FINAL

Total Maximum Daily Load (TMDL)
for
Flint River
Assessment Unit ID # AL06030002-0401-102
Pathogens (fecal coliform)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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Figure I. §303(d) Listed Portion of Flint River in the Tennessee River Basin

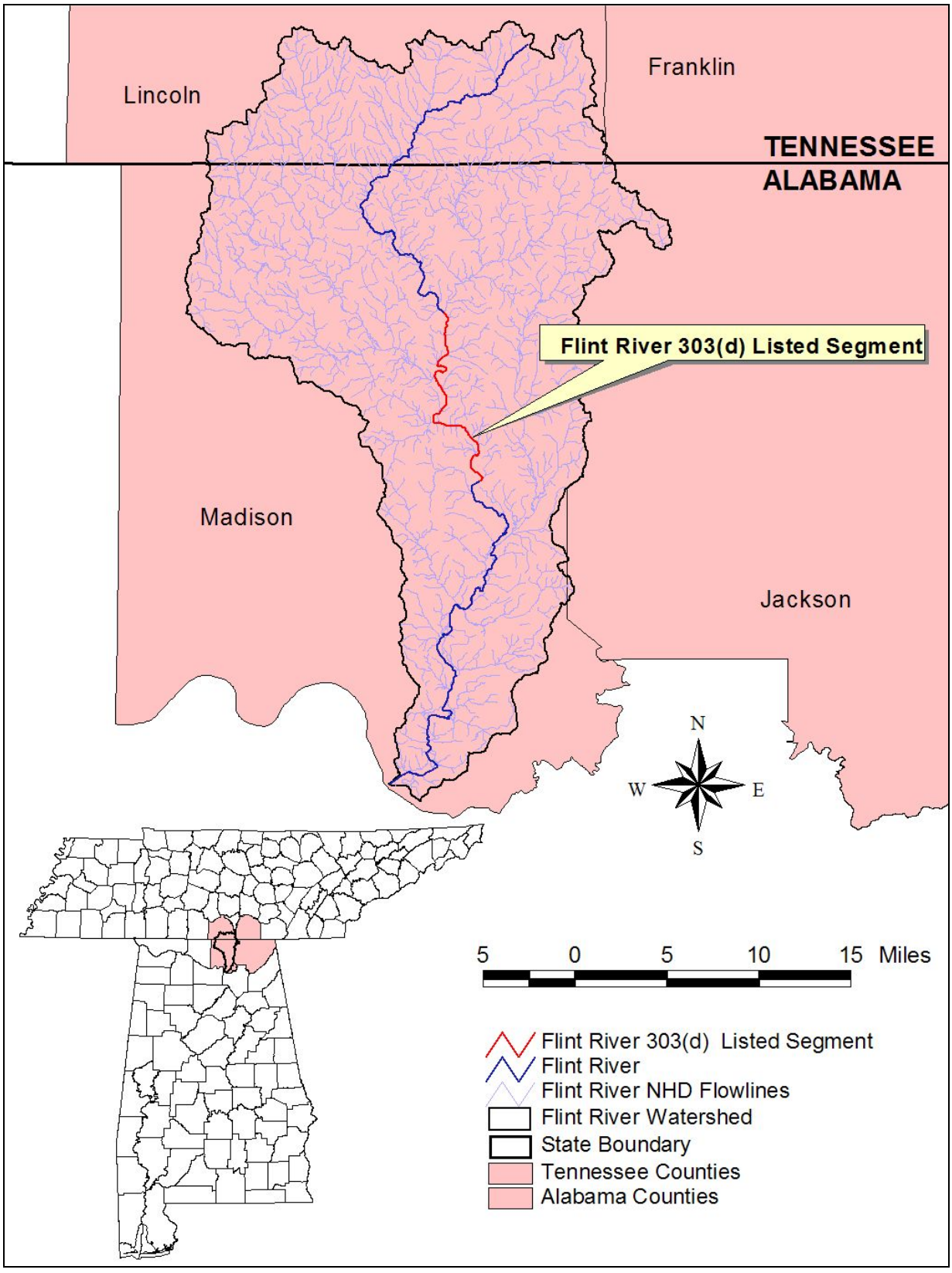


Table of Contents

List of Figures

List of Tables

1.0 Executive Summary

Flint River is located in the Tennessee River basin in the central part of North Alabama and South Tennessee. Flint River forms in southeastern Lincoln County, Tennessee and flows south through Madison County, Alabama into Wheeler Reservoir southeast of Huntsville, Alabama. The pathogens listed portion of Flint River is from U.S Highway 72 upstream to Mountain Fork of Flint River. This 15.32 mile segment was first placed on the State of Alabama's §303(d) use impairment list for pathogens in 2000. The source of the pathogens was listed as pasture grazing. The listed segment of Flint River has the designated use classification of Fish and Wildlife. This segment of the Flint River is also listed as impaired for turbidity; however, only the pathogen impairment will be addressed in this TMDL.

Data collected in 1999 by the United States Geological Survey (USGS) indicated Flint River was impaired by pathogens (fecal coliform). USGS collected 18 samples from February through October in 1999. Three of those 18 samples exceeded the 2000 colonies/100 mL single sample criterion for fecal coliform. Flint River was subsequently sampled by the Alabama Department of Environmental Management (ADEM) at multiple locations in 2003, 2004, 2005, and 2006.

In addition to the three single sample criterion violations measured in 1999 by USGS, two single sample violations were measured by ADEM: one on July 8, 2003 at FLIM-1 (Winchester Road) and the other at FLIM-2A (Brownsboro Road) on January 23, 2006. Two geometric mean concentrations greater than the June – September water quality criterion of 200 colonies/100 mL were measured in July 2003 at stations FLIM-1 and FLIM-2. No single sample or geometric mean violations were recorded at any station in 2004 or 2005.

A mass balance approach was used for calculating the pathogen Total Maximum Daily Load (TMDL) for Flint River. The mass balance approach required the highest load reduction and was chosen to determine the pathogen TMDL for Flint River. The mass balance approach utilizes the conservation of mass principle. Loads can be calculated by multiplying fecal coliform concentrations times respective instream flows. The current pathogen loading to Flint River was calculated using the geometric mean exceedance concentration from station FLIM-2 in July 2003 times the average flow for the 5 samples used to calculate the geometric mean.

Table 1-1. July 2003 Coliform Loads and Required Reductions

Source	July 2003 Exceedance Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction %
NPS load	5.45E+12 [A]	2.17E+12 [C]	3.28E+12	60%
Point Source	9.20E+07 [B]	3.87E+10 [D]	0.00E+00	0%

[A] July 2003 exceedance load minus the July 2003 point source load
[B] July 2003 point source load calculated from DMR data
[C] Total allowable load minus the total allowable point source load
[D] Total allowable point source load based on permitted point sources in July 2003

The allowable loading was calculated using the same average flow value times the fecal coliform geometric mean criterion target of 180 colonies/100 mL (200 colonies/100 mL – 10% Margin of Safety). Reductions to meet the allowable loading were then calculated by subtracting the allowable loading from the current loading. Table 1.1 is a summary of current loads and load reductions needed to meet the applicable water quality pathogen geometric mean criterion for Flint River. Table 1.2 lists the required TMDL pathogen loadings under critical conditions for Flint River.

Table 1-2. Fecal Coliform TMDL for Flint River

TMDL	Margin of Safety	Waste Load Allocation		Load Allocation	
		WWTPs	MS4s		
(colonies/day)	(colonies/day)	(colonies/day)	(% reduction)	(colonies/day)	(% reduction)
2.45E+12	2.45E+11	3.87E+10	60.3%	2.17E+12	60.3%

2.0 Basis for §303(d) Listing

2.1 Introduction

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)] require states to identify waterbodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters for a waterbody, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified the 15.32 mile segment of the Flint River from U.S. Highway 72 to Mountain Fork in Madison County as being impaired by pathogens (fecal coliform). The §303(d) listing was originally reported on Alabama's 2000 List of Impaired Waters, and subsequently included on the 2002, 2004, 2006, and 2008 lists. The source of the impairment is listed as pasture grazing on the 2008 §303(d) list.

2.2 Problem Definition

Waterbody Impaired:	Flint River from U.S. Hwy 72 to Mountain Fork.
Waterbody length:	15.32 miles
Waterbody drainage area:	418 square miles
Water Quality Standard Violation:	Fecal Coliform (single sample) Fecal Coliform (geometric mean)
Pollutant of Concern:	Pathogens (fecal coliform)
Water Use Classification:	Fish and Wildlife

Usage related to classification:
The impaired segment of Flint River is classified as Fish and Wildlife. Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

(a) Best usage of waters: fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food-processing purposes.

