Total Maximum Daily Load

Evaluation

for

Six Stream Segments

in the

Flint River Basin

for

Fecal Coliform

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

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

January 2008

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EXECUTIVE SUMMARY

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

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

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

The process of developing fecal coliform bacteria TMDLs for the Flint 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 Bacteria Loads and Required Fecal Coliform Load Reductions

Stream Segment	Current Load (counts/ 30 days)	TMDL Components					Percent Reduction
		WLA (counts/ 30 days)[1]	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Beaver Dam Creek	3.03E+11			7.23E+10	8.04E+09	8.04E+10	73.5
East Jesters Creek	5.04E+11			1.32E+11	1.46E+10	1.46E+11	71.0
Hurricane Creek	4.77E+11			1.42E+11	1.58E+10	1.58E+11	66.9
Line Creek	1.97E+13	4.04E+10	1.01E+13	5.19E+12	1.70E+12	1.70E+13	13.5
Pennahatchee Creek	4.44E+12			1.19E+12	1.32E+11	1.32E+12	70.2
Turkey Creek	1.01E+12	2.54E+10		5.68E+11	6.60E+10	6.60E+11	34.9

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* (GA EPD, 2000 – 2001). This document is available on the Georgia Environmental Protection Division (GA EPD) website.

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

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

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

Stream Segment	Location	Segment Length (miles)	Designated Use	Listing
Beaver Dam Creek	Lake Joy to Flint River (Clayton Co)	3	Fishing	PS
East Jesters Creek	Headwaters to Jesters Creek (Clayton Co)	4	Fishing	PS
Hurricane Creek	Headwaters to Flint River (Clayton Co)	3	Fishing	PS
Line Creek	Flat Creek to Flint River (Fayette/ Spalding/ Coweta Co)	15	Fishing	PS
Pennahatchee Creek	Sandy Mount Creek to Turkey Creek (Dooly Co)	6	Fishing	NS
Turkey Creek	Rogers Branch to Pennahatchee Creek (Dooly Co)	9	Fishing	NS

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

1.2 Watershed Description

The Flint River Basin is located in the western third of the State of Georgia, and is entirely within the boundaries of the State. The River drains an area of approximately 8,460 square miles. The Basin contains parts of the Piedmont and Coastal Plain physiographic provinces that extend throughout the southeastern United States. The Flint River originates in the south side of Fulton County, in metropolitan Atlanta, by Hartsfield International Airport (Figure 1). The river flows south to Lake Blackshear to Lake Seminole. At this point, the Flint converges with the Chattahoochee River in Lake Seminole at the Georgia-Florida border. The outflow from Lake Seminole forms the Apalachicola River in Florida, which ultimately discharges to the Gulf of Mexico.

The Flint River basin includes six United States Geologic Survey (USGS) eight-digit hydrologic units, HUC 03130005 – 03130010. Figure 1 shows the locations of these sub-basins. Figures 2 and 3 show the locations of the listed segments and associated counties in HUCs 03130005 and 03130006.

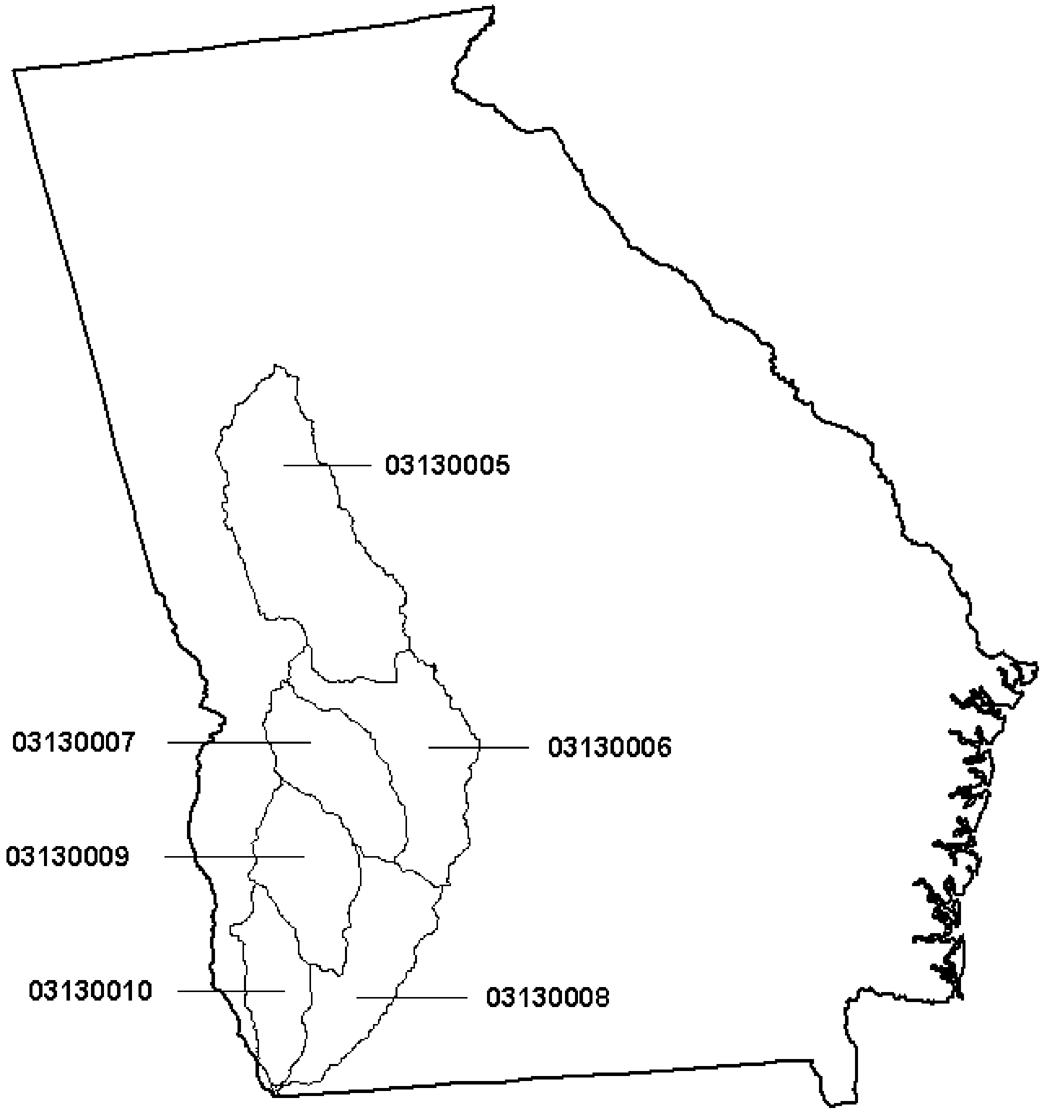
The land use characteristics of the Flint River Basin watersheds were determined using data from the National Land Cover Dataset (NLCD) for Georgia. This coverage was produced from Landsat Thematic Mapper digital images developed in 2001. Land use classification is based on a modified Anderson level one and two system. Table 2 lists the watershed land coverage distribution of the 6 stream segments.

1.3 Water Quality Standard

The water use classification for the listed stream segments in the Flint 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, 2005), are:

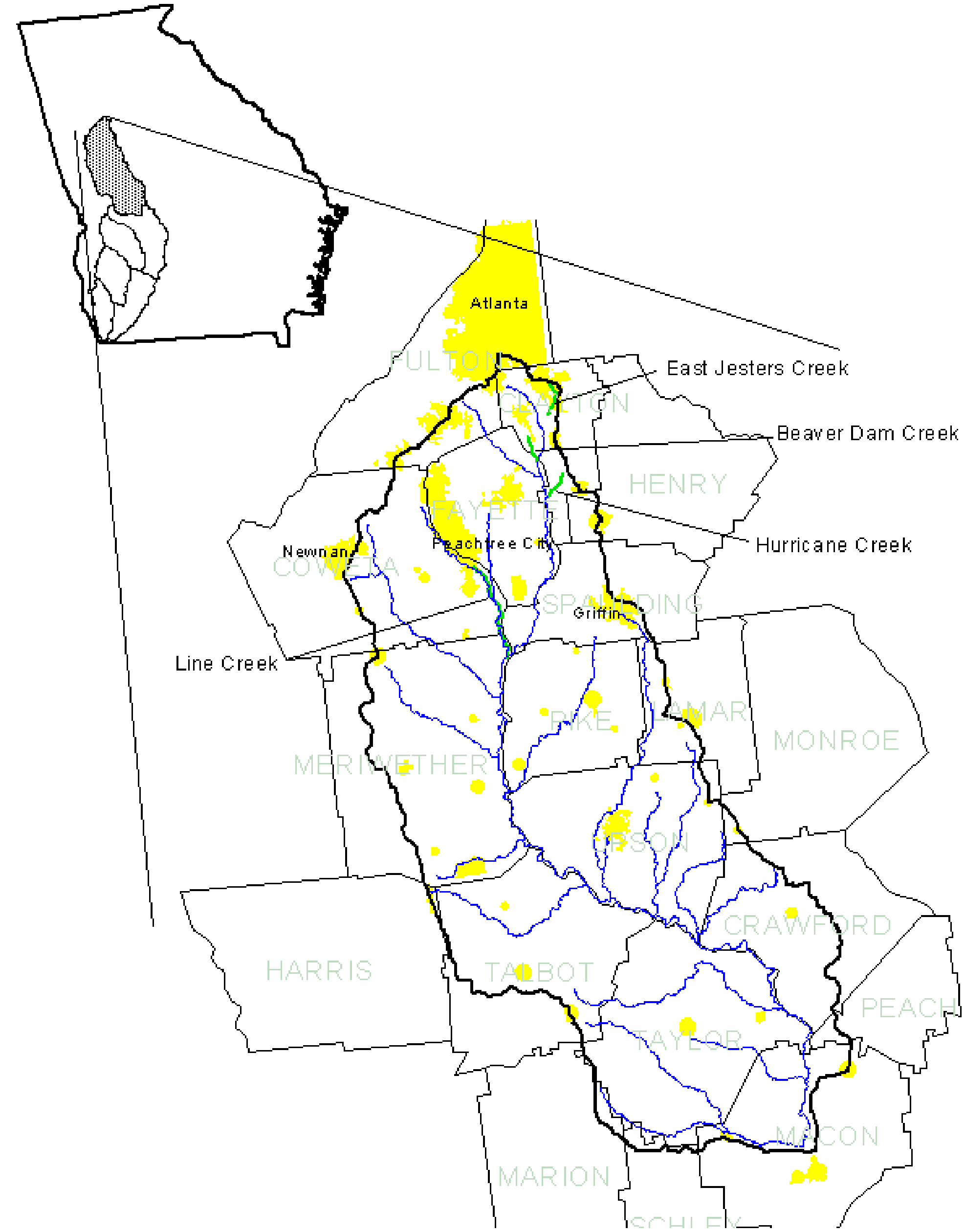
(c) Fishing: Propagation of Fish, Shellfish, Game and Other Aquatic Life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality:

