5.4	6.18E+12	7.97E+11
15-Jul-03	80	6.3				
29-Jul-03	270	74.6				
5-Aug-03	700	54.4				
12-Aug-03	1100	58.6	359	48.5	1.28E+13	7.11E+12
18-Nov-03	70	4.5				
2-Dec-03	130	8.7				
9-Dec-03	80	4.3				
16-Dec-03	170	12.2	105	7.4	5.74E+11	5.45E+12

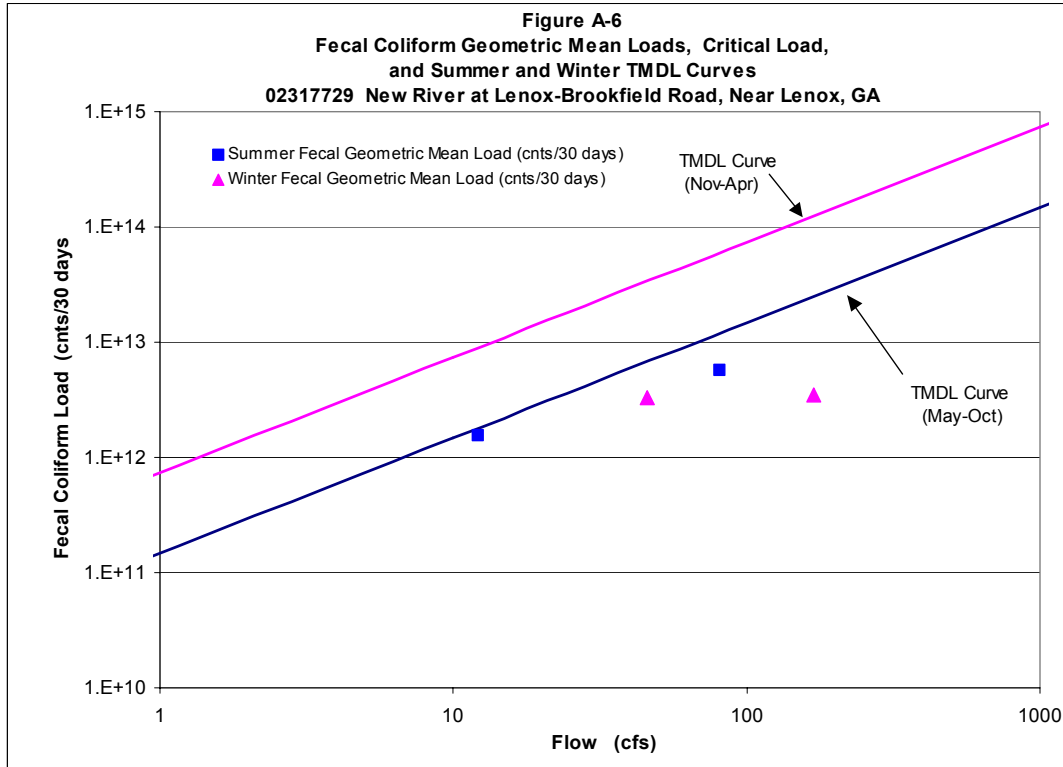
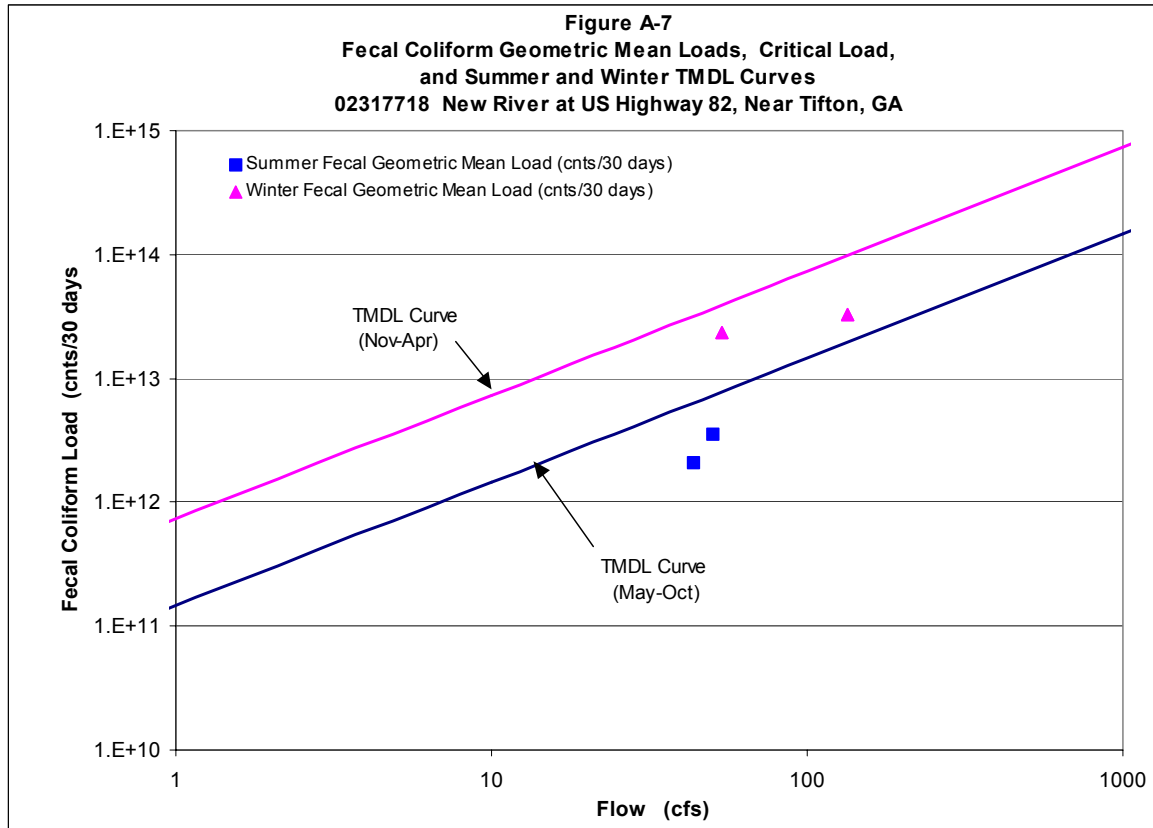