(b) Conditions related to best usage: the waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters: it is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage: the waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

Fecal Coliform Criteria:
Criteria for acceptable bacteria levels for the Fish and Wildlife use classification are described in ADEM Admin. Code R. 335-6-10-.09(5)(e)7(i) and (ii) as follows:

7. Bacteria:

(i) In non-coastal waters, bacteria of the fecal coliform group shall not exceed a geometric mean of 1,000 colonies/100 mL; nor exceed a maximum of 2,000 colonies/100 mL in any sample. In coastal waters, bacteria of the enterococci group shall not

exceed a maximum of 275 colonies/100 mL in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours.

(ii) For incidental water contact and recreation during June through September, the bacterial quality of water is acceptable when a sanitary survey by the controlling health authorities reveals no source of dangerous pollution and when the geometric mean fecal coliform organism density does not exceed 200 colonies/100 mL in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 colonies/100 mL nor exceed a maximum of 158 colonies/100 mL in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours. When the geometric bacterial coliform organism density exceeds these levels, the bacterial water quality shall be considered acceptable only if a second detailed sanitary survey and evaluation discloses no significant public health risk in the use of the waters. Waters in the immediate vicinity of discharges of sewage or other wastes likely to contain bacteria harmful to humans, regardless of the degree of treatment afforded these wastes, are not acceptable for swimming or other whole body water-contact sports.

Criteria Exceeded:
Water quality data collected by the United States Geological Survey (USGS) in 1999 was used for listing Flint River on Alabama's 2000 §303(d) list. At the time of the listing, waters in which less than or equal to 10% of the samples collected over a five year period exceed the single-sample maximum of 2000 colonies/100 mL or a geometric mean of 200 colonies/100 mL (June-September) or 1000 colonies/100 mL (October-May) in at least five samples collected in a thirty day period were considered to comply with Alabama's water quality standard for fecal coliform bacteria. Waters in which greater than 10% of the samples exceed the single-sample maximum of 2000 colonies/100 mL or a geometric mean of 200 colonies/100 mL (June-September) or 1000 colonies/100 mL (October-May) in at least five samples collected in a thirty day period were considered impaired and listed for pathogens (fecal coliform) on Alabama's §303(d) list.

USGS collected data on Flint River at Brownsboro Road (03575100) in February through October 1999. According to the 2000 §303(d) list fact sheet, Flint River was listed as impaired because "Of 17 samples collected by USGS in 1999, 3 samples exceeded the 2000 colonies/100 ml single sample criterion for fecal coliform bacteria."

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

For the purpose of this TMDL a geometric mean fecal coliform target of 180 colonies/100 mL will be used. This target was derived by using a 10% explicit margin of safety from the geometric mean of 200 colonies/100 mL criterion. This target should not allow the geometric mean of 200 colonies/100 mL or the single sample maximum of 2000 colonies/100 mL to be exceeded.

3.2 Source Assessment

Point Sources in the Flint River Watershed

A point source can be defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source contributions can typically be attributed to municipal wastewater facilities, illicit discharges, and leaking sewers in urban areas. Municipal wastewater treatment facilities are permitted through the National Pollutant Discharge Elimination System (NPDES) process administered by ADEM. In urban settings sewer lines can typically run parallel to streams in the floodplain. If there is a leaking sewer line, high concentrations of fecal coliform can flow into the stream or leach into the groundwater. Illicit discharges are facilities that are discharging fecal coliform bacteria when they are not permitted or they are violating their defined permit limit by exceeding the fecal coliform concentration.

In the Alabama portion of the Flint River watershed there are 17 permitted NPDES point sources as of August 01, 2007 (Table 3-1). Figure 3-1 shows the location of these facilities. Six of the 17 facilities, Tennessee Valley Sewer Authority, West Fork WWTP, Buckhorn WWTP, Banyon Creek Subdivision, Inspiration Pointe, and Union Springs WWTP, were permitted after June 1, 2006 and are not currently discharging. Gurley WWTP, Huntsville Big Cove WWTP, and Owens Cross Roads WWTP discharge downstream of the pathogen listed segment of Flint River. The 8 remaining facilities discharge directly to the pathogen listed segment of Flint River or to a tributary draining to the pathogen listed segment of Flint River. All of these NPDES permitted facilities in Alabama have a 200 colonies/100 mL monthly average and 2000 colonies/100 mL daily maximum fecal coliform permit limit for June through September. They are limited to a 1000 colonies/100 mL monthly average and 2000 colonies/100 mL daily maximum fecal coliform permit limit for October through May.

In addition to the NPDES permitted facilities in Alabama there is one NPDES permitted facility in Tennessee. Highland Rim Elementary School (TN0058939) has a 0.015 million gallons per day (MGD) permitted discharge to Harper Branch in Lincoln County, Tennessee according to the Environmental Protection Agency's PCS system. It has a daily maximum fecal coliform limit of 200 colonies/100 mL and a monthly average limit of 1000 colonies/100mL. This facility is not expected to cause or contribute to the fecal coliform criteria exceedences in Alabama.

Part of the Flint River watershed qualifies as a Municipal Separate Stormwater Sewer System (MS4) area and must be addressed in the TMDL process as part of the Wasteload Allocation (WLA). Portions of the Flint River watershed are within the boundary of the Huntsville Area Phase I MS4 (ALS000005) as well as the Madison County Phase II MS4 (ALR040014) area. Figure 3-2 shows the coverages of the MS4 areas in the Flint River watershed. Portions of the Huntsville Area Phase I MS4 overlap areas of the Madison County MS4. Contributions from these areas of the Flint River watershed draining to the pathogen listed segment will be allocated as MS4 WLAs in the TMDL.

Table 3-1. Permitted NPDES dischargers in the Flint River Basin in Alabama

Type	NPDES #	Facility Name	Stream	Flow (MGD)
SPP	AL0078409	Tennessee Valley Sewer Authority	Walker Creek	0.95
SPP	AL0078344	West Fork WWTP	West Fork Flint River	0.995
SPP	AL0066478	Hazel Green School	Flint River	0.04
SPP	AL0051691	Buckhorn High School	UT to Flint River	0.06
SPP	AL0078336	Buckhorn WWTP	Flint River	0.995
SPP	AL0051721	Sparkman Middle School	UT to Beaverdam Creek	0.045
SPP	AL0073083	Banyon Creek Subdivision	Beaverdam Creek	0.995
SPP	AL0077950	Inspiration Pointe	Beaverdam Creek	0.48
SPP	AL0069591	North County Sewer WWTP	Brier Fork	0.95
SPP	AL0078298	Union Springs WWTP	Brier Fork	3.0
Municipal	AL0057428	Huntsville Chase Creek WWTP	Flint River	4.0
Industrial	AL0071650	Giles & Kendall	UT to Flint River	0.016
SPP	AL0048810	Central School	Flint River	0.006
SPP	AL0070467	Madison County High School	Flint River	0.05
Municipal	AL0070661	Gurley WWTP	Hurricane Creek	0.20
Municipal	AL0055042	Huntsville Big Cove WWTP	Flint River	2.19
Municipal	AL0053228	Owens Cross Roads WWTP	Flint River	0.20