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



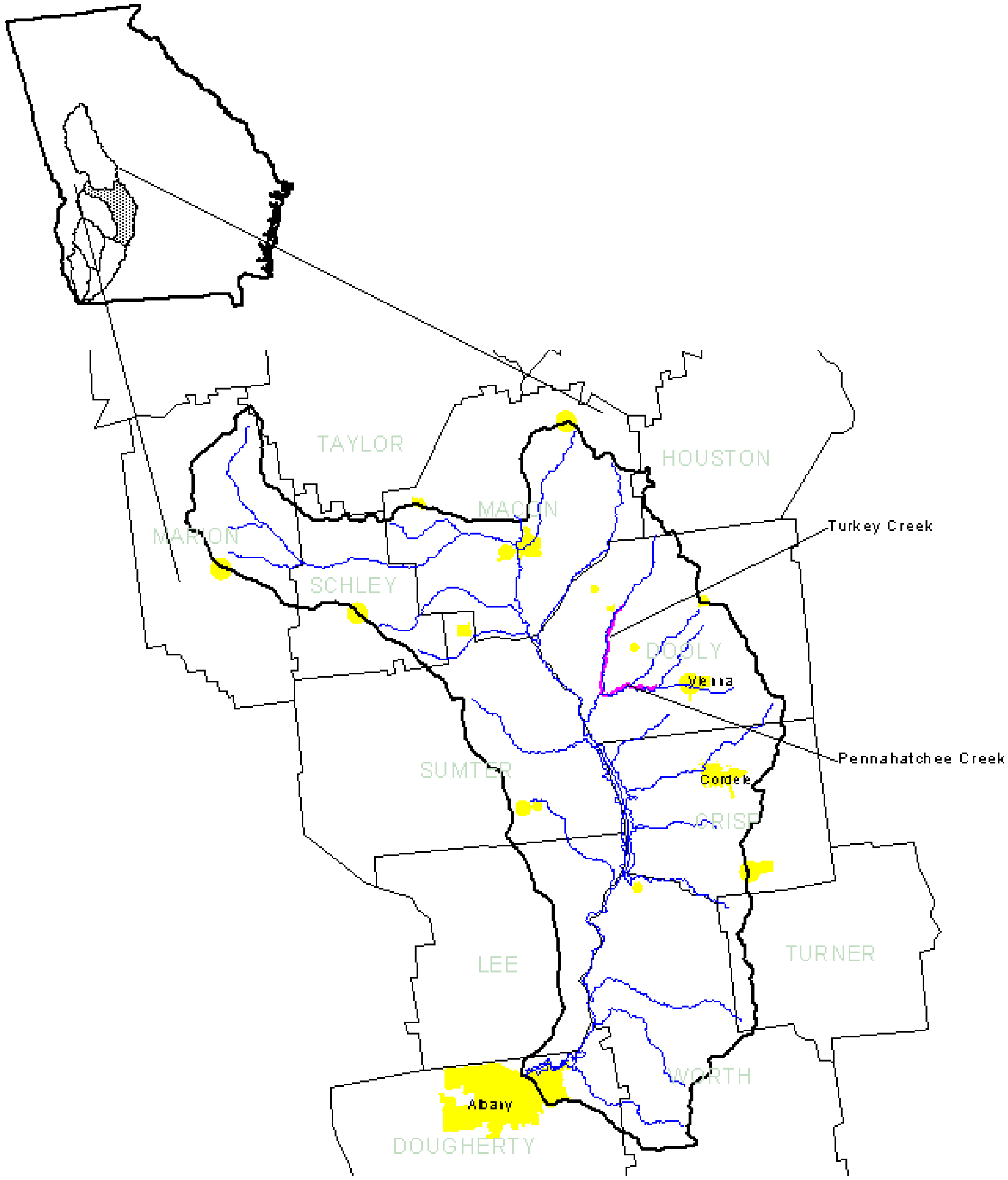
TMDL Evaluation - Fecal Coliform
Flint River Basin

Figure 2. USGS 8-Digit HUCs for Flint River Basin



TMDL Evaluation - Fecal Coliform
Flint River Basin

Figure 2. 303(d) Listed Stream Segments in HUC 03130005



TMDL Evaluation - Fecal Coliform
Flint River Basin

Figure 3. 303(d) Listed Stream Segments in HUC 03130006

Table 2. Flint River Basin Land Coverage

Stream/Segment	Landuse Categories - Acres (Percent)												
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial, Industrial, Transportation	Bare Rock, Sand, Clay	Quarries, Strip Mines, Gravel Pits	Forest	Row Crops	Pasture, Hay	Other Grasses (Urban, recreational; e.g. parks, lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total
Beaver Dam Creek	8	653	104	41	3	0	261	0	187	453	77	0	1,786
	(0.4)	(36.6)	(5.8)	(2.3)	(0.2)	(0.0)	(14.6)	(0.0)	(10.5)	(25.4)	(4.3)	(0.0)	(100.0)
East Jesters Creek	5	947	391	406	14	0	677	0	52	717	31	0	3,241
	(0.2)	(29.2)	(12.1)	(12.5)	(0.4)	(0.0)	(20.9)	(0.0)	(1.6)	(22.1)	(1.0)	(0.0)	(100.0)
Hurricane Creek	8	752	131	12	48	0	1,522	0	596	346	110	0	3,526
	(0.2)	(21.3)	(3.7)	(0.3)	(1.4)	(0.0)	(43.2)	(0.0)	(16.9)	(9.8)	(3.1)	(0.0)	(100.0)
Line Creek	2,841	11,726	2,582	1,106	812	425	77,835	110	31,704	16,775	12,033	0	157,950
	(1.8)	(7.4)	(1.6)	(0.7)	(0.5)	(0.3)	(49.3)	(0.1)	(20.1)	(10.6)	(7.6)	(0.0)	(100.0)
Pennahatchee Creek	134	1,657	354	87	68	0	11,758	32,039	7,150	2,321	6,942	642	63,151
	(0.2)	(2.6)	(0.6)	(0.1)	(0.1)	(0.0)	(18.6)	(50.7)	(11.3)	(3.7)	(11.0)	(1.0)	(100.0)
Turkey Creek	62	407	27	8	30	0	13,071	23,160	8,260	1,841	4,560	351	51,777
	(0.1)	(0.8)	(0.1)	(0.0)	(0.1)	(0.0)	(25.2)	(44.7)	(16.0)	(3.6)	(8.8)	(0.7)	(100.0)

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 2000 and 2003. Sources of these data include the following:

- Clayton County Water Authority, 2002 – 2003
- Georgia Environmental Protection Division (GA EPD) trend monitoring data, 2001 – 2003
- Middle Flint Regional Development Center, May – August 2002

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 accumulated fecal coliform bacteria that wash off land surfaces as a result of storm events.

3.1 Point Source Assessment

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

3.1.1 Wastewater Treatment Facilities

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

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

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

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

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

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

Facility Name	NPDES Permit No.	Receiving Stream	Actual 2003 Discharge		NPDES Permit Limits		Number of fecal coliform Violations 2003 - 2005
			Average Monthly Flow (MGD)[1]	Geometric Mean (No./100 mL)[2]	Average Monthly Flow (MGD)	Average Monthly FC (No./100mL)	
Byromville Pond	GA0025623	Turkey Creek	0.05	414.3	0.104	200	5
Peachtree City Line Creek[a]	GA0035777	Line Creek - Whitewater Creek	1.14	9.5	1.1	200	1
Peachtree City Rockaway	GA0046655	Line Creek Tributary	2.35	34.1	4	200	8

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.
[a] The facility discharges November through April; during May through October the facility is reuse.

Six CSOs outfalls, included under a single NPDES permit (GA0036854), are located in the City of Albany. However, these CSOs do not discharge into streams in the Flint River Basin that are 303(d) listed for fecal coliform bacteria. Further, no discharge events have occurred from these CSOs since 1998. No other permitted CSOs occur within the Flint River Basin.

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 fifteen Phase I MS4s in the Flint River Basin (Table 4).

As of March 10, 2003, small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an area with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty counties and 56 communities are permitted under the Phase II regulations in Georgia. There are 15 counties or communities located in the Flint River Basin that are covered by the Phase II General Storm Water Permit (Table 5).

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

Name	Permit No.	Watershed
Atlanta	GAS000100	Flint, Chattahoochee, Ocmulgee
Clayton County	GAS000107	Flint, Ocmulgee
College Park	GAS000109	Flint, Chattahoochee
East Point	GAS000114	Flint, Chattahoochee, Ocmulgee
Fairburn	GAS000115	Flint, Chattahoochee
Forest Park	GAS000116	Flint, Ocmulgee
Fulton County	GAS000117	Flint, Chattahoochee, Ocmulgee, Coosa
Hapeville	GAS000119	Flint, Ocmulgee
Jonesboro	GAS000120	Flint, Ocmulgee
Lake City	GAS000141	Flint, Ocmulgee
Lovejoy	GAS000142	Flint, Ocmulgee
Morrow	GAS000126	Flint, Ocmulgee
Palmetto	GAS000128	Flint, Chattahoochee
Riverdale	GAS000130	Flint
Union City	GAS000136	Flint, Chattahoochee

Source: Nonpoint Source Permitting Program, GA DNR, 2007

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

Name	Permit No.	Watershed
Albany	GAG610000	Flint
Cordele	GAG610000	Flint
Coweta County	GAG610000	Flint, Chattahoochee
Dougherty County	GAG610000	Flint
Fayette County	GAG610000	Flint
Fayetteville	GAG610000	Flint
Griffin	GAG610000	Flint, Ocmulgee
Hampton	GAG610000	Flint, Ocmulgee
Henry County	GAG610000	Flint, Ocmulgee
Lee County	GAG610000	Flint
Leesburg	GAG610000	Flint
Newnan	GAG610000	Flint, Chattahoochee
Peachtree City	GAG610000	Flint
Tyrone	GAG610000	Flint
Spalding County	GAG610000	Flint, Ocmulgee

Source: Nonpoint Source Permitting Program, GA DNR, 2007

Most of the Line Creek watershed is located within Phase I or Phase II MS4 city or county urbanized areas. Table 6 provides the total area of the Line Creek watershed, and the percentage of the watershed that is MS4 area. No other watersheds in the Flint River Basin that are 303(d) listed for fecal coliform bacteria occur within MS4 city or county urbanized areas.