Table A-6. Data for Figure A-6

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)
15-Jan-03	20	50.0				
28-Jan-03	230	35.0				
5-Feb-03	230	37.0				
12-Feb-03	90	62.0	99	46.0	3.34E+12	3.38E+13
26-Mar-03	20	173.0				
2-Apr-03	20	84.0				
9-Apr-03	20	246.0				
14-Apr-03	80	171.0	28	168.5	3.50E+12	1.24E+14
21-Aug-03	130	97.0				
4-Sep-03	110	94.0				
10-Sep-03	80	112.0				
17-Sep-03	80	20.0	98	80.8	5.80E+12	1.19E+13
25-Sep-03	330	13.0				
8-Oct-03	70	5.9				
15-Oct-03	490	9.6	173	12.1	1.54E+12	1.78E+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)
13-Jan-03	330	55.0				
30-Jan-03	2,400	45.0				
4-Feb-03	330	59.0				
11-Feb-03	490	56.0	598	53.8	2.36E+13	3.95E+13
25-Mar-03	700	89.0				
3-Apr-03	170	325.0				
9-Apr-03	20	113.0				
15-Apr-03	5,400	8.5	337	133.9	3.31E+13	9.83E+13
20-Aug-03	330	75.0				
3-Sep-03	330	75.0				
9-Sep-03	40	3.6				
16-Sep-03	20	47.0	97	50.2	3.56E+12	7.36E+12
24-Sep-03	80	47.0				
7-Oct-03	90	43.0				
14-Oct-03	120	38.0	64	43.8	2.07E+12	6.42E+12

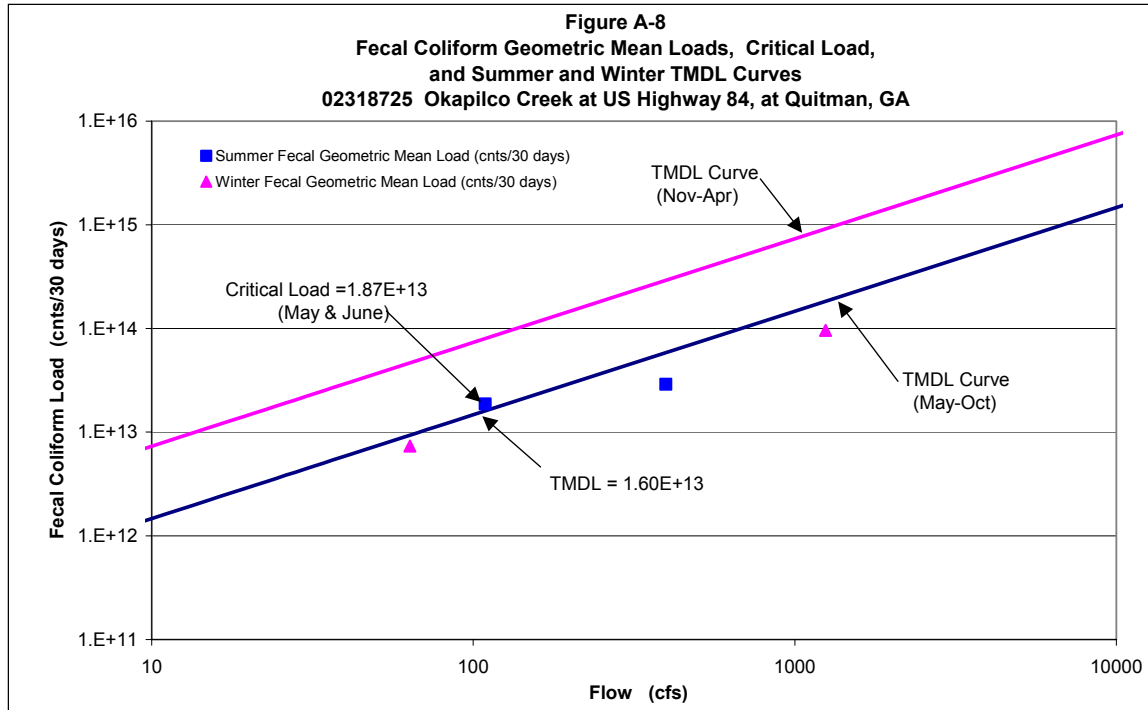


Table A-8. Data for Figure A-8

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)
27-Feb-03	790	564.0				
5-Mar-03	20	1,440.0				
11-Mar-03	70	2,020.0				
20-Mar-03	110	959.0	105	1,245.8	9.60E+13	9.14E+14
20-May-03	17,000	59.0				
3-Jun-03	20	29.0				
10-Jun-03	220	204.0				
17-Jun-03	40	144.0	234	109.0	1.87E+13	1.60E+13
15-Jul-03	50	84.0				
29-Jul-03	170	698.0				
5-Aug-03	230	300.0				
12-Aug-03	50	508.0	99	397.5	2.90E+13	5.84E+13
18-Nov-03	20	28.0				
2-Dec-03	790	103.0				
9-Dec-03	80	31.0				
16-Dec-03	490	92.0	158	63.5	7.35E+12	4.66E+13