SPP = Semi-public/private

Figure 3-1. NPDES Permitted Point Sources in the Flint River Watershed

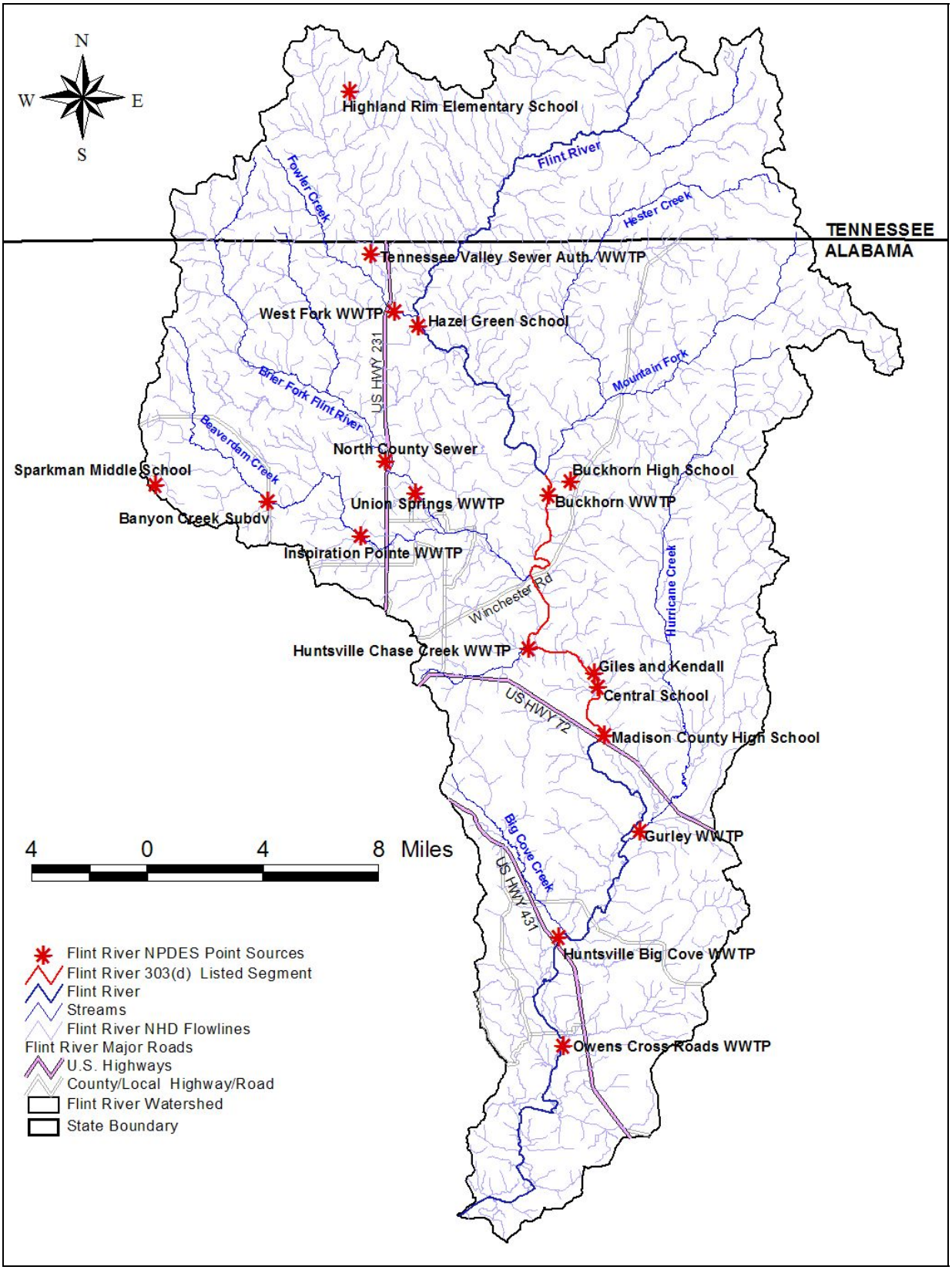
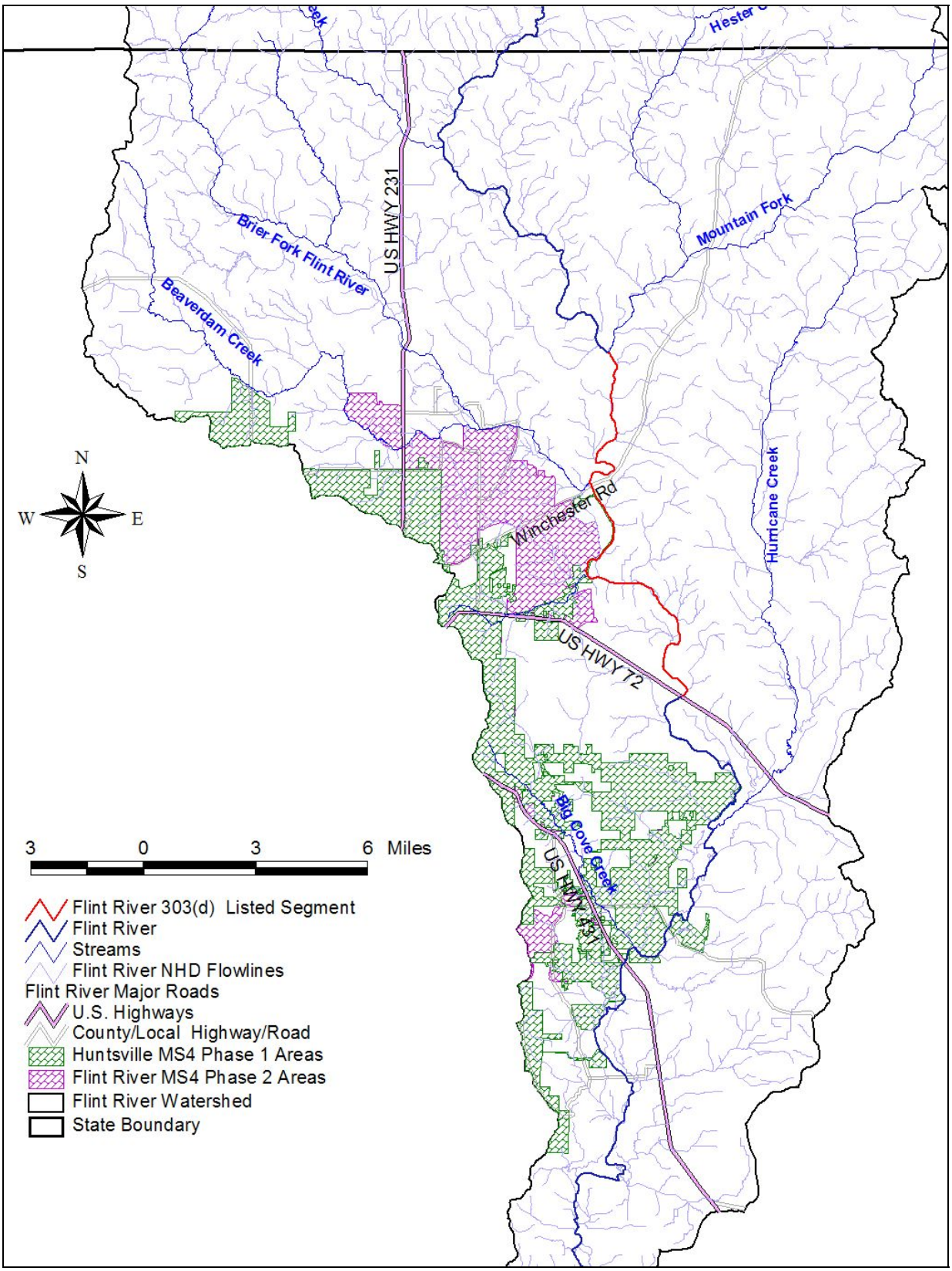


Figure 3-2. MS4 Areas in the Flint River Watershed



Nonpoint Sources in the Flint River Watershed

Nonpoint sources of fecal coliform bacteria do not have a defined discharge point, but rather, occur over the entire length of a stream or waterbody. On the land surface, fecal coliform bacteria can accumulate over time in the soil and then are washed off during rain events. As the runoff transports the sediment over the land surface, more fecal coliform bacteria are collected and carried to the stream or waterbody. Therefore, there is some net loading of fecal coliform bacteria into the stream as dictated by the watershed hydrology.

Agricultural land can be a source of fecal coliform bacteria. Runoff from pastures, confined animal feeding operations (CAFOs), improper land application of animal wastes, and animals with direct access to streams are all mechanisms that can contribute fecal coliform bacteria to waterbodies. To account for the potential influence from animals with direct access to stream reaches in the watershed, fecal coliform loads can be calculated as a direct source into the stream.

Fecal coliform bacteria can also originate from forested areas due to the presence of wild animals such as deer, raccoons, turkeys, waterfowl, etc. Wildlife deposit feces onto land surfaces where it can be transported during rainfall events to nearby streams. Control of these sources is usually limited to land management BMPs and may be impracticable in most cases. As a result, forested areas are not specifically targeted in this TMDL.

Fecal coliform loading from urban areas is potentially attributable to multiple sources including storm water runoff, illicit discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. Septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters. Onsite septic systems have the potential to deliver fecal coliform bacteria to surface waters due to system failure and malfunction.

3.3 Land Use Assessment

The Flint River watershed is comprised of twelve 12-digit hydrologic unit codes (HUCs) (Table 3-2) in the Wheeler Lake catalogue unit (06030002). The total drainage area of the Flint River watershed is 564 square miles. 441.3 square miles (78.2%) of the watershed are located in Madison County, Alabama with the remaining 122.7 square miles (21.8%) located in Lincoln County, Tennessee. Land use for the Flint River watershed was determined using ArcView with land use information derived from the 2001 National Land Cover Dataset (NLCD). Table 3-3 contains the land use areas for the Flint River watershed. Figure 3-3 is a map of land use within the Flint River.

The land use characteristics of the Flint River watershed vary significantly in Alabama and Tennessee. Approximately 71% of the land use in Tennessee is agricultural, 22% forested, and 7% developed. In Alabama, 48% of the land use is considered agricultural, 42% forested, and 8% developed. Overall, 90.4% of the Flint River watershed is used for agriculture or silviculture with only 9.6% of the land used for residential, commercial, or other uses. 52.9% of the Flint

River watershed is used for agricultural purposes with cultivated crops (25.3%) and pasture/hay (27.6%) landuses being roughly equal.