Table 6. Percentage of the Watershed of the 303(d) Listed Segment of Line Creek Located in MS4 City or County Urbanized Areas

Name	Total Area (acres)	% in MS4 area
Line Creek	157,950	94.4

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 7 presents the swine and non-swine (primarily dairies) CAFOs located in the Flint River Basin that are registered or have land application permits.

3.2 Nonpoint Source Assessment

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

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

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

Table 7. Registered CAFOs in the Flint River Basin

Name	County	Animal Type	Total No. of Animals	Permit No.
Anthony's Dairy	Sumter	Dairy	750	GAG930000
Atkinson	Miller	Swine	1,830	GAU700000
Aurora Dairy Georgia, LLC	Mitchell	Dairy	4,250	GAG930000
Big Oak Farm	Macon	Dairy	211	Pending
Bud Butcher's Dairy	Coweta	Dairy	320	GAU700000
Cox, Donnell	Miller	Swine	1,350	GAU700000
Dan-Rae Farm	Macon	Dairy	265	Pending
Grady Ranch	Grady	Dairy	675	GAU700000
Green Valley Farms	Pike	Dairy	285	GAU700000
Hambone Farm Camilla Floor	Mitchell	Swine	2,000	GAU700000
Hambone Farms Holton Farm	Mitchell	Swine	2,400	GAU700000
Hambone Farms Nine Mile Hog Unit	Mitchell	Swine	2,000	GAU700000
Haygood Farm	Upson	Dairy	400	GAU700000
Highbrighton Dairy	Macon	Dairy	3,000	GAG930000
Hooks Place Vince Barfield	Calhoun	Swine	1,200	GAU700000
Oak Hills Farm Dairy Division	Lee	Dairy	1,800	GAG930000
Peachy, Joe I.	Randolph	Dairy	272	GAU700000
Peacot Farms Inc. North	Mitchell	Swine	2,400	GAU700000
Peacot Farms Inc. South	Mitchell	Swine	2,400	GAU700000
Powell Farms	Sumter	Dairy	1,100	GAG930000
Providence Dairy, Inc.	Decatur	Dairy	770	GAG930000
Rogers Floor David Rogers Farm	Mitchell	Swine	2,080	GAU700000
Rucks Dairy	Spalding	Dairy	350	GAU700000
Southern Maid Farm Premium Standard Farms of NC, Inc.	Crisp	Swine	2,400	GAU700000
Stephenson Hog Farm	Dooly	Swine	1,500	GAU700000
Stephenson Partners Genetics	Dooly	Swine	1,000	GAU700000
Westhaven Farm	Mitchell	Dairy	600	GAU700000

Source: GA Dept. of Agriculture, 2006

3.2.1 Wildlife

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

White-tailed deer populations are significant throughout the Flint River Basin. The WRD estimates deer populations each year for all of its deer management units. Estimated deer densities for 2005 – 2006 for counties in the Flint River Basin are presented in Table 8.

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

3.2.2 Agricultural Livestock

Agricultural livestock are a potential source of fecal coliform to streams in the Flint 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 9 provides the estimated number of beef cattle, dairy cattle, goats, horse, swine, sheep, and chickens by category reported by county. These data were provided by the Natural Resources Conservation Service (NRCS).

Table 8. Deer Census Data in the Flint River Basin

County	2005-2006 Estimated Densities (Number/Sq Mi)
Baker	17.3
Calhoun	17.3
Chattahoochee	17.3
Clay	17.3
Clayton	34.1
Colquitt	17.3
Coweta	29.7
Crawford	29.7
Crisp	17.3
Decatur	17.3
Dooly	17.3
Dougherty	17.3
Early	17.3
Fayette	29.7
Fulton	34.1
Grady	17.3
Henry	29.7
Houston	32.9
Lamar	29.7
Lee	17.3
Macon	17.3
Marion	17.3
Meriwether	29.7
Miller	17.3
Mitchell	17.3
Monroe	29.7
Peach	32.9
Pike	29.7
Randolph	17.3
Schley	17.3
Seminole	17.3
Spalding	29.7
Stewart	17.3
Sumter	17.3
Talbot	29.7
Taylor	29.7
Terrell	17.3
Turner	17.3
Upson	29.7
Webster	17.3
Worth	17.3

Source: Wildlife Resources Division, GA DNR, 2004

Table 9. Estimated Agricultural Livestock Populations in the Flint River Basin

County	Livestock							
	Cattle	Dairy Cattle	Swine	Beef Sheep	Goats	Horses	Chickens-Layers	Chickens-Broilers Sold
Baker	10,350	-	1,000	25	400	180	176,000	8,280,000
Calhoun	6,625	-	-	100		60	-	5,760,000
Chattahoochee	650	-	-			25	-	1,150,000
Clay	6,900	-	25		75	70	-	-
Clayton	600	-	-		600	50	-	-
Colquitt	17,559	457	2,250	-	884	956	280,000	19,120,000
Coweta	6,520	350	-	20	180	1,250	-	-
Crawford	1,475	-	-		200	340	-	9,165,000
Crisp	5,550	-	3,580		1,200	180	-	2,268,000
Decatur	5,100	700	200		450	75	80,000	8,160,000
Dooly	3,000	420	3,300		200	85	-	5,280,000
Dougherty	4,200	-	-	55		1,938	-	460,000
Early	18,120	-	350		150	140	-	460,000
Fayette	5,100	-	25	20	150	1,300	-	-
Fulton	4,350	-	-		325	500	-	-
Grady	13,200	860	2,900	35	800	380	80,000	7,982,000
Henry	8,018	-	-	45	275	1,700	-	-
Houston	7,250	800	-	20	300	475	-	5,022,000
Lamar	5,950	600	1,030	25	850	700	-	6,500,000
Lee	8,000	1,700	150		200	500	-	-
Macon	3,250	9,000	-		650	150	312,000	26,444,500
Marion	5,295	-	10	30	1,200	115	41,000	7,309,000
Meriwether	13,800	400	40	100	2,500	1,575	-	-
Miller	11,500	-	2,650	-		70	-	750,000
Mitchell	21,500	3,800	16,000	125	675	1,725	160,000	22,195,000
Monroe	7,300	850	-		1,200	350	-	10,223,195
Peach	1,850	1,000	-		150	860	-	-
Pike	6,400	200	-	25	500	550	-	3,640,000
Randolph	5,310	390	2,550		50	110	-	-
Schley	1,175	-	1,200		185	105	20,000	5,875,000
Seminole	10,800	97	455	176	460	650	-	-
Spalding	2,200	270	-		75	600	-	1,040,000
Stewart	3,500	-	-		200	160	-	1,150,000
Sumter	5,500	2,100	-		1,600	825	-	5,634,900
Talbot	6,300	-	-		150	200	-	-
Taylor	7,375	-	200		570	130	54,000	7,280,000
Terrell	1,550	-	20	35	400	950	-	-
Turner	17,000	-	30	80	700	525	-	4,000,000
Upson	7,600	390	-	75	1,000	350	-	7,280,000
Webster	7,500	-	178		300	120	-	460,000
Worth	21,340	-	65	-	1,100	385	20,000	2,115,000

Source: NRCS, 2005

3.2.3 Urban Development

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

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

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

3.2.3.1 Leaking Septic Systems

A portion of the fecal coliform in the Flint River Basin may be attributed to failure of septic systems and illicit discharges of raw sewage. Table 10 presents the number of septic systems in each county of the Flint River Basin existing in 2000 and the number existing in 2005, based on the Georgia Department of Human Resources, Division of Public Health data. In addition, an estimate of the number of septic systems installed and repaired during the five year period from 2000 through 2005 is given. These data show that a substantial increase in the number of septic systems has occurred in some counties. Often, this is a reflection of population increases outpacing the expansion of sewage collection systems during this period. Hence, a large number of septic systems are installed to contain and treat the sanitary waste.

Table 10. Number of Septic Systems in the Flint River Basin

County	Existing Septic Systems (2000)	Existing Septic Systems (2005)	No. of Septic Systems Installed (2000 to 2005)	No. of Septic Systems Repaired (2000 to 2005)
Baker	1,751	1,963	212	60
Calhoun	1,027	1,173	146	23
Chattahoochee	1,048	1,173	125	11
Clay	1,227	1,356	129	5
Clayton	17,408	19,147	1,739	721
Colquitt	9,898	11,730	1,832	555
Coweta	29,232	35,577	6,345	1,301
Crawford	5,247	5,897	650	242
Crisp	6,117	6,692	575	165
Decatur	11,393	12,619	1,226	633
Dooly	2,964	3,171	207	42
Dougherty	9,537	10,139	602	666
Early	3,727	4,386	659	288
Fayette	19,825	23,146	3,321	1,229
Fulton	30,312	32,748	2,436	768
Grady	7,530	8,777	1,247	348
Henry	32,741	42,446	9,705	854
Houston	16,549	19,947	3,398	636
Lamar	3,252	4,394	1,142	195
Lee	7,968	9,842	1,874	581
Macon	8,477	8,719	242	29
Marion	6,527	6,877	350	11
Meriwether	7,052	8,620	1,568	224
Miller	2,204	2,521	317	96
Mitchell	5,780	7,147	1,367	644
Monroe	7,832	9,565	1,733	153
Peach	5,279	6,527	1,248	207
Pike	5,969	7,511	1,542	146
Randolph	1,928	2,099	171	12
Schley	1,064	1,295	233	53
Seminole	6,399	7,073	674	203
Spalding	15,553	17,806	2,253	672
Stewart	1,315	1,455	140	3
Sumter	6,865	7,618	753	228
Talbot	2,742	3,038	296	23
Taylor	1,626	2,030	404	18
Terrell	4,715	5,089	374	176
Turner	1,833	1,998	165	5
Upson	9943	10902	959	522
Webster	1015	1186	171	6
Worth	15018	15596	938	267

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

3.2.3.2 Land Application Systems

Many smaller communities use land application systems (LAS) for treatment of their sanitary wastewaters. These facilities are required through LAS permits to treat all their wastewater by land application and are to be properly operated as non-discharging systems that contribute no runoff to nearby surface waters. However, runoff during storm events may carry surface residual containing fecal coliform bacteria to nearby surface waters. Some of these facilities may also exceed the ground percolation rate when applying the wastewater, resulting in surface runoff from the field. If not properly bermed, this runoff, which probably contains fecal coliform bacteria, may discharge to nearby surface waters. There are 19 permitted LAS systems located in the Flint River Basin (Table 11).