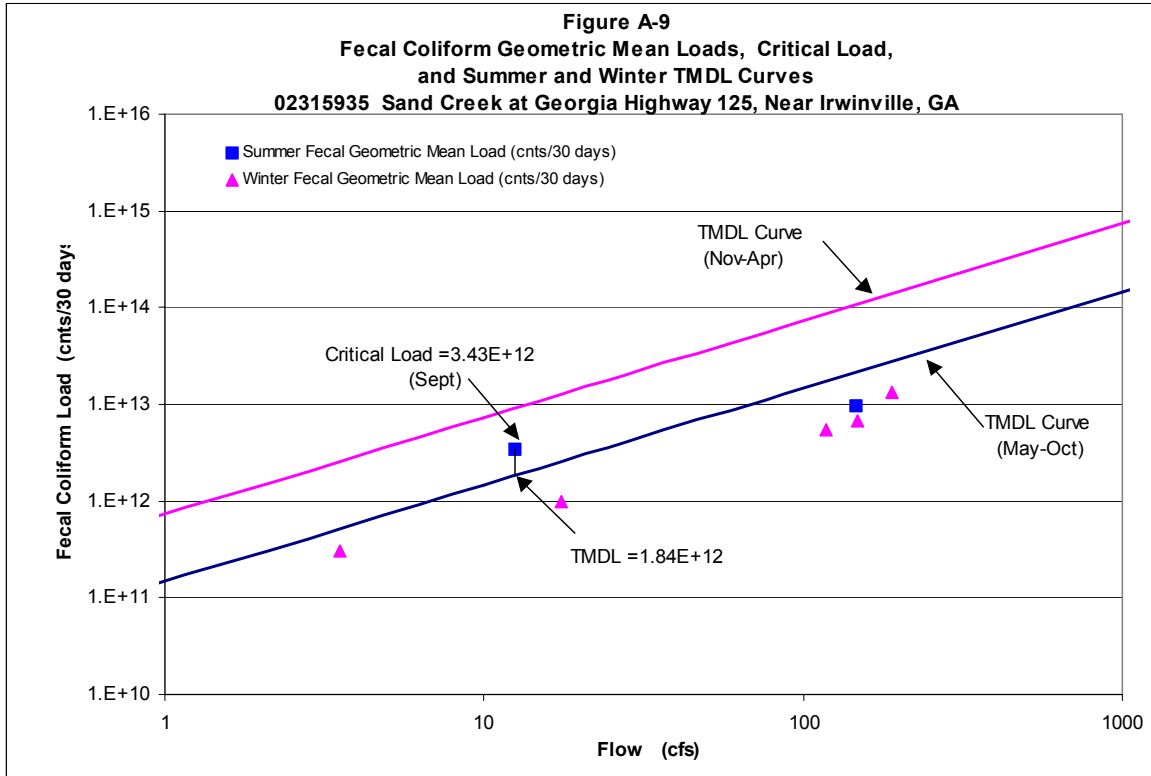


Table A-9. Data for Figure A-9

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)
23-Feb-98	1,100	174.2				
2-Mar-98	50	96.6				
16-Mar-98	80	124.1				
22-Mar-98	20	363.9	97	189.7	1.35E+13	1.39E+14
22-Mar-98	20	363.9				
6-Apr-98	170	19.7				
13-Apr-98	220	69.5				
20-Apr-98	20	17.5	62	117.7	5.37E+12	8.64E+13
7-Sep-98	50	23.8				
14-Sep-98	70	6.6				
21-Sep-98	24,000	7.4				
29-Sep-98	230	12.4	373	12.6	3.43E+12	1.84E+12
3-Nov-98	170	3.2				
9-Nov-98	170	3.2				
16-Nov-98	130	3.8				
1-Dec-98	50	3.9	117	3.5	3.03E+11	2.59E+12
13-Jan-03	70	22.2				
29-Jan-03	110	11.1				
4-Feb-03	230	10.8				
10-Feb-03	20	25.7	77	17.4	9.88E+11	1.28E+13
24-Mar-03	80	395.5				
2-Apr-03	20	43.7				
8-Apr-03	490	31.3				
16-Apr-03	20	119.2	63	147.4	6.81E+12	1.08E+14
19-Aug-03	20	103.4				
2-Sep-03	170	58.2				
9-Sep-03	220	279.9	91	147.2	9.81E+12	1.08E+14