Based on these statistics, the Flint River watershed can be considered rural. However, the Flint River watershed is becoming increasingly developed as Madison County grows. Currently Madison County is the third fastest growing county in Alabama based on population increase (U.S. Census Bureau, 2007). A large percentage of the land used for silviculture and agriculture can have significant nonpoint source impacts if it is not managed properly.

Table 3-2. 12-Digit HUCs in the Flint River Watershed

12 Digit HUC	12 Digit HUC Name
060300020301	Upper Flint River- Slate Rock B
060300020302	West Fork - Flint River
060300020303	Pigrum Branch
060300020304	Mountain Fork
060300020305	Upper Brier Fork
060300020306	Beaverdam Creek
060300020307	Lower Brier Fork
060300020401	Upper Flint River - Acuff Spring
060300020402	Upper Hurricane Creek
060300020403	Lower Hurricane Creek
060300020404	Middle Flint River - Goose Creek
060300020405	Lower Flint River - Yellow Bank Creek

Figure 3-3. Land Use Map for the Flint River Watershed

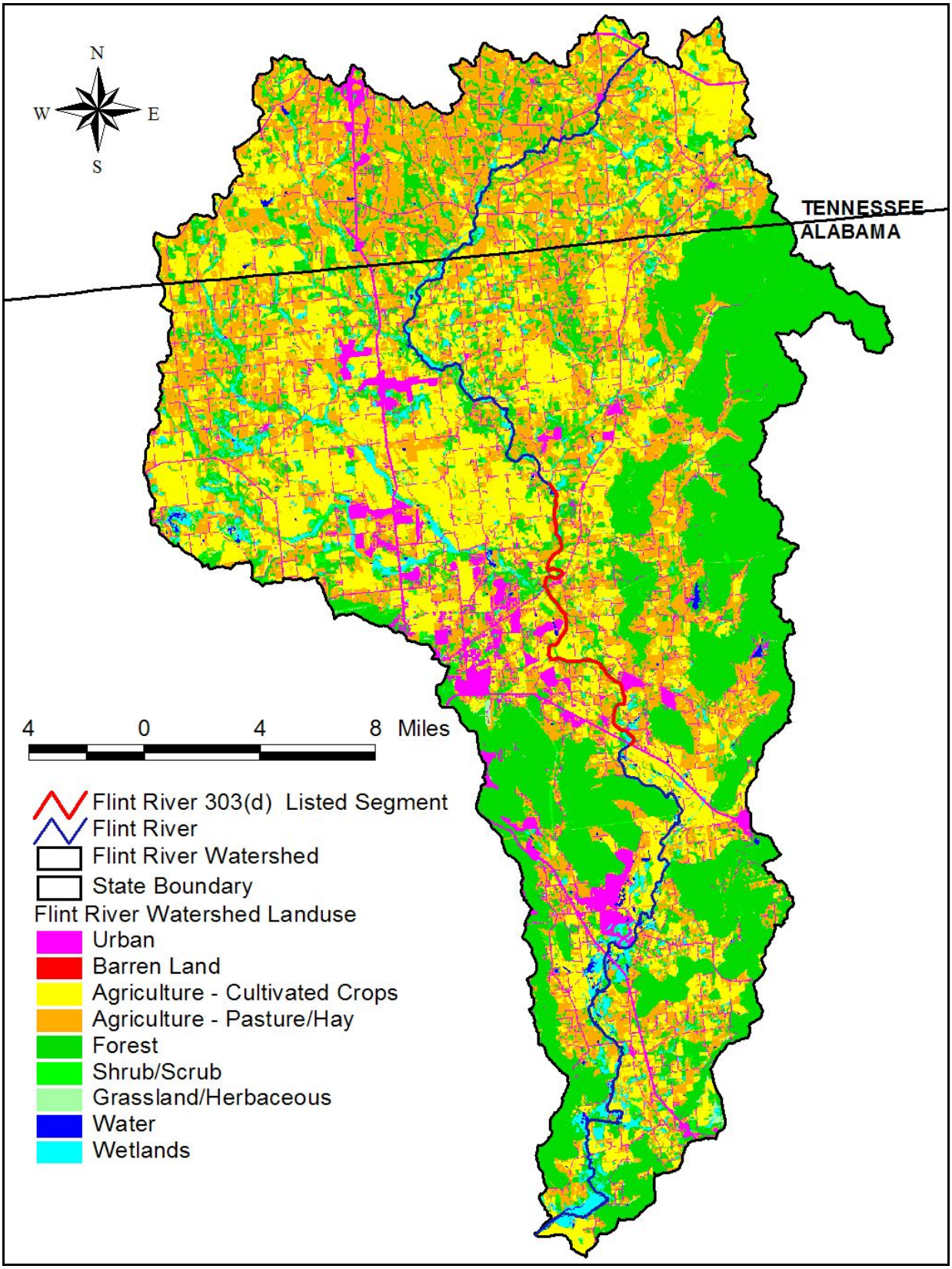


Table 3-3. Land Use Areas for the Flint River Watershed

	Flint River Watershed						Combined Watershed Totals		
	Tennessee portion			Alabama portion					
Landuse (Acres / Square Miles / Percent)	Acres	Sq. Miles	Percent	Acres	Sq. Miles	Percent	Acres	Sq. Miles	Percent
Open Water	209	0.3	0.3%	1,627	2.5	0.6%	1,835	2.9	0.5%
Developed, Open Space	4,128	6.4	5.3%	16,277	25.4	5.8%	20,405	31.9	5.7%
Developed, Low Intensity	868	1.4	1.1%	6,014	9.4	2.1%	6,881	10.8	1.9%
Developed, Medium Intensity	153	0.2	0.2%	785	1.2	0.3%	938	1.5	0.3%
Developed, High Intensity	24	0.0	0.0%	278	0.4	0.1%	302	0.5	0.1%
Barren Land (Rock/Sand/Clay)	24	0.0	0.0%	91	0.1	0.0%	115	0.2	0.0%
Deciduous Forest	12,319	19.2	15.7%	86,525	135.2	30.6%	98,844	154.4	27.4%
Evergreen Forest	85	0.1	0.1%	4,758	7.4	1.7%	4,843	7.6	1.3%
Mixed Forest	178	0.3	0.2%	5,852	9.1	2.1%	6,030	9.4	1.7%
Shrub/Scrub	2,315	3.6	2.9%	10,365	16.2	3.7%	12,680	19.8	3.5%
Grassland/Herbaceous	649	1.0	0.8%	3,548	5.5	1.3%	4,197	6.6	1.2%
Pasture/Hay	34,959	54.6	44.5%	64,544	100.8	22.9%	99,503	155.5	27.6%
Cultivated Crops	20,472	32.0	26.1%	70,907	110.8	25.1%	91,380	142.8	25.3%
Woody Wetlands	2,143	3.3	2.7%	10,775	16.8	3.8%	12,918	20.2	3.6%
Emergent Herbaceous Wetlands	1	0.0	0.0%	71	0.1	0.0%	73	0.1	0.0%
Total	**78,527**	**122.7**	**100.0%**	**282,416**	**441.3**	**100.0%**	**360,943**	**564.0**	**100.0%**
Agriculture	55,432	86.6	70.6%	135,451	211.6	48.0%	190,883	298.3	52.9%
Forest	17,041	26.6	21.7%	118,346	184.9	41.9%	135,388	211.5	37.5%
Developed	5,173	8.1	6.6%	23,353	36.5	8.3%	28,526	44.6	7.9%
Other	882	1.4	1.1%	5,265	8.2	1.9%	6,147	9.6	1.7%
Total	**78,527**	**122.7**	**100.0%**	**282,416**	**441.3**	**100.0%**	**360,943**	**564.0**	**100.0%**

3.4 Linkage Between Numeric Targets and Sources

The Flint River watershed has two main landuses: agriculture and forest. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most likely sources of pathogen loadings in the Flint River watershed are from the agricultural land uses, failing septic systems, and MS4 areas. It is not considered practicable to calculate individual components for nonpoint source loadings. Hence, there will not be individual loads or reductions calculated for different nonpoint sources such as forest, agriculture, and septic systems. The loadings and reductions will only be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

This segment of Flint River was listed for pathogens (fecal coliform) based on data collected in 1999 by USGS. USGS collected water quality data for the Flint River at Brownsboro Road (Station 03575100, ADEM Station FLIM-2A) from February 10, 1999 through October 12, 1999 (Table 3-4). Of the eighteen fecal coliform samples collected, three were greater than the single sample water quality criterion of 2000 colonies/100 mL. Two of these three measurements were collected during extremely high flows (>4000 cfs) during winter months. The necessary number of samples were not collected within the needed timeframe to calculate a geometric mean fecal coliform concentration.