Table 11. Permitted Land Application Systems in the Flint River Basin

LAS Name	County	Permit No.	Type	Flow (MGD)
Autry Correctional Institution	Mitchell	GA03-740	Private	0.25
Butler LAS	Taylor	GA02-074	Municipal	0.5
Camilla LAS	Mitchell	GA02-088	Municipal	3.1
Clayton County Shoal Creek	Clayton	GA02-236	Municipal	1.1
Fairburn	Fulton	GA02-189	Municipal	1
Fayette County Redwine	Fayette	GA03-898	Municipal	0.15
Griffin Shoal LAS	Spalding	GA02-036	Municipal	2.25
Henry Co Bear Creek LAS	Henry	GA02-095	Municipal	0.25
Lee Correctional Institution	Lee	GA02-284	Public	0.105
Manchester	Meriwether	GA02-081	Municipal	0.812
Morgan LAS	Calhoun	GA02-076	Municipal	0.146
Senoia LAS	Coweta	GA02-135	Municipal	0.49
Southern Mills Inc. Plant Ray	Upson	GA01-578	Industrial	0.5
Spring Lake WPCP	Spalding	GA03-905	Municipal	0.275
Terra Renewal Services, Inc.	Sumter/Lee	GA01-587	Industrial	Report
Vienna	Dooly	GA02-244	Municipal	0.75
Vienna North	Dooly	GA02-167	Municipal	0.99
Woodbury	Meriwether	GA02-079	Municipal	0.325
Zebulon LAS	Pike	GA02-012	Municipal	0.499

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

3.2.3.3 Landfills

Leachate from landfills may contain fecal coliform bacteria that may at some point discharge into surface waters. Sanitary (or municipal) landfills are the most likely to serve as a source of fecal coliform bacteria. These types of landfills receive household wastes, animal manure, offal, hatchery and poultry processing plant wastes, dead animals, and other types of wastes. Older sanitary landfills were not lined and most have been closed. Those that remain active and have not been lined operate as construction/demolition landfills. Currently active sanitary landfills are lined and have leachate collection systems. All landfills, excluding inert landfills, are now required to install environmental monitoring systems for groundwater and methane sampling. There are 143 known landfills in the Flint River Basin (Table 12). Of these, 10 are active landfills and 133 are inactive or closed. As shown in Table 12, many of the older, inactive landfills were never permitted.

Table 12. Landfills in the Flint River Basin

Name	County	Permit No.	Type	Status
Acree Ga. Landfill	Dougherty		NA	Inactive
Allied Services, Llc -Sr 90/Sr 137 Charing	Taylor	133-003D(SL)	Municipal Solid Waste Landfill	Operating
Americus	Sumter		NA	Inactive
Andersonville - Freeman St.	Sumter	129-001D(SL)	NA	Inactive
Andersonville (City)	Sumter		NA	Inactive
Andersonville (County)	Sumter		NA	Inactive
Andersonville-Freeman St (L)	Sumter	129-010D(L)	Construction and Demolition Landfill	Closed
Arabi	Crisp		NA	Inactive
B.F.I., Inc. Roberts Rd.	Fayette	056-004D(SL)	NA	Inactive
B.F.I., Inc. Roberts Rd.	Fayette	056-008D(SL)	NA	Inactive
B.F.I., Inc. Roberts Rd.	Fayette	056-011D(SL)	NA	Inactive
Baconton, City Of (L)	Mitchell	101-005D(L)	Construction and Demolition Landfill	Closed
Bainbridge - Butler Ferry Rd	Decatur	043-001D(SL)	Sanitary Landfill	Closed
Bainbridge-Ave C (L)	Decatur	043-004D(L)	Construction and Demolition Landfill	Closed
Baker Co. - Newton (Sr200/Cr35)	Baker		NA	Inactive
Bfi-Roberts Rd Ph 2 (Sl)	Fayette	056-012D(SL)	Sanitary Landfill	Closed
Blakely-Howell St/Pitt Rd (Sl)	Early	049-002D(SL)	Sanitary Landfill	Closed
Boykin	Miller		NA	Inactive
Brooks	Fayette		NA	Inactive
Calhoun Co-Sr 45 Morgan (Sl)	Calhoun	019-004D(SL)	Sanitary Landfill	Closed
City Of Dawson Sanitary Landfill	Terrell	135-004D(SL)	Sanitary Landfill	Closed
Clayton Co-Sr 3 Lovejoy #2 (Sl)	Clayton	031-027D(SL)	Sanitary Landfill	Closed
Clayton Co-Sr 3 Lovejoy Site # 3	Clayton	031-037D(SL)	Municipal Solid Waste Landfill	Operating
Colquitt	Miller		NA	Inactive
Cordele	Crisp		NA	Inactive
Cordele - Us 41s, Ph. 2	Crisp	040-002D(SL)	NA	Inactive
Cordele-Us 41 S Ph 2 (Sl)	Crisp	040-004D(SL)	Sanitary Landfill	In-Closure
Cr 195 Ph3	Sumter	APL-1291	NA	Inactive
Crawford Co. - Co. Rd. 48 - S, Ph.1	Crawford		NA	Inactive
Crawford Co-Cr 49 Roberta (Sl)	Crawford	039-005D(SL)	Sanitary Landfill	Closed
Crisp Co-Us 41s Site 2 (Ph 4&5) Mswl	Crisp	040-008D(MSWL)	Municipal Solid Waste Landfill	Operating
Cuthbert	Randolph		NA	Inactive
Damascus	Early		NA	Inactive
Decatur Co. - Sr 309, Ph. 2	Decatur	043-005D(SL)	NA	Inactive
Decatur Co-Sr 309 Bnbrdg Ph 2 (Sl)	Decatur	043-006D(SL)	Unlined Sanitary Landfill	Operating
District Rd. (County)	Sumter		NA	Inactive
Dominy Branch (County)	Sumter		NA	Inactive
Donalsonville	Seminole		NA	Inactive
Donalsonville Rd.	Miller		NA	Inactive
Donalsonville-Sr 39 (Sl)	Seminole	125-003D(SL)	Sanitary Landfill	Closed
Donalsonville-Sr 39 N (L)	Miller	100-005D(L)	Dry Trash Landfill	Closed

Table 12. Landfills in the Flint River Basin

Name	County	Permit No.	Type	Status
Dooly Co-Cr 101 (Sl)	Dooly	046-006D(SL)	Sanitary Landfill	Closed
Dooly Co-Us 41 (Sl)	Dooly	046-001D(SL)	Sanitary Landfill	Closed
Dougherty Co-Fleming/Gaissert Rd (Sl)	Dougherty	047-014D(SL)	Municipal Solid Waste Landfill	Operating
Dougherty County - South Front St.	Dougherty		NA	Inactive
Ellaville	Schley		NA	Inactive
Fayette Co. - Dixon Bridge Rd.	Fayette		NA	Inactive
Fayette Co-1st Manassas Mile Rd (Sl)	Fayette	056-014D(SL)	Sanitary Landfill	Closed
Fayette Co-1st Manassas Mile Rd N side	Fayette	056-015D(L)	Construction and Demolition Landfill	Closed
Fayette Co-Grady Ave Ph 2 (Sl)	Fayette	056-006D(SL)	Sanitary Landfill	Closed
Fayette County - Grady Ave.	Fayette	056-001D(SL)	NA	Inactive
Flintside (County)	Sumter		NA	Inactive
Forest Park	Clayton	031-012D(L)	NA	Inactive
Forest Park - Jones Rd Ph3	Clayton	031-031D(L)	Dry Trash Landfill	Closed
Forest Park - Jones Rd. Ext.	Clayton	031-023D(L)	Dry Trash Landfill	Closed
Fountain School	Clayton		NA	Inactive
Friendship Road (County)	Sumter		NA	Inactive
General (Allied) Chemical Co (Li)	Fulton	060-036D(LI)	Industrial Landfill	Operating
Gowan St. Landfill	Dougherty		NA	Inactive
Greenville	Meriwether		NA	Inactive
Griffin-Shoal Creek Rd (Sl)	Spalding	126-003D(SL)	Sanitary Landfill	Closed
Hawkinstown Road	Baker		NA	Inactive
Hwy. 200	Baker		NA	Inactive
Industrial Park	Decatur		NA	Inactive
Iron City (County)	Seminole		NA	Inactive
Kendrick - Waymonville Rd.	Upson		NA	Inactive
Kersey-Firetower Rd/Jeff Davis Rd (L)	Upson	145-007D(L)	Tire Landfill	In-Closure
King & Kings Realty	Dougherty		NA	Inactive
Lamar Co - Cedar Grove Regional Mswl	Lamar	085-007D(MSWL)	Municipal Solid Waste Landfill	Operating
Lamar Co-Grve St Ext (Old Mlnr Rd) (Sl)	Lamar	085-004D(SL)	Sanitary Landfill	Closed
Lee Co-Sr 32 Ph 1 (Sl)	Lee	088-006D(SL)	Sanitary Landfill	Closed
Lee St. (County)	Sumter		NA	Inactive
Leesburg	Lee		NA	Inactive
Leslie - De Soto (County)	Sumter		NA	Inactive
Macon Co.	Macon		NA	Inactive
Macon Co. - Middle Ga Swma Regional Mswl	Macon	094-009D(MSWL)	Construction and Demolition Landfill	Operating
Macon Co. (Montezuma)	Macon		NA	Inactive
Macon Co-Sr 49 N #3 (Sl)	Macon	094-005D(SL)	Sanitary Landfill	Closed
Manchester	Meriwether		NA	Inactive
Maple Hill Landfill, Inc.	Dougherty	047-018D(L)	Construction and Demolition Landfill	Closed
Marine Corps Logistics Base (L)	Dougherty	047-012D(L)	Dry Trash Landfill	Closed
Marion Co-Mt Zion Ch Rd Ph 1,2(Sl)&3inert	Marion	096-002D(SL)	Sanitary Landfill	Closed
Marshallville	Macon		NA	Inactive