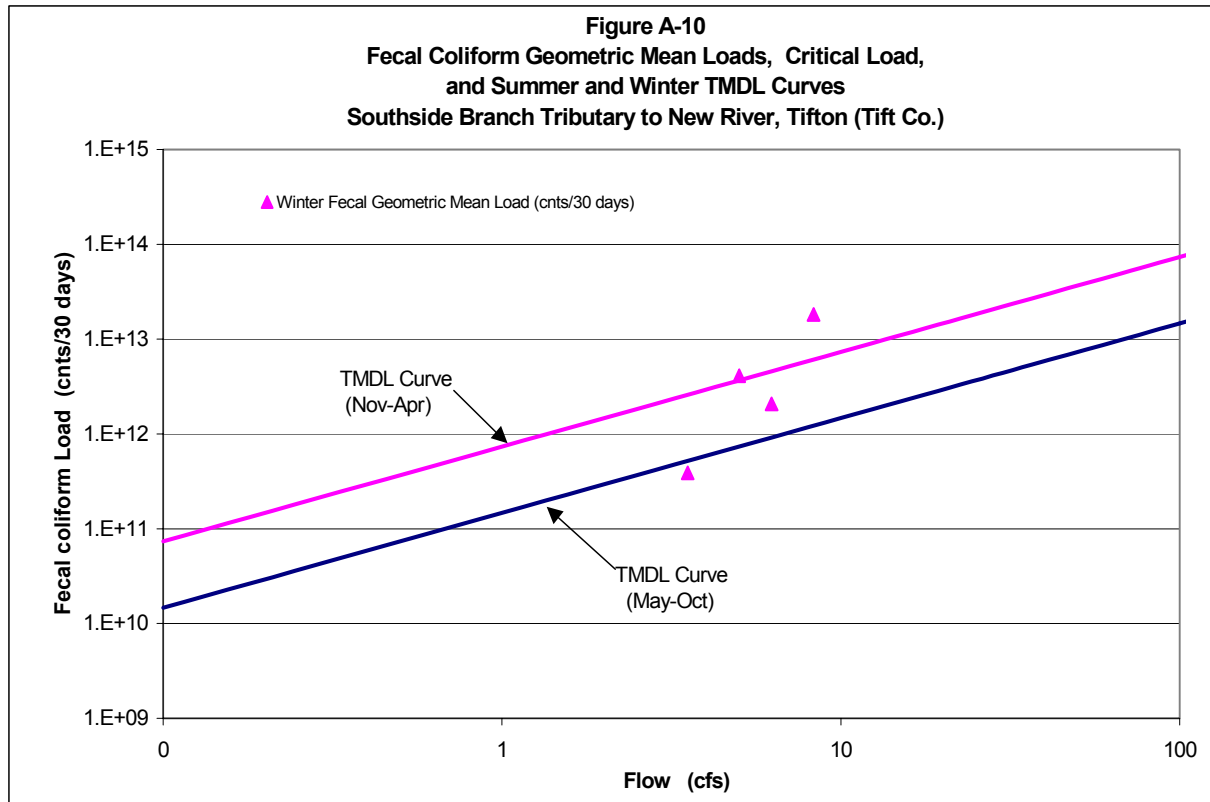


Table A-10. Data for Figure A-10

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)
1-Feb-92	20	3.1				
2-Feb-92	330	3.5				
3-Feb-92	360	3.9				
4-Feb-92	210	3.7	149	3.5	3.87E+11	2.59E+12
19-Feb-92	1367	4.5				
20-Feb-92	480	6.3				
21-Feb-92	300	7.5				
22-Feb-92	210	6.6	451	6.2	2.07E+12	4.59E+12
8-Jan-93	1800	1.7				
9-Jan-93	950	4.6				
10-Jan-93	1400	5.8				
11-Jan-93	650	8.0	1117	5.0	4.11E+12	3.68E+12
12-Jan-93	2000	8.6				
13-Jan-93	4700	7.3				
14-Jan-93	4300	7.8				
15-Jan-93	2000	9.5	2999	8.3	1.83E+13	6.09E+12