Table 3-4. Fecal Coliform Data Collected by USGS in 1999 at Station 03575100

Station ID	Date	Time (24hr)	Turbidity (NTU)	USGS Flow (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor*
03575100	2/10/1999	13:30	93	1900	4200	E
03575100	2/28/1999	15:00	88	4070	8400	---
03575100	3/9/1999	15:00	11	1480	230	E
03575100	3/14/1999	9:45	83	5710	5600	---
03575100	3/25/1999	8:30	5	806	60	---
03575100	4/7/1999	14:00	2.6	613	48	---
03575100	4/19/1999	16:10	2	383	32	---
03575100	4/27/1999	8:45	250	854	1200	E
03575100	5/4/1999	15:30	7	434	130	---
03575100	5/12/1999	18:00	6	562	90	---
03575100	5/25/1999	13:45	5	306	50	E
03575100	6/8/1999	13:30	28	448	390	---
03575100	7/8/1999	8:30	16	218	200	E
03575100	7/13/1999	11:45	48	599	1900	E
03575100	7/27/1999	7:45	16	161	140	---
03575100	8/10/1999	16:30	8	118	81	---
03575100	9/7/1999	11:30	3	108	53	---
03575100	10/12/1999	10:30	6.4	96	48	---

*E – Estimated Value

ADEM conducted follow-up sampling on Flint River at three locations from 2003 through 2006. ADEM collected water quality data on the pathogen listed segment of Flint River in 2003 and 2004 at FLIM-1 and FLIM-2 as part of Alabama's §303(d) Monitoring Programs and monthly from March 2005 through February 2006 at FLIM-2A as part of the Ambient Monitoring Program. ADEM sampling station locations are presented in Table 3-5 and Figure 3-4.

Table 3-5. ADEM Sampling Stations on the Flint River Pathogens Listed Segment

Years	Station ID	Station Location	Latitude	Longitude
2003, 2004	FLIM-1	Winchester Road above the Brier Fork confluence	34.82650	-86.48270
2003, 2004	FLIM-2	Ryland Pike	34.76850	-86.44280
2005, 2006	FLIM-2A	Brownsboro Road	34.74926	-86.44666

Two fecal coliform samples collected by ADEM from 2003 through 2006 exceeded the single sample maximum criterion of 2000 colonies/100 mL. At FLIM-1 on July 8, 2003 the fecal coliform concentration was 2500 colonies/100 mL at a streamflow of 246 cfs. A fecal coliform concentration of 4300 colonies/100 mL was measured at FLIM-2A on January 23, 2006 at a streamflow of 4743 cfs. None of the other 66 samples collected at FLIM-1, FLIM-2, or FLIM-2A in 2003 through 2006 violated the single sample criterion of 2000 colonies/100 mL.

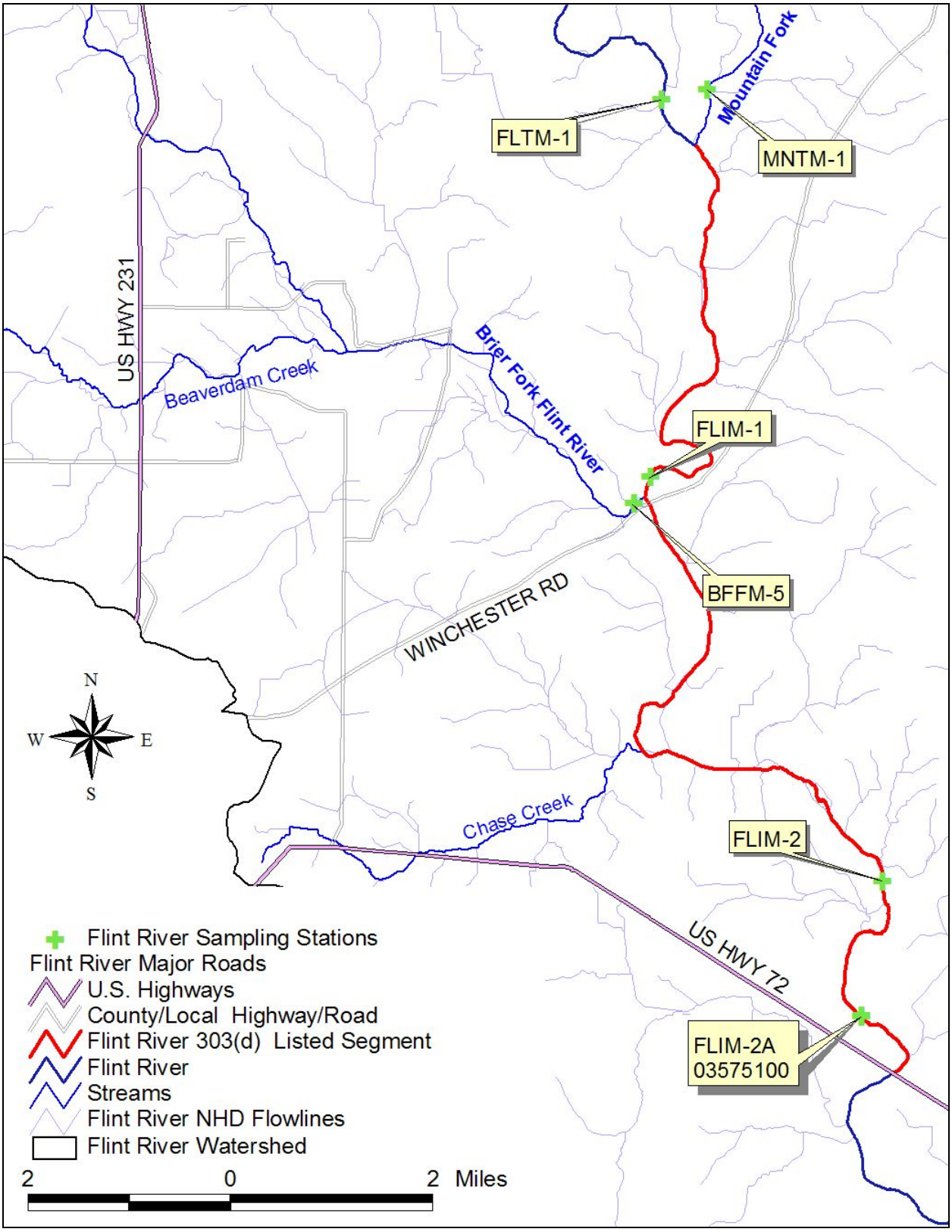
Samples were also collected in the necessary time intervals such that geometric mean values could be calculated to compare results to the 30-day geometric mean criterion of 200 colonies/100 mL. Data was collected to determine geometric mean concentrations for FLIM-1 and FLIM-2 in July and September 2003 as well as June and September 2004. At FLIM-1 and FLIM-2 the July 2003 geometric mean concentrations were 445 colonies/100 mL. None of the other geometric mean concentrations were greater than 200 colonies/100 mL. A complete list of the data collected by ADEM can be found in Appendix 7.2 of this report.

Stream flow rates are necessary when collecting fecal coliform samples so a total mass loading of fecal coliform can be calculated. Sometimes stream flows can not be measured when fecal coliform samples are collected due to unsafe conditions or the stream may not be wadeable. A stream flow could not be measured for more than half of the fecal coliform samples collected at FLIM-1 and FLIM-2 in 2003 and 2004 due to dangerous or unwadeable conditions. The USGS operates a real-time stream flow gage on Flint River at Brownsboro Road (Gage 03575100) that records flow and stage every 30 minutes. Stream flows at FLIM-1 and FLIM-2 were calculated based on a ratio of drainage areas to estimate a stream flow for each fecal coliform sample collected. The 30-minute stream flow estimates from the USGS gage at the times closest to the sample times were used to calculate the stream flows for the samples collected at FLIM-1, FLIM-2, and FLIM-2A. Stream flow estimates from the USGS gage as well as stream flows measured by ADEM during sample collection can be found in Appendix 7.2.

Station ID	Drainage Area*
FLIM-1	230.2 mi^2
FLIM-2	369.5 mi^2
FLIM-2A & USGS 03575100	372.5 mi^2

*Drainage areas estimated using ArcView

Figure 3-4. Map of ADEM and USGS Sampling Stations



ADEM has also sampled Flint River upstream of the pathogens listed segment at FLTM-1 as well as Brier Fork (BFFM-5) and Mountain Fork (MNTM-1) just upstream of their confluence with Flint River (Table 3-6). Brier Fork and Mountain Fork are two major tributaries to the §303(d) listed segment of Flint River. The only fecal coliform measurement at FLTM-1 was 34 colonies/100 mL on May 28, 2003. The maximum fecal coliform concentration measured on Brier Fork was 1800 colonies/100 mL on January 23, 2002. All other samples collected at BFFM-5 were 108 colonies/100 mL or less (Table 7-4). Mountain Fork did not have any single sample criterion exceedance in 2003 or 2004, but the geometric mean criteria was exceeded at MNTM-1 in July and September 2003 (Table 7-5). A pathogens TMDL has been developed for Mountain Fork and was approved by EPA in January 2007.