Table 12. Landfills in the Flint River Basin

Name	County	Permit No.	Type	Status
Marshallville City Landfill	Macon	094-006D(L)	Dry Trash Landfill	Closed
Meansville	Pike		NA	Inactive
Meriwether Co-Whit Waddell Rd #2 (Sl)	Meriwether	099-014D(SL)	Sanitary Landfill	Closed
Meriwether Co-Whit Waddell Rd S (Sl)	Meriwether	099-011D(SL)	Sanitary Landfill	Closed
Middle Georgia Waste, Inc. - Sr 49	Macon	094-007D(SL)	NA	Inactive
Miller Co-Cr 37/Sheffield (Sl)	Miller	100-004D(SL)	Sanitary Landfill	Closed
Mitchell Co S1643	Mitchell	101-002D(SL)	Sanitary Landfill	Closed
Mitchell Co-Sr 3a (Sl)	Mitchell	101-004D(SL)	Sanitary Landfill	In-Closure
Molena	Pike		NA	Inactive
New Era (County)	Sumter		NA	Inactive
Newton (New Site)	Baker		NA	Inactive
Newton Rd.	Dougherty		NA	Inactive
Newton-Baker Co.	Baker		NA	Inactive
No Name	Fayette		NA	Inactive
No Name	Fayette		NA	Inactive
Oglethorpe (South)	Macon		NA	Inactive
Oglethorpe (West)	Macon		NA	Inactive
Oxford Const. Co.	Dougherty	047-011D(L)	NA	Inactive
Parrott	Terrell		NA	Inactive
Peachtree City	Fayette		NA	Inactive
Pecan Rd. (County)	Sumter		NA	Inactive
Pike Co-County Farm Rd (L)	Pike	114-009D(L)	Dry Trash Landfill	Closed
Pike Co-County Farm Rd (Sl)	Pike	114-007D(SL)	Sanitary Landfill	Closed
Plains	Sumter		NA	Inactive
Preston	Webster		NA	Inactive
Prison Farm, Jordan Rd.	Lee	088-001D(SL)	Sanitary Landfill	Closed
Putney Ga. - Hwy 19s	Dougherty		NA	Inactive
Randolph Co-Brooksville Rd Ph 1 (Sl)	Randolph	120-002D(SL)	Sanitary Landfill	Closed
Reynolds	Taylor		NA	Inactive
Roy Pittman Prop. - Hwy 29	Fulton	060-028D(L)	Dry Trash Landfill	Closed
Schley Co-Cr 65/Hicks (Sl)	Schley	123-004D(SL)	Sanitary Landfill	Closed
Schley Co-Sr 26 E Ph 1 (Sl)	Schley	123-002D(SL)	Sanitary Landfill	Closed
Senoia	Coweta		NA	Inactive
Shellman	Randolph		NA	Inactive
Smithville	Lee		NA	Inactive
So. Ga. Tech. & Voc. School	Sumter		NA	Inactive
Spalding Co-Griffin/Shoal Creek Rd Ph 2	Spalding	126-009D(C&D)	Construction and Demolition Landfill	Operating
Sr 91	Miller	100-002D(SL)	Sanitary Landfill	Closed
Steel Bridge Rd. (County)	Sumter		NA	Inactive
Sumter Co. - Cr 195	Sumter	129-002D(SL)	NA	Inactive
Sumter Co. - Public Works Camp (New)	Sumter		NA	Inactive
Sumter Co-Cr 195 Ph 2 (Sl)	Sumter	129-011D(SL)	Sanitary Landfill	Closed

Table 12. Landfills in the Flint River Basin

Name	County	Permit No.	Type	Status
Sumter Co-Cr 195 S Ph 1 (Sl)	Sumter	129-007D(SL)	Sanitary Landfill	Closed
Talbot Co - Cr 65 #2 (Sl)	Talbot	130-006D(SL)	Sanitary Landfill	Closed
Talbot Co-Adams St (Sl)	Talbot	130-005D(SL)	Sanitary Landfill	Closed
Talbotton	Talbot		NA	Inactive
Taylor Co-Sr 137 Butler (Sl)	Taylor	133-002D(SL)	Sanitary Landfill	Closed
Terrell Co-Us 82 Dawson (Sl)	Terrell	135-005D(SL)	Sanitary Landfill	Closed
Thomaston-Zorn St Ph 2 &3 (Sl)	Upson	145-005D(SL)	Sanitary Landfill	Closed
Upson Co. - Zorn St., Thomaston	Upson	145-003D(SL)	NA	Inactive
Upson Co. US 19 At Pobiddy Rd. MSWL	Upson	145-010D(SL)	Sanitary Landfill	Inactive
Us 41s Site 2 Ph4 Mswl	Crisp	APL-0402		Inactive
Vienna	Dooly		NA	Inactive
Watson Tire Landfill	Upson	145-009D(L)	Dry Trash Landfill	Inactive
Webster Co-Sr 41 S Reston (Sl)	Webster	152-001D(SL)	Sanitary Landfill	Closed
Weyerhauser Co. (Li)	Macon	094-004D(LI)	Industrial Landfill	Operating
Wmi-Rolling Hills (Sl)	Clayton	031-017D(SL)	Sanitary Landfill	Closed
Woodbury	Meriwether		NA	Inactive
Woodland	Talbot		NA	Inactive
Yatesville Rd.	Upson		NA	Inactive

Source: Land Protection Branch, GA DNR, 2006

4.0 ANALYTICAL APPROACH

The process of developing fecal coliform TMDLs for the Flint 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 13 lists those segments for which no flow data were available and indicates the gaged station that was used to estimate the flow.

Table 13. Stream Segments with Estimated Flows and Corresponding USGS Flow Gages

Monitoring Station	USGS Station Name	Station No.
Beaver Dam Creek - Lake Joy to Flint River	Line Creek Near Senoia, GA	02344700
East Jesters Creek - Headwaters to Jesters Creek	Line Creek Near Senoia, GA	02344700
Hurricane Creek - Headwaters to Flint River	Line Creek Near Senoia, GA	02344700
Line Creek - Flat Creek to Flint River	Line Creek Near Senoia, GA	02344700
Pennahatchee Creek - Sandy Mount Creek to Turkey Creek	Turkey Creek At Byromville, GA	02349900
Turkey Creek - Rogers Branch to Pennahatchee Creek	Turkey Creek At Byromville, GA	02349900

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

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

Where:

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

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

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

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

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

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

$$TMDL_{critical} = C_{standard} \text{ x } Q_{mean}$$

Where:

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

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

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

5.0 TOTAL MAXIMUM DAILY LOADS

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

A TMDL is expressed as follows:

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

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

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

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

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

5.1 Waste Load Allocations

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

NPDES permitted facilities with fecal coliform permit limits in the Flint 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 14. 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 14. WLAs for the Flint River Basin

Facility Name	Permit No.	Receiving Stream	Listed Stream Segment	WLA (counts/30 days)
Byromville Pond	GA0025623	Turkey Creek	Turkey Creek Rogers Branch to Pennahatchee Creek	2.37E+10
Peachtree City Line Creek	GA0035777	Line Creek-Whitewater Creek	Line Creek Flat Creek to Flint River	2.50E+11
Peachtree City Rockaway	GA0046655	Line Creek Tributary	Line Creek Flat Creek to Flint River	9.10E+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 (WLAsw) are estimated based on the percentage of urban area in each watershed covered by the MS4 storm water permit. At this time, the portion of each watershed that goes directly to a permitted storm sewer and that which goes through non-permitted point sources, or is sheet flow or agricultural runoff, has not been clearly defined. Thus, it is assumed that approximately 70 percent of storm water runoff from the regulated urban area is collected by the municipal separate storm sewer systems.

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

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

5.2 Load Allocations

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

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

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

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

As described above, there are two types of load allocations: loads to the stream independent of precipitation, including sources such as failing septic systems, leachate from landfills, animals in the stream, and leaking sewer system collection lines, or background loads; and loads associated with fecal coliform accumulation on land surfaces that is washed off during storm events, including runoff from saturated LAS fields. At this time, it is not possible to partition the various sources of load allocations. Table 15 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 Flint 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 15 for each listed segment was based on the season in which the critical load occurred. The TMDLs for each season, for any given flow, are presented as equations in Section 5.5.

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

5.4 Margin of Safety

The MOS is a required component of TMDL development. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative modeling assumptions to develop allocations; or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For this TMDL, an explicit MOS of 10 percent of the TMDL was used. The MOS values are presented in Table 15.

5.5 Total Fecal Coliform Load

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

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

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

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

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

For purposes of determining necessary load reductions required to meet the instream water quality criteria, the current critical TMDL was determined. This load is the product of the applicable seasonal fecal coliform standard and the mean flow used to calculate the current critical load. It represents the sum of the allocated loads from point and nonpoint sources located within the immediate drainage area of the listed segment, the NPDES-permitted point discharges with recorded fecal coliform violations from the nearest upstream subwatersheds, and a margin of safety (MOS). For these calculations, the fecal load contributed by each facility to the WLA was not the maximum presented in Table 14, but rather was the product of the fecal coliform permitted limit and the average monthly discharge at the time of the critical load. The current critical loads and corresponding TMDLs, WLAs (WLA and WLA_{sw}), LAs, MOSs, and percent load reductions for the Flint River Basin listed stream segments are presented in Table 15.

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 15 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 15. Fecal Coliform Loads and Required Fecal Coliform Load Reductions

Stream Segment	Current Load (counts/ 30 days)	TMDL Components					Percent Reduction
		WLA (counts/ 30 days)[1]	WLAsw (counts/ 30 days)	LA (counts/ 30 days)	MOS (counts/ 30 days)	TMDL (counts/ 30 days)	
Beaver Dam Creek	3.03E+11			7.23E+10	8.04E+09	8.04E+10	73.5
East Jesters Creek	5.04E+11			1.32E+11	1.46E+10	1.46E+11	71.0
Hurricane Creek	4.77E+11			1.42E+11	1.58E+10	1.58E+11	66.9
Line Creek	1.97E+13	4.04E+10	1.01E+13	5.19E+12	1.70E+12	1.70E+13	13.5
Pennahatchee Creek	4.44E+12			1.19E+12	1.32E+11	1.32E+12	70.2
Turkey Creek	1.01E+12	2.54E+10		5.68E+11	6.60E+10	6.60E+11	34.9

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

6.0 RECOMMENDATIONS

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

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

6.1 Monitoring

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

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

6.2 Fecal Coliform Management Practices

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

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

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

6.2.1 Point Source Approaches

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

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

6.2.2 Nonpoint Source Approaches

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

6.2.2.1 Agricultural Sources

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

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

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

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

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

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

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

6.2.2.2 Urban Sources

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

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

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

- Sustained compliance with storm water NPDES permit requirements; and

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

6.3 Reasonable Assurance

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

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

6.4 Public Participation

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

7.0 INITIAL TMDL IMPLEMENTATION PLAN

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

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

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

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

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

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

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

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

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

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

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

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

Management Measure Selector Table

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

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

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Appendix A

30-day Geometric Mean Fecal Coliform Monitoring Data

Monitoring Water Quality Stations

Stream Segment	Location	Monitoring Station Description
Beaver Dam Creek	Lake Joy to Flint River (Clayton Co)	at F.R. Road, Clayton Co
East Jesters Creek	Headwaters to Jesters Creek (Clayton Co)	at Reynolds Road, Clayton Co.
Hurricane Creek	Headwaters to Flint River (Clayton Co)	at Turner Road, Clayton Co.
Line Creek	Flat Creek to Flint River (Fayette/ Spalding/ Coweta Co)	at State Road 16 Near Digbey, GA
Pennahatchee Creek	Sandy Mount Creek to Turkey Creek (Dooly Co)	at Templeton Road, Dooly Co.
Turkey Creek	Rogers Branch to Pennahatchee Creek (Dooly Co)	at CSX Railroad Crossing, Dooly Co.