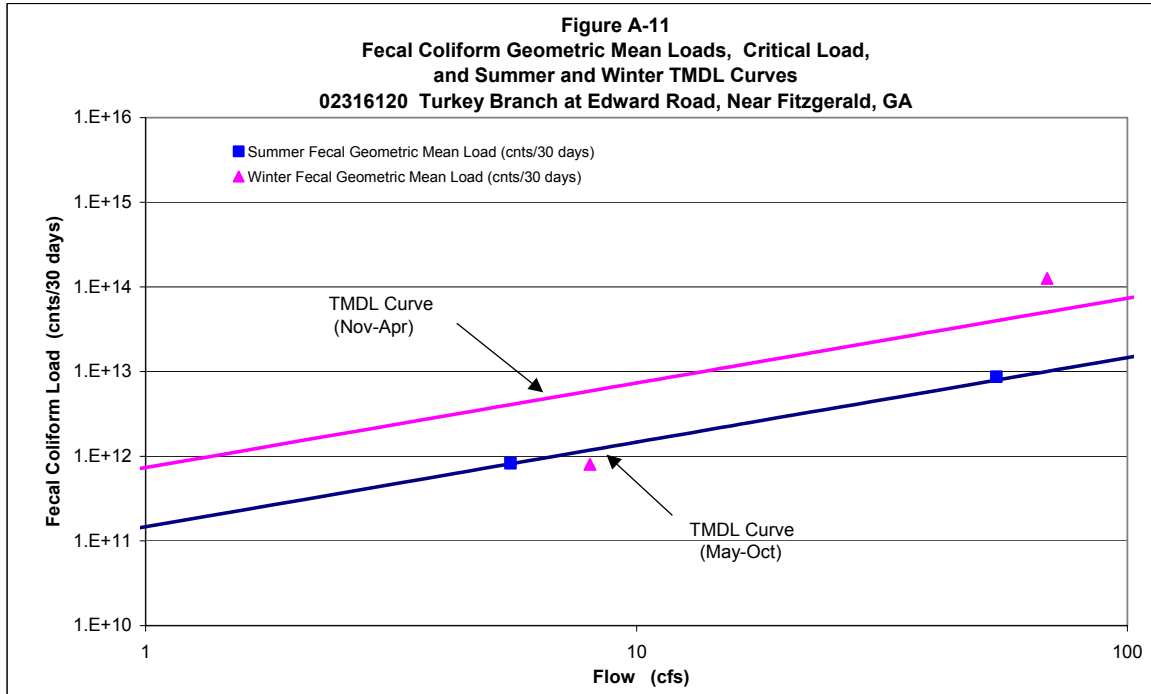


Table A-11. Data for Figure A-11

Date	Observed Fecal Coliform (counts/100 ml)	Gage Height (ft)	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)
13-Jan-03	490	5.73	10.2				
29-Jan-03	50	5.40	5.1				
4-Feb-03	700	5.66	5.0				
10-Feb-03	20	5.88	11.8	136	8.0	8.03E+11	5.90E+12
24-Mar-03	16,000	5.85	182.1				
1-Apr-03	90	5.50	22.9				
8-Apr-03	16,000	5.38	14.4				
16-Apr-03	1,700	5.38	54.9	2,502	68.6	1.26E+14	5.03E+13
19-Aug-03	2,200	6.07	47.6				
2-Sep-03	310	5.16	26.8				
9-Sep-03	170	5.33	128.9				
16-Sep-03	20	4.91	13.0	219	54.1	8.71E+12	7.94E+12
23-Sep-03	50	4.94	4.1				
7-Oct-03	790	4.86	1.6				
14-Oct-03	2,200	4.93	3.5	204	5.5	8.30E+11	8.13E+11

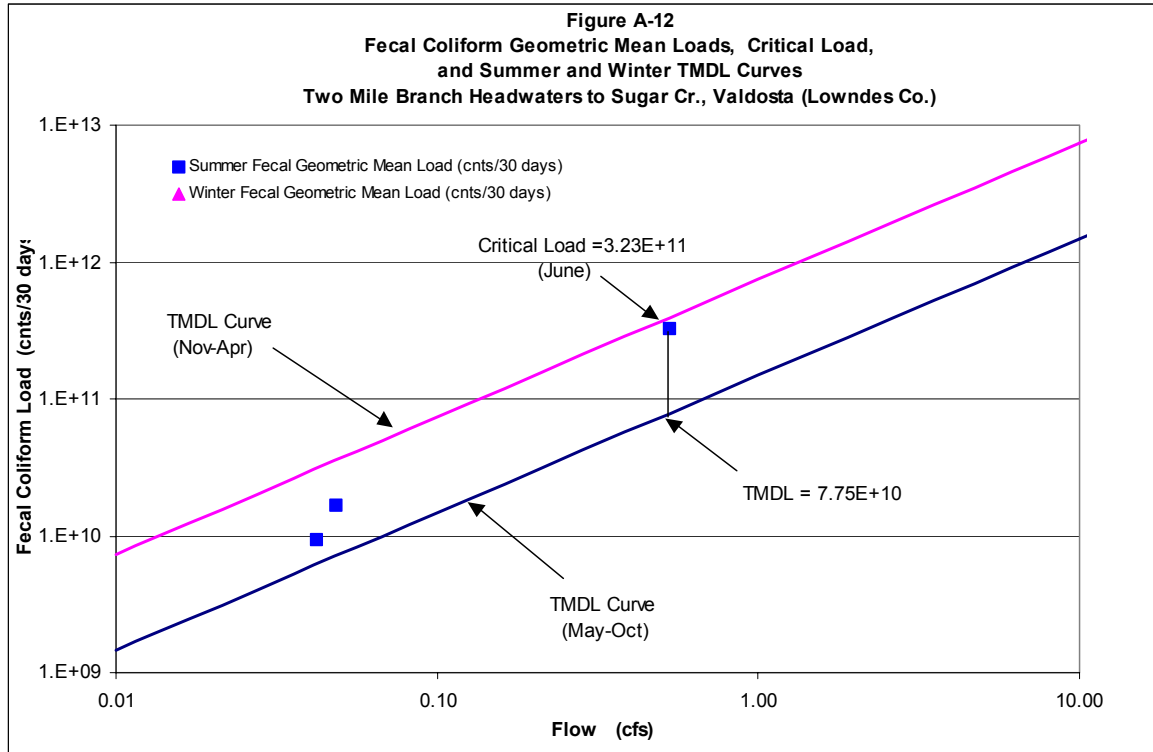


Table A-12. Data for Figure A-12

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)
25-May-93	1,110	0.05				
26-May-93	285	0.04				
27-May-93	70	0.04				
28-May-93	380	0.04	303	0.04	9.32E+09	6.15E+09
29-May-93	115	0.04				
30-May-93	475	0.04				
31-May-93	360	0.06				
1-Jun-93	2,600	0.05	476	0.05	1.68E+10	7.07E+09
2-Jun-93	1,160	0.05				
9-Jun-93	1,195	0.03				
22-Jun-93	135	0.02				
29-Jun-93	2,600	2.02	835	0.5	3.23E+11	7.75E+10