Table 3-6. ADEM Sampling Stations on Tributaries to the Flint River Pathogens Listed Segment

Years	Station ID	Station Location	Latitude	Longitude
2003	FLTM-1	Oscar Patterson Road	34.88059	-86.48555
2001, 2002	BFFM-5	Riverton Road	34.82279	-86.48050
2003, 2004	MNTM-1	Oscar Patterson Road	34.88200	-86.47250

3.6 Critical Conditions

Normally, the summer months are generally considered critical conditions. This can be explained by the nature of storm events in the summer versus the winter. Periods of dry weather interspersed with thunderstorms allow for the accumulation and washing off of fecal coliform bacteria into streams, resulting in spikes of fecal coliform bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up of fecal coliform bacteria on the land surface, resulting in a more uniform loading rate. Also, the summer fecal coliform criterion is more stringent than the winter criterion.

The Flint River watershed generally follows the trends described above for the summer months of June through September. Figure 3-5 shows that a majority of the higher concentrations of fecal coliform occur in Flint River during higher stream flows. The same holds true for the geometric mean concentrations in Figure 3-6. The maximum geometric mean concentration of 445 colonies/100 mL with an average flow of 501 cfs at FLIM-2 will be used to estimate the TMDL pathogen loadings to Flint River under critical conditions.

3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

An explicit MOS was incorporated in this TMDL. The explicit MOS includes the uncertainty of the fecal coliform data used in this analysis and the uncertainty of selecting an appropriate critical condition from the existing fecal coliform loads. A margin of safety was applied to the TMDL by reducing the criterion concentration by ten percent and calculating a mass loading target with measured flow data. The summer geometric mean criteria was reduced by ten percent to achieve the target concentrations 180 colonies/100 mL.

Figure 3-5. Flint River June – September Fecal Coliform Data

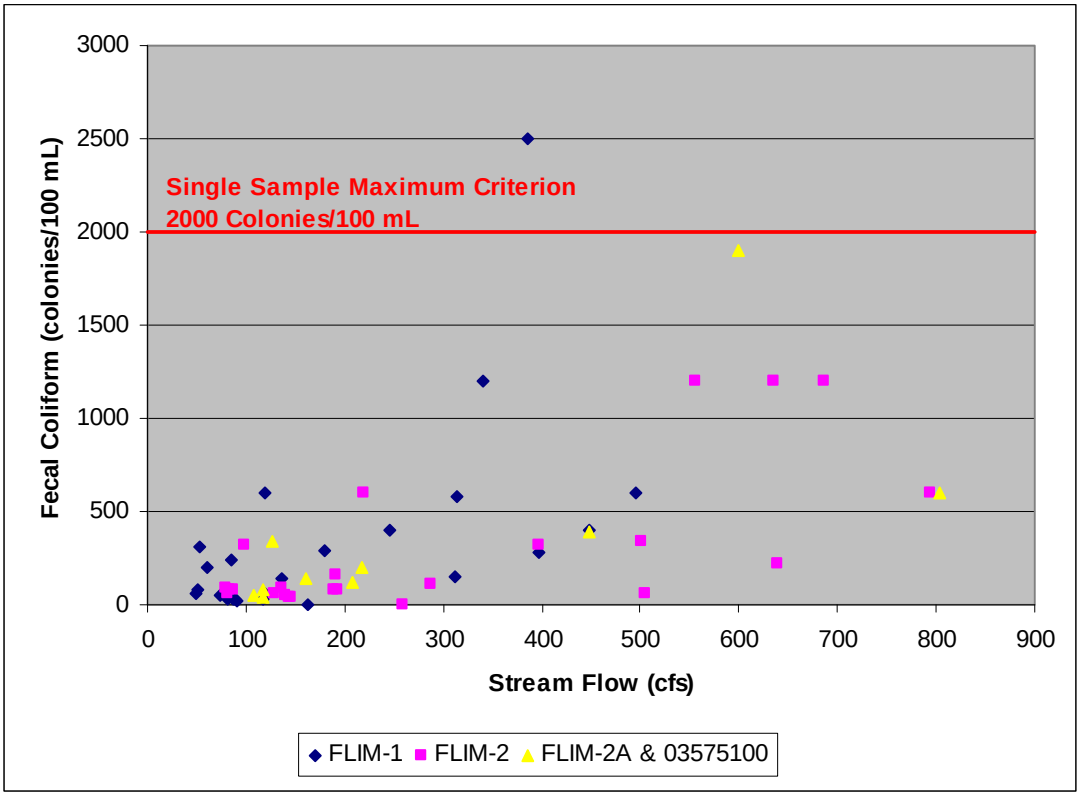
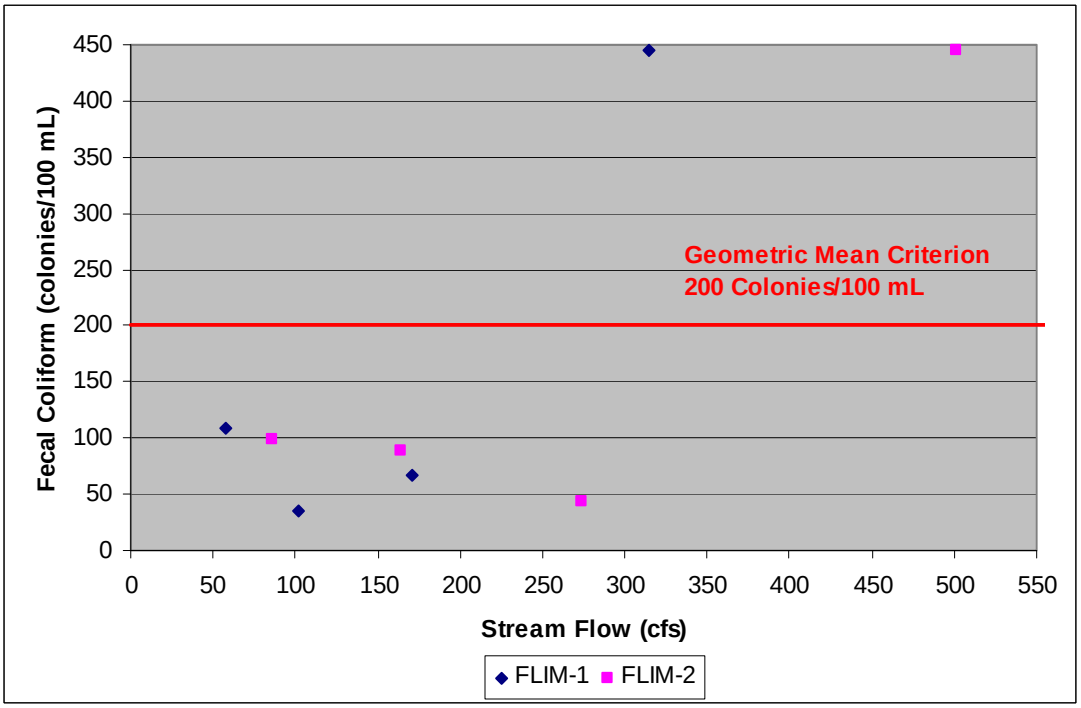


Figure 3-6. Flint River Geometric Mean Fecal Coliform Data



4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (TMDL) is the sum of individual wasteload allocations for point sources (WLAs), load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS). The margin of safety can be included either explicitly or implicitly and accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. As discussed earlier, the MOS is explicit in this TMDL. A TMDL can be denoted by the equation:

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

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions. For some pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). However, for pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i).

4.2 Load Calculations

A mass balance approach was used to calculate the pathogen TMDL for Flint River. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the fecal coliform concentration times the stream flow.