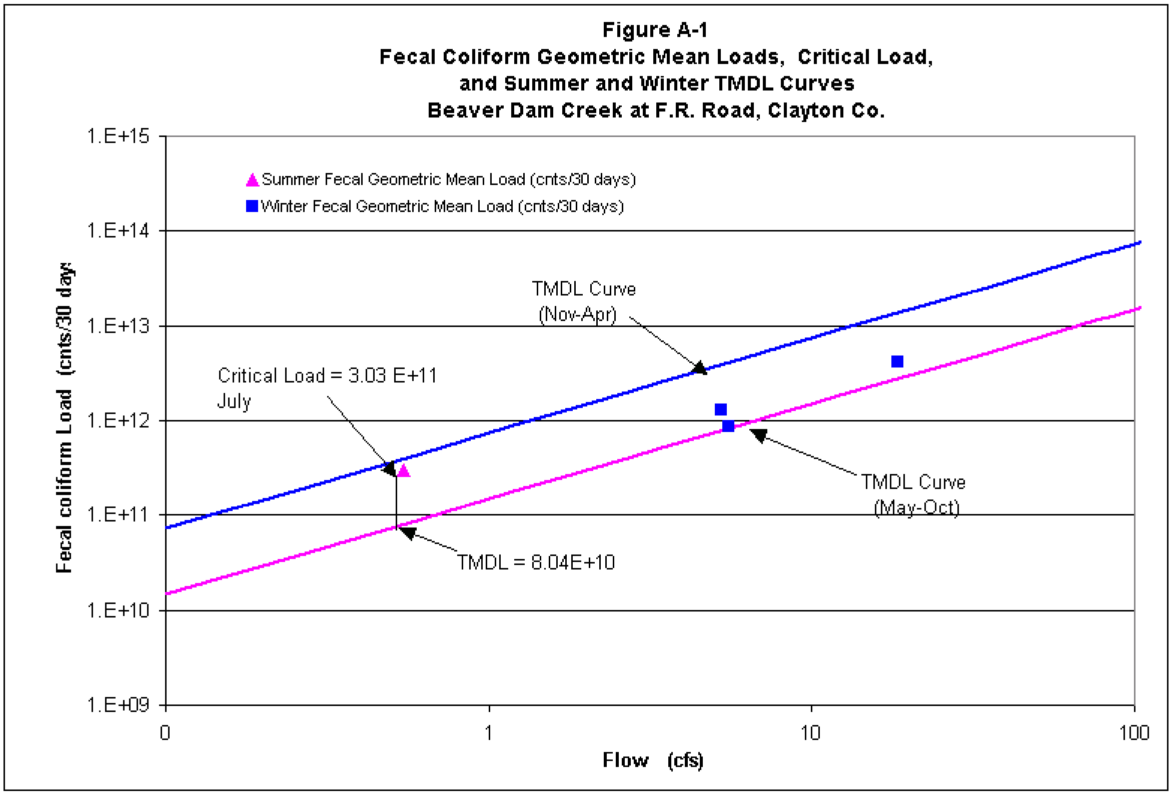

Figure A-1
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
Beaver Dam Creek at F.R. Road, Clayton Co.

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)
10-Jul-02	840	0.4				
17-Jul-02	610	0.7				
22-Jul-02	370	0.7				
30-Jul-02	**1700**	**0.4**	**753**	**0.5**	**3.03E+11**	**8.04E+10**
11-Mar-03	2400	4.8				
13-Mar-03	1980	3.4				
17-Mar-03	2600	5.8				
19-Mar-03	1	7.1	333	5.3	1.29E+12	3.86E+12
21-Mar-03	1900	57.7				
25-Mar-03	400	5.0				
27-Mar-03	200	5.8				
31-Mar-03	60	5.4	309	18.5	4.19E+12	1.35E+13
3-Apr-03	135	3.3				
7-Apr-03	490	6.2				
9-Apr-03	600	9.6				
15-Apr-03	50	3.1	211	5.6	8.60E+11	4.07E+12

Figure A-2
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
East Jesters Creek at Reynolds Road, Clayton Co.

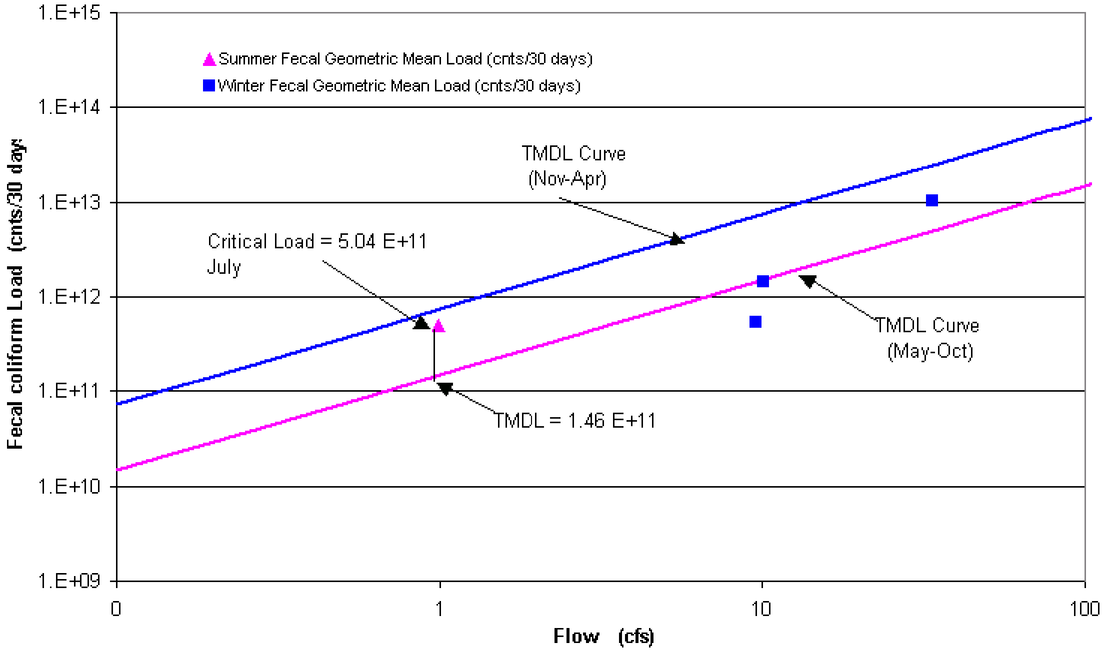

Table A-2. Data for Figure A-2

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)
10-Jul-02	450	0.8				
17-Jul-02	560	1.4				
22-Jul-02	520	1.2				
30-Jul-02	**1720**	**0.7**	**689**	**1.0**	**5.04E+11**	**1.46E+11**
11-Mar-03	90	8.7				
13-Mar-03	330	6.1				
17-Mar-03	1	10.6				
19-Mar-03	1140	12.9	76	9.6	5.36E+11	7.02E+12
21-Mar-03	470	105.0				
25-Mar-03	200	9.1				
27-Mar-03	400	10.5				
31-Mar-03	810	9.8	418	33.6	1.03E+13	2.47E+13
3-Apr-03	400	6.0				
7-Apr-03	1000	11.3				
9-Apr-03	15	17.5				
15-Apr-03	244	5.7	196	10.1	1.45E+12	7.42E+12

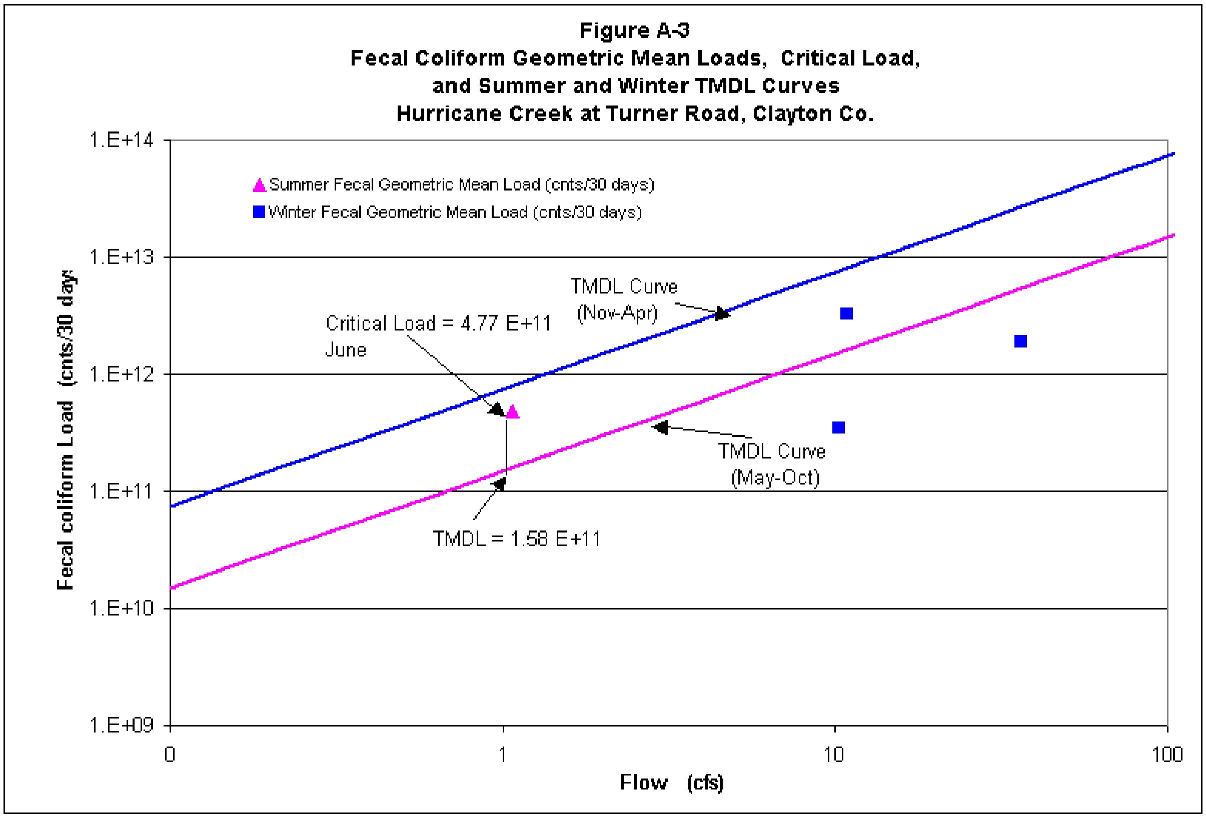

Table A-3. Data for Figure A-3

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)
10-Jul-02	340	0.8				
17-Jul-02	510	1.5				
22-Jul-02	1970	1.3				
30-Jul-02	**390**	**0.7**	**604**	**1.1**	**4.77E+11**	**1.58E+11**
11-Mar-03	50	9.4				
13-Mar-03	100	6.6				
17-Mar-03	870	11.4				
19-Mar-03	1	13.9	46	10.3	3.46E+11	7.57E+12
21-Mar-03	300	113.3				
25-Mar-03	1	9.9				
27-Mar-03	600	11.3				
31-Mar-03	135	10.6	70	36.3	1.87E+12	2.66E+13
3-Apr-03	160	6.5				
7-Apr-03	3800	12.1				
9-Apr-03	380	18.8				
15-Apr-03	120	6.2	408	10.9	3.27E+12	8.00E+12