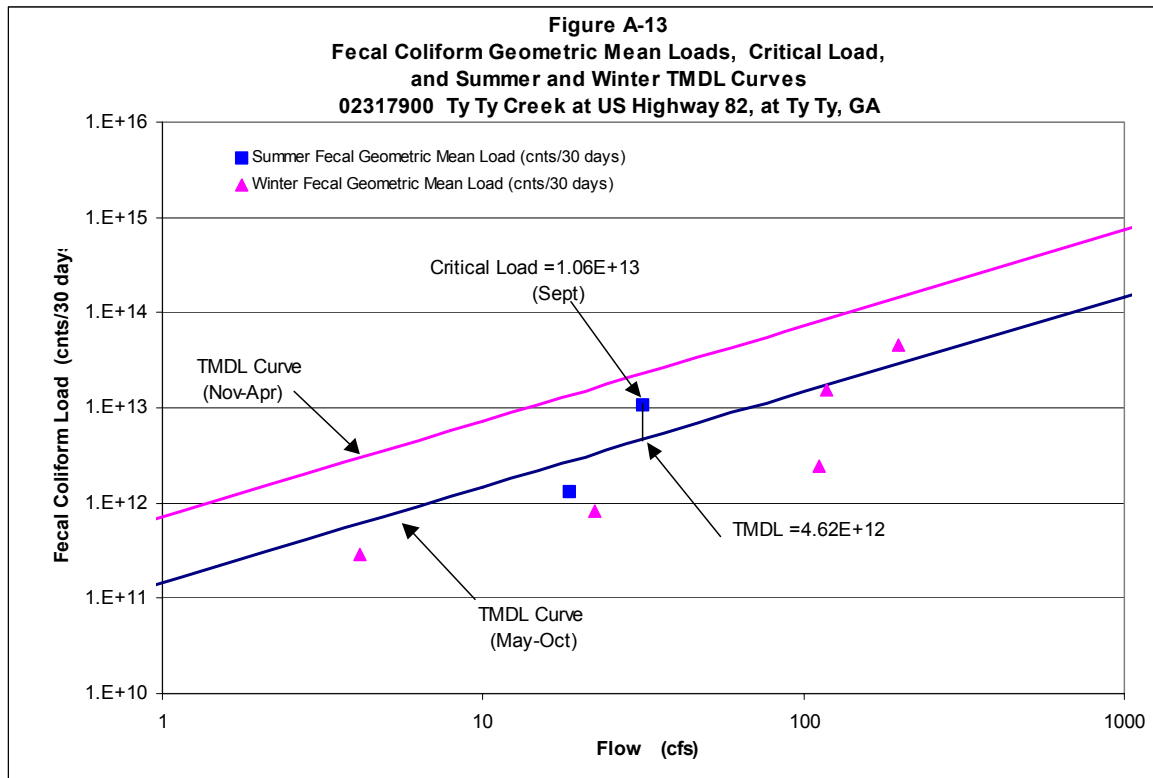


Table A-13. Data for Figure A-13

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)
24-Feb-98	2,200	235.1				
3-Mar-98	80	100.4				
17-Mar-98	330	115.5				
23-Mar-98	170	336.3	315	196.8	4.55E+13	1.44E+14
23-Mar-98	170	336.3				
7-Apr-98	330	21.1				
14-Apr-98	220	97.1				
21-Apr-98	80	19.2	177	118.4	1.54E+13	8.69E+13
8-Sep-98	20	26.4				
15-Sep-98	170	6.2				
21-Sep-98	2,400	8.8				
30-Sep-98	5,400	84.5	458	31.5	1.06E+13	4.62E+12
4-Nov-98	20	4.0				
10-Nov-98	20	3.6				
17-Nov-98	1,300	4.6				
2-Dec-98	170	4.3	97	4.1	2.93E+11	3.02E+12
14-Jan-03	210	23.8				
30-Jan-03	20	11.0				
5-Feb-03	20	9.3				
11-Feb-03	80	45.0	51	22.3	8.32E+11	1.63E+13
25-Mar-03	20	80.0				
3-Apr-03	50	22.0				
9-Apr-03	20	310.0				
15-Apr-03	40	35.0	30	111.8	2.45E+12	8.20E+13
20-Aug-03	330	15.0				
3-Sep-03	40	36.0				
10-Sep-03	90	21.0				
17-Sep-03	80	2.0	99	18.5	1.34E+12	2.72E+12