The first mass loading calculated was an estimate of the pathogen loading to the watershed during a violation event. It was done by multiplying the geometric mean sample exceedance concentration of 445 colonies/100 mL times the average flow for all five of the fecal coliform measurements. This concentration was calculated based on measurements at FLIM-2 on July 7, 8, 9, 14, and 15, 2003 and can be found in Table 7-1. The average stream flow, determined by a drainage area ratio of stream flows estimated from USGS Gage 03575100, for these five sampling events was 501 cfs. The product of these two values and a conversion factor gives the total mass loading of fecal coliform to Flint River under exceedance conditions.

$$\frac{501\,\mathrm{ft}^3}{\mathrm{s}} \times \frac{445\,\mathrm{colonies}}{100\,\mathrm{mL}} \times \frac{24465755 \quad 100\,\mathrm{mL} * \mathrm{s}}{\mathrm{ft}^3 * \mathrm{day}} = \frac{5.45 \times 10^{12}\ \mathrm{colonies}}{\mathrm{day}}$$

The second load represents the loading allowable from NPDES point sources in the watershed, the WLA. Since the exceedance condition is based on the July 2003 conditions, the loading from NPDES point sources in July 2003 must be determined. A list of NPDES permitted point sources with a discharge to the pathogen listed segment of Flint River in July 2003 is located in Table 4-1. Of those 5 facilities, Buckhorn High School, Central School, and Madison County High School did not discharge in July 2003. The only facilities actively discharging in July 2003 were the Huntsville Chase Creek WWTP and Giles & Kendall. Giles & Kendall is an industrial

facility that processes cedar trees for closet lining boards and panels and aromatic oils. Its discharge is small and is not expected to contribute fecal coliform to the Flint River.

Table 4-1. NPDES Point Sources Permitted Prior to July 2003

Type	NPDES #	Facility Name	Stream	Flow (MGD)
SPP	AL0051691	Buckhorn High School	UT to Flint River	0.06
Municipal	AL0057428	Huntsville Chase Creek WWTP	Flint River	4.0
Industrial	AL0071650	Giles & Kendall	UT to Flint River	0.016
SPP	AL0048810	Central School	Flint River	0.006
SPP	AL0070467	Madison County High School	Flint River	0.05

The WLA loading during the violation period in July 2003 only includes one point source, Huntsville Chase Creek WWTP. The discharge monitoring report (DMR) for July 2003 for the Huntsville Chase Creek WWTP shows an average flowrate of 0.81 million gallons per day (MGD) and an average fecal coliform concentration of 3 colonies/100 mL, with a maximum flowrate of 0.97 MGD and a maximum fecal coliform concentration of 14 colonies/100 mL. The mass loading from the Huntsville Chase Creek WWTP during July 2003 was:

$$\frac{0.81\times10^{6}\,\text{gal}}{\text{day}}\times\frac{3785.41\,\text{mL}}{\text{gal}}\times\frac{3\,\text{colonies}}{100\,\text{mL}}=\frac{9.20\times10^{7}\,\text{colonies}}{\text{day}}$$

Table 4-2. NPDES Point Sources included in the WLA Portion of the TMDL

Type	NPDES #	Facility Name	Stream	Flow (MGD)
SPP	AL0051691	Buckhorn High School	UT to Flint River	0.06
SPP	AL0078336	Buckhorn WWTP	Flint River	0.995
Municipal	AL0057428	Huntsville Chase Creek WWTP	Flint River	4.0
SPP	AL0048810	Central School	Flint River	0.006
SPP	AL0070467	Madison County High School	Flint River	0.05

The WLA for the TMDL will include the Huntsville Chase Creek WWTP, the 3 schools that did not discharge in July 2003, as well as the Buckhorn WWTP that has recently been permitted. All of the NPDES permitted facilities in the Flint River basin in Alabama have a 200 colonies/100 mL monthly average and 2000 colonies/100 mL daily maximum fecal coliform permit limit for June through September. They are limited to a 1000 colonies/100 mL monthly average and 2000 colonies/100 mL daily maximum fecal coliform permit limit for October through May. For this TMDL the June through September monthly average fecal coliform limit of 200 colonies/100 mL and total permitted flowrates of 5.111 MGD will be used to calculate the WLA:

$$\frac{5.111\times10^{6}\,\text{gal}}{\text{day}}\times\frac{3785.41\,\text{mL}}{\text{gal}}\times\frac{200\,\text{colonies}}{100\,\text{mL}}=\frac{3.87\times10^{10}\,\text{colonies}}{\text{day}}$$

The other NPDES permitted point sources listed in Table 3-1 and shown in Figure 3-1 do not discharge to the impaired segment and would not be expected to cause or contribute to a fecal coliform criteria exceedance in Flint River. The number of NPDES permitted point sources in the Flint River watershed has increased. This increase will likely continue if Huntsville and Madison counties continue to experience their current growth. Any new or expanded dischargers to the Flint River watershed will be required to meet a monthly discharge limit of 200 colonies/100 mL and a daily maximum limit of 2000 colonies/100 mL for fecal coliform for the months of June through September. If these facilities are meeting their permitted fecal coliform limits they will not cause or contribute to any fecal coliform criteria exceedances in Flint River. Thus, no future WLAs are included in this TMDL.

The third load represents the allowable value to the watershed under the same physical conditions as the first. This is done by taking the product of the flow used for the violation event times the conversion factor times the allowable geometric mean fecal concentration of 180 colonies/100 mL. The allowable fecal coliform loading is:

$$\frac{501\,\text{ft}^3}{\text{s}} \times \frac{180\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.21 \times 10^{12}\ \text{colonies}}{\text{day}}$$

The explicit margin of safety of 20 colonies/100 mL equals a daily loading of:

$$\frac{501\,\text{ft}^3}{\text{s}} \times \frac{20\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.45 \times 10^{11}\ \text{colonies}}{\text{day}}$$

The difference between the loading during the violation event and the allowable loading converted to a percent reduction represents the total loading reduction needed to achieve the fecal coliform water quality criterion under those specific conditions. The TMDLs were calculated as the total daily fecal coliform load to the listed segment evaluated at station FLIM-2. The MS4 areas are required to make the same percent reductions as the neighboring land uses. Table 4-3 shows the results of the fecal coliform TMDL and percent reductions.

Table 4-3. July 2003 Coliform Loads and Required Reductions

Source	July 2003 Exceedance Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction %
NPS load	5.45E+12 [A]	2.17E+12 [C]	3.28E+12	60%
Point Source	9.20E+07 [B]	3.87E+10 [D]	0.00E+00	0%

[A] July 2003 exceedance load minus the July 2003 point source load
[B] July 2003 point source load calculated from DMR data
[C] Total allowable load minus the total allowable point source load
[D] Total allowable point source load based on permitted point sources in July 2003

Table 4-4. Fecal Coliform TMDL and Percent Reductions for the Flint River at FLIM-2

TMDL	Margin of Safety	Waste Load Alocation		Load Allocation	
		WWTPs	MS4s		
(colonies/day)	(colonies/day)	(colonies/day)	(% reduction)	(colonies/day)	(% reduction)
2.45E+12	2.45E+11	3.87E+10	60.3%	2.17E+12	60.3%

4.3 TMDL Summary

Regulations require that a TMDL be established to protect water quality standards, while taking into account seasonal variations. Data from the ADEM sampling programs was collected during wet and dry seasons, thereby taking these seasonal variations into account. Data was collected during all 12 months of the year. Three single sample criterion violations were measured by USGS in February and March 1999. The geometric mean criterion was violated in July 2003 at stations FLIM-1 and FLIM-2. The single sample criterion was also exceed at FLIM-2A on January 23, 2006. No other violations of the fecal coliform criteria were measured from 2003 through 2006. Violations were recorded in the winter and summer seasons. However, all the violations were measured during periods of higher than normal flows indicating the likely cause to be nonpoint sources.

Landuse for the portion of the Flint River watershed located upstream of U.S. Highway 72 was determined and is located in Table 4-5. The watershed upstream of U.S. Highway 72 is 63% agriculture and 27% forested based on the 2001 NLCD. The most probable sources of fecal coliform in this portion of the watershed are agricultural sources, the MS4 areas, and upstream loading from the Mountain Fork watershed. Reductions in pathogens will be have to occur in this portion of the Flint River watershed upstream of U. S. Hwy 72.

Flint River was sampled upstream of the listed segment in 2003 and samples did not show any impairment from fecal coliform. Brier Fork was sampled just upstream of its confluence with Flint River in 2001 and 2002 and samples showed no impairment from fecal coliform as well. The Mountain Fork watershed has been intensively sampled and data collected on Mountain Fork and Hester Creek indicated that the water quality standards were not being met for fecal coliform. A separate TMDL for fecal coliform has been developed for the Mountain Fork watershed and approved by EPA in January 2007.

ADEM will need to verify the possible sources of fecal coliform located in the watershed upstream U.S. Highway 72 in Alabama. ADEM will also have to coordinate with the Tennessee Department of Environment and Conservation (TDEC) to determine possible sources of fecal coliform in the Flint River watershed in Tennessee. Based on results of these studies, the two agencies will need to generate a plan that can produce the needed reduction in fecal coliform using best management practices.