Figure A-4
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
Line Creek at State Road 16 Near Digbey, Georgia

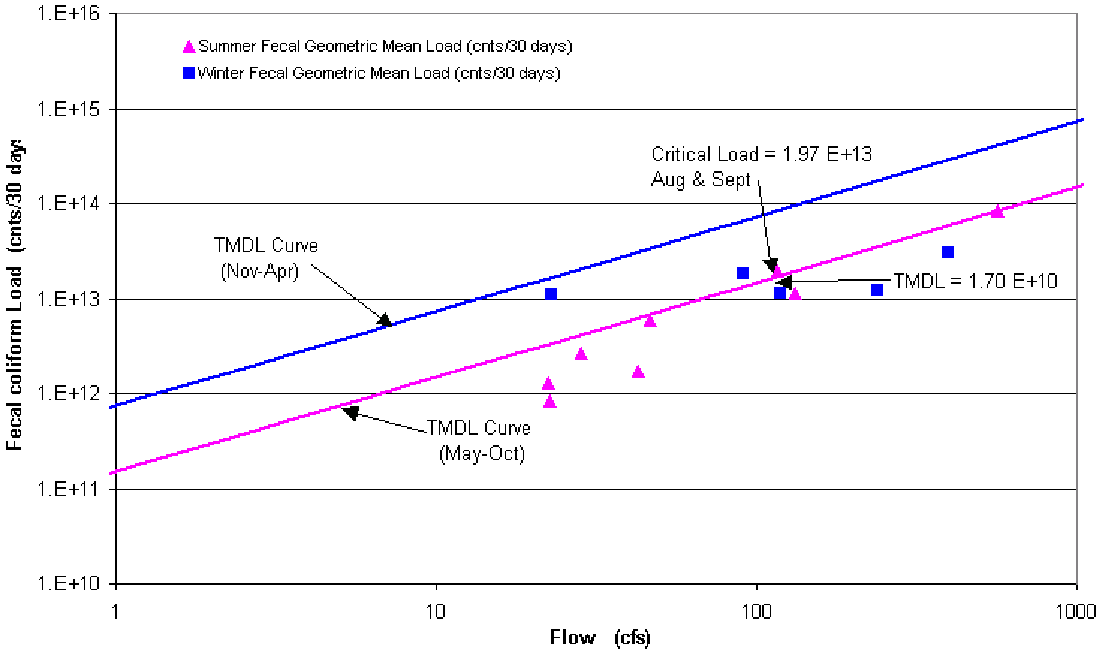

Table A-4. Data for Figure A-4

Date	Observed Fecal Coliform (counts/100 ml)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 ml)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
26-Jan-00	40	366.5				
16-Feb-00	170	285.9				
23-Feb-00	70	158.8				
24-Feb-00	50	144.2	70	238.9	1.22E+13	1.75E+14
31-May-00	80	39.1				
13-Jun-00	80	29.3				
27-Jun-00	130	22.2				
29-Jun-00	330	23.5	129	28.5	2.70E+12	4.19E+12
11-Jul-00	110	13.0				
18-Jul-00	20	12.0				
26-Jul-00	50	41.5	78	22.5	1.28E+12	3.30E+12
26-Sep-00	130	107.5				
17-Oct-00	20	21.3				
19-Oct-00	70	19.8				
23-Oct-00	50	21.7	55	42.6	1.72E+12	6.25E+12
12-Sep-01	80	66.0				
19-Sep-01	300	31.8				
24-Sep-01	220	41.5				
26-Sep-01	170	46.4	173	46.4	5.90E+12	6.82E+12
5-Dec-01	220	44.0				
12-Dec-01	490	80.6				
18-Dec-01	300	173.5				
27-Dec-01	170	63.5	272	90.4	1.81E+13	6.64E+13
6-Feb-02	220	180.8				
13-Feb-02	300	129.5				
20-Feb-02	90	85.5				
27-Feb-02	50	78.2	131	118.5	1.14E+13	8.70E+13
9-May-02	80	217.5				
15-May-02	230	156.4				
22-May-02	40	92.9				
29-May-02	260	61.1	118	132.0	1.14E+13	1.94E+13
7-Aug-02	50	26.9				
14-Aug-02	40	17.1				
21-Aug-02	40	26.9				
28-Aug-02	80	19.3	50	22.5	8.32E+11	3.31E+12
6-Nov-02	1300	566.9				
13-Nov-02	230	694.0				
20-Nov-02	20	207.7				
27-Nov-02	20	124.6	105	398.3	3.06E+13	2.92E+14
20-Feb-03	70	288.3				
26-Feb-03	20	293.2				
5-Mar-03	80	256.6				
13-Mar-03	130	295.7	62	283.5	1.29E+13	2.08E+14
20-May-03	790	1331.7				
28-May-03	170	381.2				
3-Jun-03	40	224.8				
10-Jun-03	330	312.8	205	562.6	8.47E+13	8.26E+13
19-Aug-03	700	237.0				
26-Aug-03	170	95.3				
3-Sep-03	80	66.0				
10-Sep-03	**300**	**66.0**	**231**	**116.1**	**1.97E+13**	**1.70E+13**
3-Nov-03	300	266.3				
12-Nov-03	110	80.6				
17-Nov-03	80	73.3				
2-Dec-03	40	173.5	101	148.4	1.10E+13	1.09E+14

Figure A-5
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
Pennahatchee Creek at Templeton Road, Dooly Co.

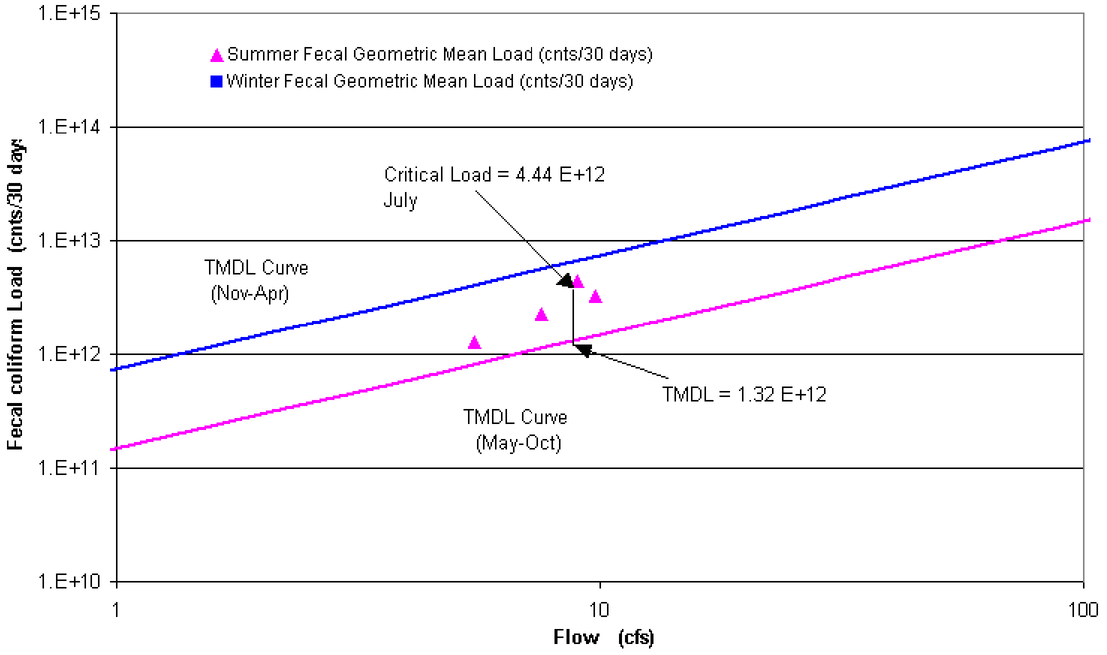

Table A-5. Data for Figure A-5

Date	Observed Fecal Coliform (counts/100 ml) (1)	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)
22-May-02		7.9				
24-May-02		7.7				
28-May-02		7.2				
31-May-02		**7.5**	407	7.6	2.26E+12	1.11E+12
3-Jun-02		7.0				
5-Jun-02		9.7				
10-Jun-02		15.6				
17-Jun-02		6.8	449	9.8	3.22E+12	1.43E+12
1-Jul-02		7.0				
8-Jul-02		14.9				
16-Jul-02		8.6				
29-Jul-02		**5.5**	**672**	**9.0**	**4.44E+12**	**1.32E+12**
2-Aug-02		5.5				
6-Aug-02		5.3				
16-Aug-02		6.6				
22-Aug-02		4.6	314	5.5	1.26E+12	8.05E+11

(1) Data provided by Middle Flint Regional Development Center - inidividual fecal coliform sample values not available.

Figure A-6
Fecal Coliform Geometric Mean Loads, Critical Load, and Summer and Winter TMDL Curves
Turkey Creek at CSX Railroad Crossing, Dooly Co.