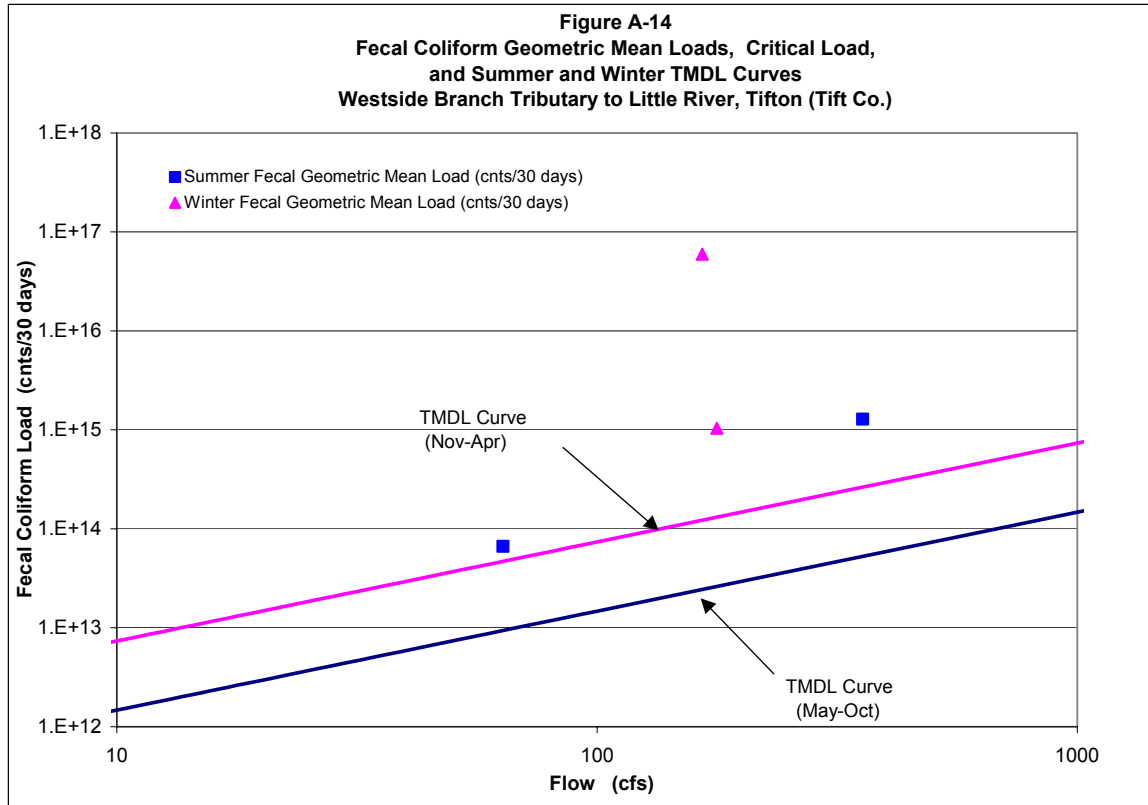


Table A-14. Data for Figure A-14

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)
4-Jul-92	3,000	293.5				
5-Jul-92	1,300	473.4				
6-Jul-92	9,200	378.7				
7-Jul-92	16,000	284.0	4,895	357.4	1.28E+15	2.62E+14
16-Jul-92	1,100	82.4				
22-Jul-92	4,600	58.7				
27-Jul-92	3,250	54.0				
13-Aug-92	250	59.6	1,424	63.7	6.65E+13	4.67E+13
10-Jan-93	2,850	189.3				
11-Jan-93	11,600	255.6				
12-Jan-93	10,000	160.9				
13-Jan-93	12,200	104.1	7,969	177.5	1.04E+15	1.30E+14
14-Jan-93	18,200	236.7				
28-Jan-93	1,180,000	151.5				
1-Feb-93	1,340,000	160.9				
10-Feb-93	1,980,000	113.6	488,575	165.7	5.94E+16	1.22E+14

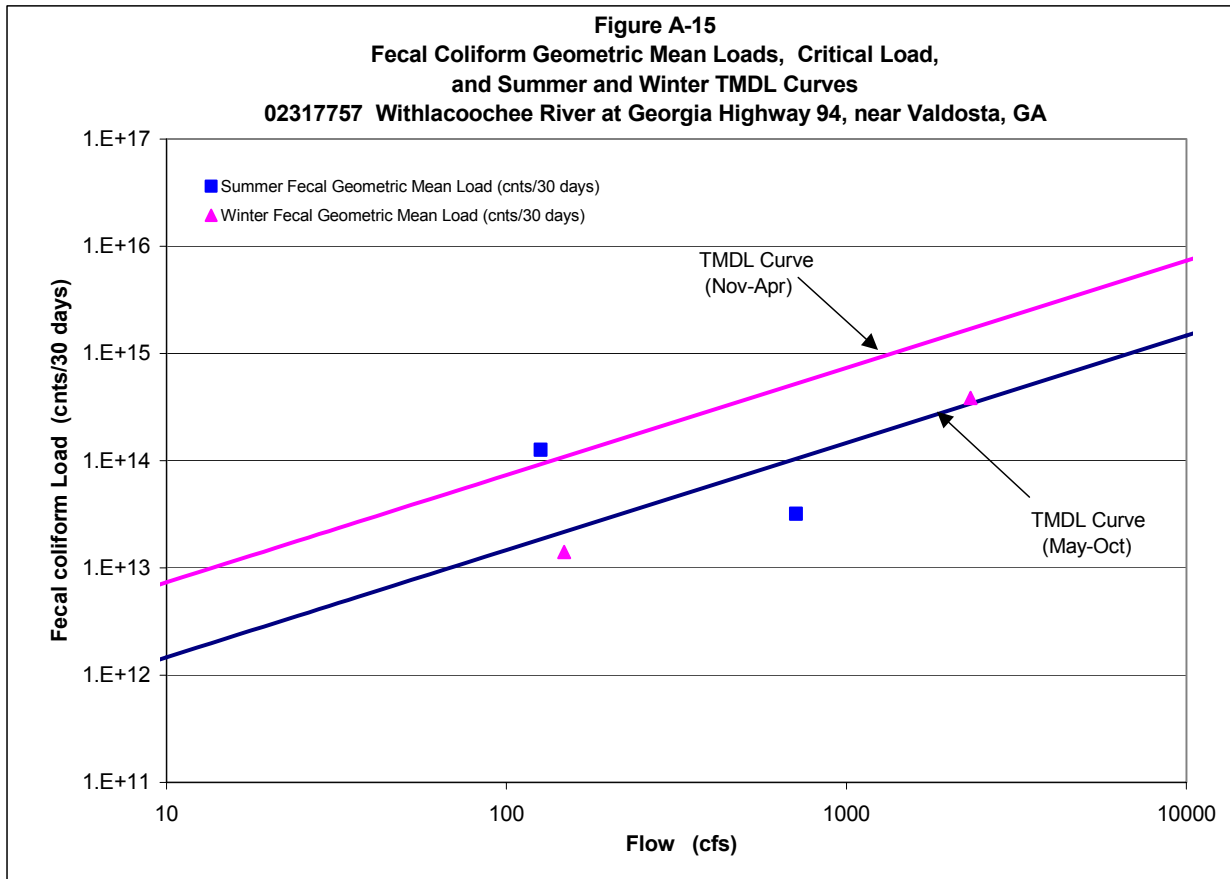


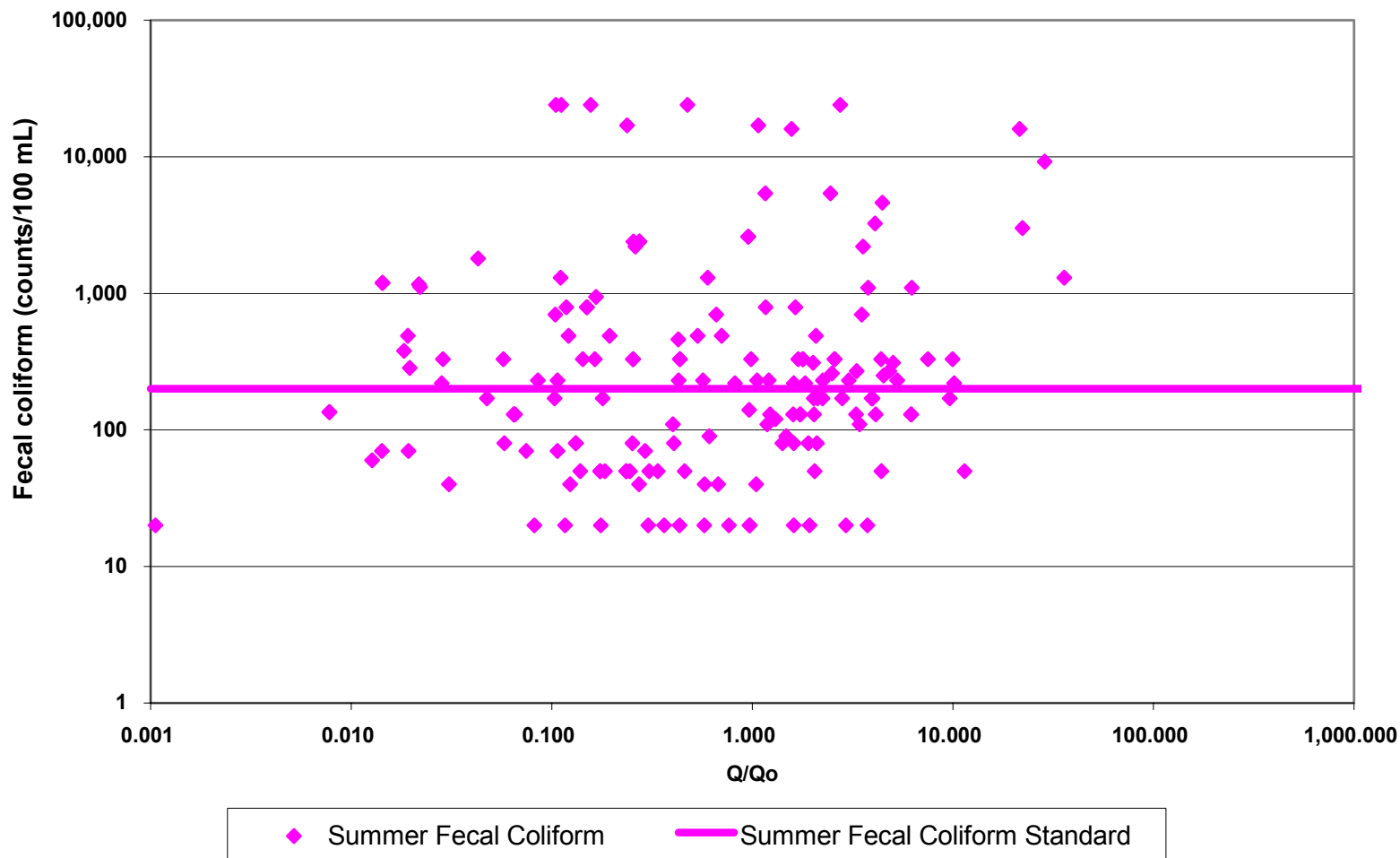
Table A-15. Data for Figure A-15

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)
27-Feb-03	5400	407.0				
5-Mar-03	50	2310.0				
10-Mar-03	490	5500.0				
20-Mar-03	20	1050.0	227	2316.8	3.86E+14	1.70E+15
20-May-03	24000	37.6				
3-Jun-03	1300	37.4				
10-Jun-03	490	237.5				
17-Jun-03	230	191.3	1369	126.0	1.27E+14	1.85E+13
15-Jul-03	20	146.5				
29-Jul-03	270	1120.0				
5-Aug-03	130	586.0				
12-Aug-03	20	990.0	61	710.6	3.19E+13	1.04E+14
18-Nov-03	20	104.8				
2-Dec-03	460	201.2				
9-Dec-03	140	99.1				
16-Dec-03	220	186.0	130	147.8	1.41E+13	1.08E+14

Appendix B

Normalized Flows Versus Fecal Coliform Plots

Normal Distribution



Normal Distribution