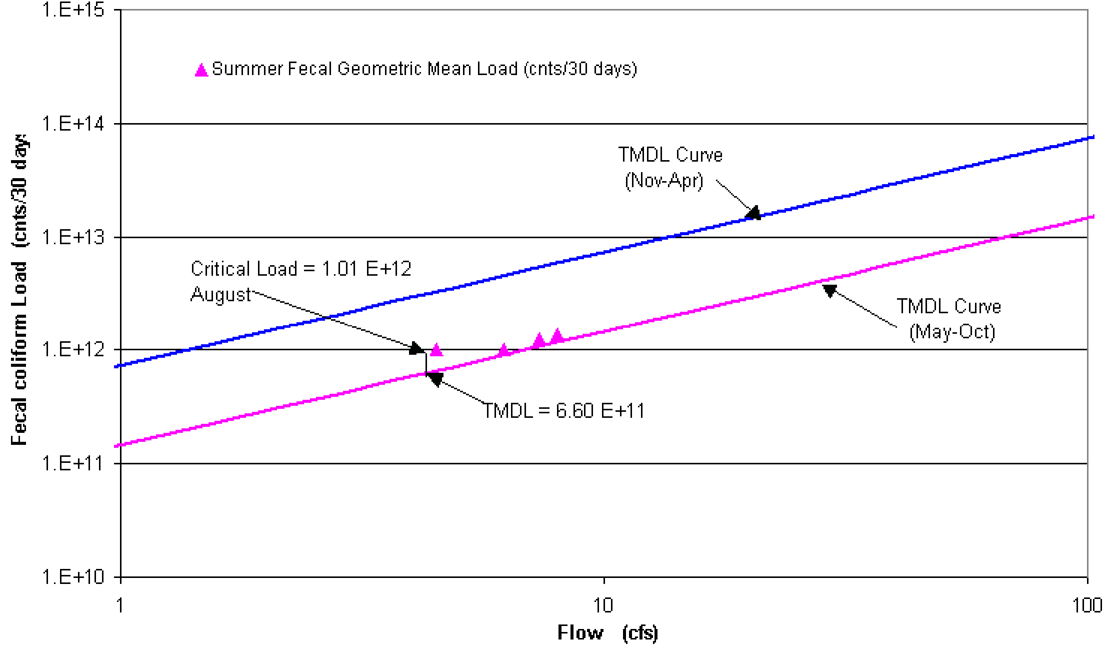

Table A-6. Data for Figure A-6

Date	Observed Fecal Coliform (counts/100 ml) (1)	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)
22-May-02		6.5				
24-May-02		6.3				
28-May-02		5.9				
31-May-02		6.1	220	6.2	1.00E+12	9.11E+11
3-Jun-02		5.8				
5-Jun-02		7.9				
10-Jun-02		12.8				
17-Jun-02		5.6	232	8.0	1.36E+12	1.17E+12
1-Jul-02		5.8				
8-Jul-02		12.2				
16-Jul-02		7.0				
29-Jul-02		4.5	232	7.4	1.26E+12	1.08E+12
2-Aug-02		4.5				
6-Aug-02		4.3				
16-Aug-02		5.4				
22-Aug-02		**3.8**	**307**	**4.5**	**1.01E+12**	**6.60E+11**

(1) Data provided by Middle Flint Regional Development Center - inidividual fecal coliform sample values not available.

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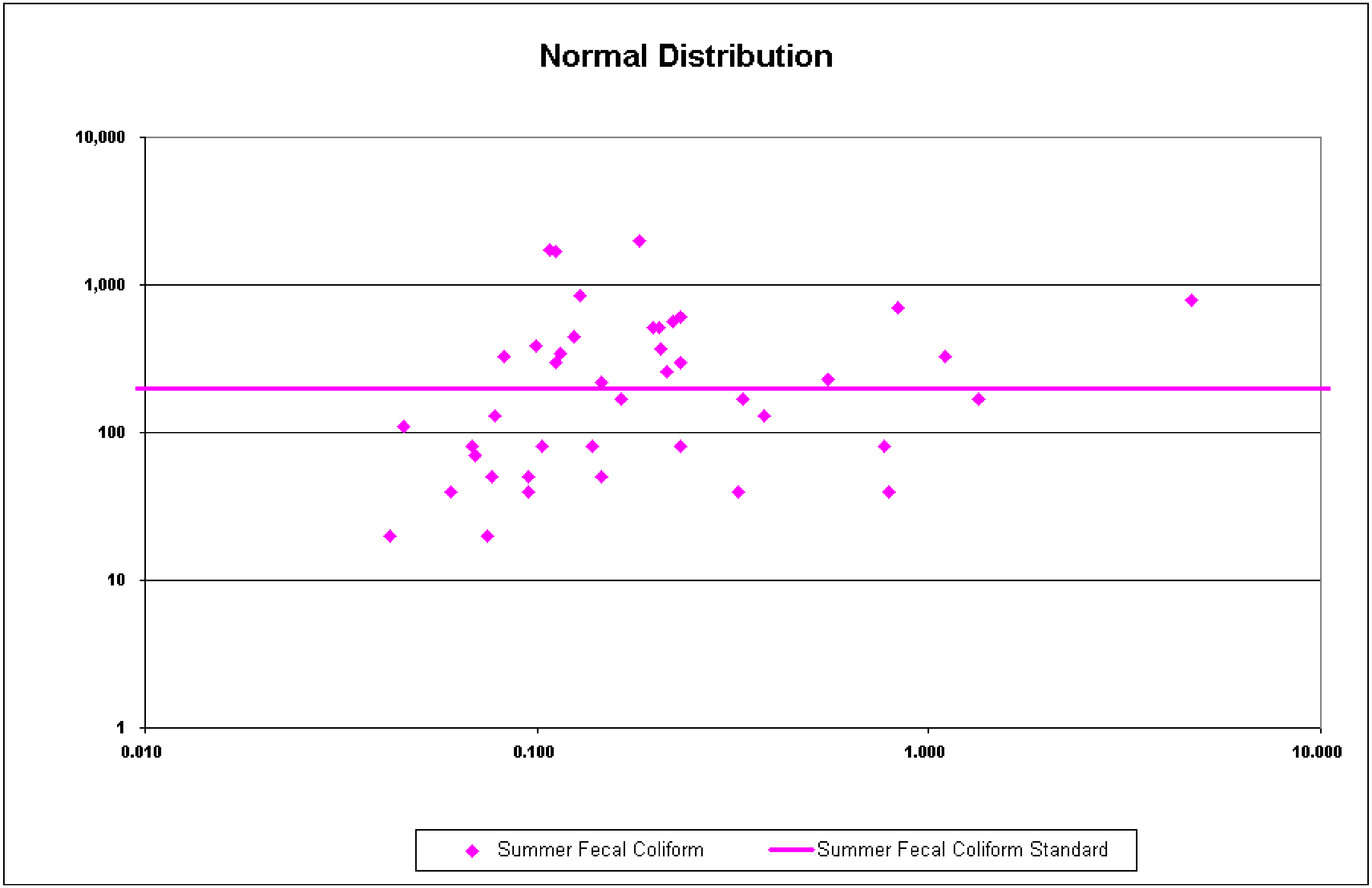
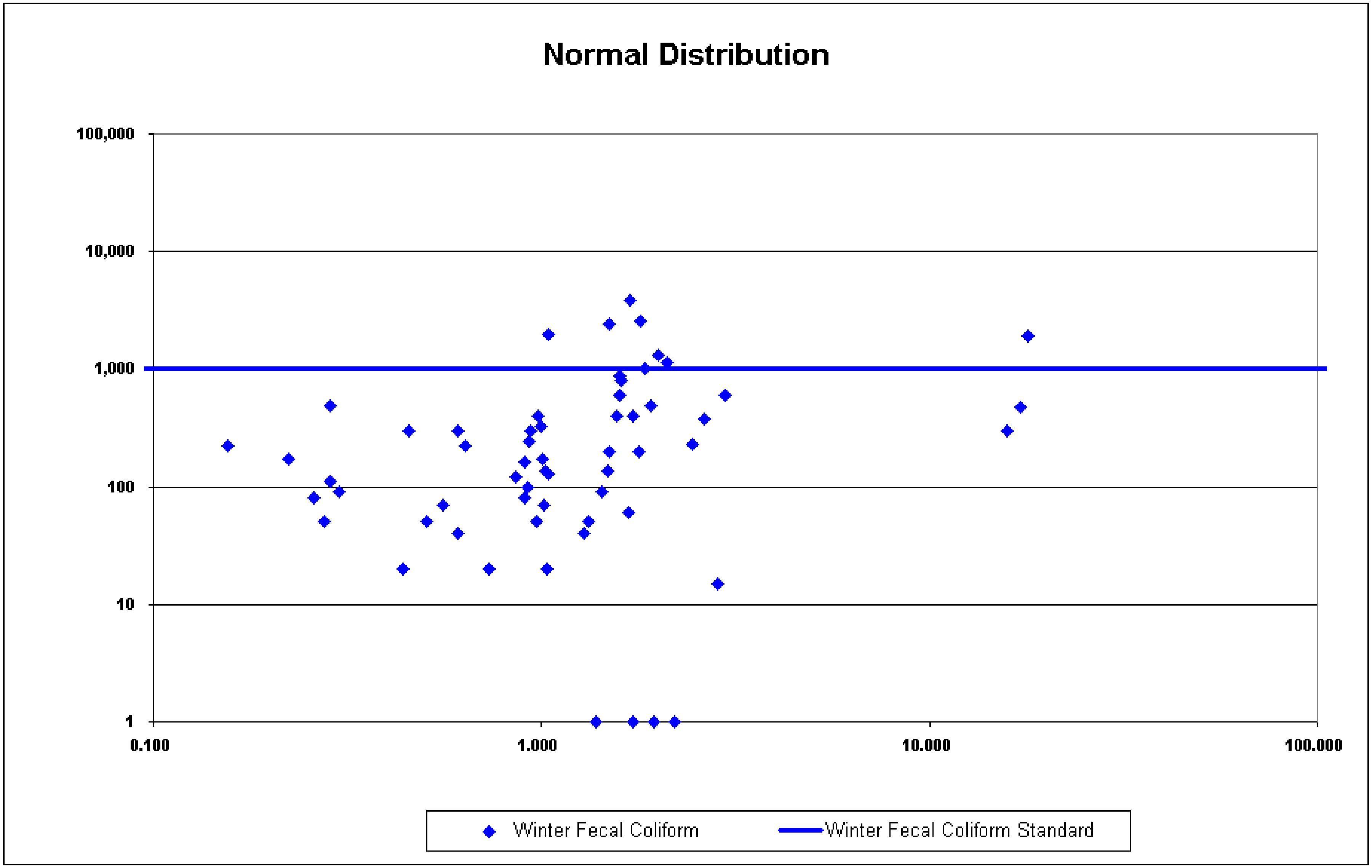
Appendix B

Normalized Flows Versus Fecal Coliform Plots


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


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