Table 4-5. Land Use for the Flint River Watershed Upstream of U.S. Highway 72

	Flint River Watershed Upstream of U.S. Highway 72						Combined Watershed Totals		
	Tennessee portion			Alabama portion					
Landuse (Acres / Square Miles / Percent)	Acres	Sq. Miles	Percent	Acres	Sq. Miles	Percent	Acres	Sq. Miles	Percent
Open Water	209	0.3	0.3%	491	0.8	0.3%	700	1.1	0.3%
Developed, Open Space	4,128	6.4	5.3%	10,131	15.8	6.3%	14,259	22.3	5.9%
Developed, Low Intensity	868	1.4	1.1%	3,920	6.1	2.4%	4,787	7.5	2.0%
Developed, Medium Intensity	153	0.2	0.2%	537	0.8	0.3%	690	1.1	0.3%
Developed, High Intensity	24	0.0	0.0%	242	0.4	0.1%	266	0.4	0.1%
Barren Land (Rock/Sand/Clay)	24	0.0	0.0%	46	0.1	0.0%	70	0.1	0.0%
Deciduous Forest	12,319	19.2	15.7%	31,241	48.8	19.3%	43,560	68.1	18.1%
Evergreen Forest	85	0.1	0.1%	1,962	3.1	1.2%	2,047	3.2	0.9%
Mixed Forest	178	0.3	0.2%	2,133	3.3	1.3%	2,312	3.6	1.0%
Shrub/Scrub	2,315	3.6	2.9%	6,776	10.6	4.2%	9,090	14.2	3.8%
Grassland/Herbaceous	649	1.0	0.8%	2,294	3.6	1.4%	2,943	4.6	1.2%
Pasture/Hay	34,960	54.6	44.5%	42,086	65.8	26.0%	77,046	120.4	32.1%
Cultivated Crops	20,472	32.0	26.1%	53,099	83.0	32.8%	73,571	115.0	30.6%
Woody Wetlands	2,143	3.3	2.7%	6,740	10.5	4.2%	8,884	13.9	3.7%
Emergent Herbaceous Wetlands	1	0.0	0.0%	32	0.1	0.0%	34	0.1	0.0%
Total	**78,527**	**122.7**	**100%**	**161,731**	**252.7**	**100%**	**240,258**	**375.4**	**100%**
Agriculture	55,432	86.6	70.6%	95,185	148.7	58.9%	150,617	235.3	62.7%
Forest	17,041	26.6	21.7%	48,884	76.4	30.2%	65,925	103.0	27.4%
Developed	5,173	8.0	6.6%	14,830	23.2	9.2%	20,002	31.3	8.3%
Other	882	1.4	1.1%	2,832	4.4	1.8%	3,714	5.8	1.5%
Total	**78,527**	**122.7**	**100.00%**	**161,731**	**252.3**	**95.38%**	**240,258**	**375.4**	**96.73%**

5.0 Follow Up Monitoring

ADEM has adopted a basin approach to water quality management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, the ADEM water quality resources are concentrated in one of the five basin groups. One goal is to continue to monitor §303(d) listed waters. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed. This monitoring will occur in each basin according the schedule shown.

Table 5-1. §303(d) Follow Up Monitoring Schedule

River Basin Group	Year to be Monitored
Chattahoochee / Chipola / Choctawhatchee / Perdido-Escambia	2008
Tennessee	2009
Alabama / Coosa / Tallapoosa	2010
Escatawpa / Mobile / Lower Tombigbee / Upper Tombigbee	2011
Black Warrior / Cahaba	2012

6.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL was made available on ADEM's Website: www.adem.state.al.us. The public can also request paper or electronic copies of the TMDL by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. The public was given an opportunity to review the TMDL and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period became part of the administrative record. ADEM considered all comments received by the public prior to finalization of this TMDL and subsequent submission to EPA Region 4 for final review and approval.

Appendix 7.1

References

ADEM Administrative Code, 2007. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2007. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2001, 2002, 2003, and 2004. ADEM.

Alabama's Ambient/Trend Monitoring Program. 2005 and 2006. ADEM

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, December 2005.

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U.S. Census Bureau, 2007. Table 3: Estimates of Population Change for Counties of Alabama and County Rankings: July 1, 2005 to July 1, 2006 (CO-EST2006-03-01). Population Division, March 22, 2007

United States Environmental Protection Agency, 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. Office of Water. EPA 440/4-91-001.

United States Environmental Protection Agency, PCS website. http://www.epa.gov/enviro/html/pcs/index.html

United States Geological Survey. Water Quality of the Flint River Basin, Alabama and Tennessee, 1999-2000. Water-Resources Investigations Report 01-4185. 2002

Appendix 7.2

Water Quality Data

Table 7-1. Pathogen Data Collected by ADEM at Stations FLIM-1 and FLIM-2 in 2003

Station ID	Date	Time (24hr)	Turb-Field (NTU)	Stream Flow (cfs)	USGS Flow from DA ratio (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor*	Daily Criterion	Fecal Geomean (col/100ml)	30-Day Geometric Mean Criterion
FLIM-1	3/20/2003	9:30	66.0	flow conditions dangerous	1237.8	1200	G	OK		
FLIM-1	4/10/2003	13:00	14.3	flow conditions dangerous	867.2	250	---	OK		
FLIM-1	5/13/2003	11:45	18.9	flow conditions dangerous	702.9	176	---	OK		
FLIM-1	6/18/2003	11:15	85.0	flow conditions dangerous	340.3	1200	G	OK		
FLIM-1	7/7/2003	9:04	58.0	not wadeable (too deep)	311.8	150	---	OK	445	VIOLATION
FLIM-1	7/8/2003	12:00	27.0	362.4	385.9	2500	---	VIOLATION		
FLIM-1	7/9/2003	12:15	24.3	246.8	245.4	400	---	OK		
FLIM-1	7/14/2003	9:45	18.0	97.9	179.8	292	---	OK		
FLIM-1	7/15/2003	9:55	27.7	not wadeable (too deep)	448.4	400	---	OK		
FLIM-1	8/5/2003	10:30	10.0	125.1	118.2	57	---	OK		
FLIM-1	9/4/2003	10:30	6.2	not wadeable (too deep)	60.0	200	---	OK	108	OK
FLIM-1	9/8/2003	10:30	5.9	81.3	53.8	310	---	OK		
FLIM-1	9/10/2003	9:.30	6.1	73.4	49.9	64	---	OK		
FLIM-1	9/18/2003	9:40	4.3	57.5	51.8	82	---	OK		
FLIM-1	9/30/2003	9:50	4.0	55.8	73.2	46	---	OK		
FLIM-1	10/16/2003	11:30	2.0	85.4	53.7	52	---	OK		
FLIM-2	3/20/2003	13:00	56.0	flow conditions dangerous	1651.8	1200	---	OK		
FLIM-2	4/10/2003	12:45	16.9	flow conditions dangerous	873.4	310	---	OK		
FLIM-2	5/13/2003	11:15	24.6	flow conditions dangerous	1137.2	200	---	OK		
FLIM-2	6/18/2003	10:45	103.3	flow conditions dangerous	555.1	1200	G	OK		
FLIM-2	7/7/2003	9:25	48.2	flow conditions dangerous	500.5	340	---	OK	445	VIOLATION
FLIM-2	7/8/2003	11:15	41.0	flow conditions dangerous	635.4	1200	G	OK		
FLIM-2	7/9/2003	11:55	32.3	not wadeable (too deep)	396.4	320	---	OK		
FLIM-2	7/14/2003	10:10	19.0	not wadeable (too deep)	286.9	112	---	OK		
FLIM-2	7/15/2003	10:20	402.1	not wadeable (too deep)	685.7	1200	G	OK		
FLIM-2	8/5/2003	11:15	15.0	225.9	192.5	80	---	OK		
FLIM-2	9/4/2003	11:30	5.1	not wadeable (too deep)	98.0	320	---	OK	99	OK
FLIM-2	9/8/2003	10:15	4.7	150.9	86.4	82	---	OK		
FLIM-2	9/10/2003	10:00	5.4	not wadeable (too deep)	80.0	86	---	OK		
FLIM-2	9/11/2003	10:40	3.7	145.6	81.6	56	---	OK		
FLIM-2	9/18/2003	10:20	4.4	96	83.2	77	---	OK		
FLIM-2	10/16/2003	10:30	3.0	148.1	86.2	46	---	OK		

*G - The actual number was probably greater than the number reported

Table 7-2. Pathogen Data Collected by ADEM at Stations FLIM-1 and FLIM-2 in 2004

Station ID	Date	Time (24hr)	Turb-Field (NTU)	Stream Flow (cfs)	USGS Flow from DA ratio (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor*	Daily Criterion	Fecal Geomean (col/100ml)	30-Day Geometric Mean Criterion
FLIM-1	6/1/2004	9:55	32.7	flow conditions dangerous	163.2	1		OK		
FLIM-1	6/8/2004	11:20	37.8	151.7	119.5	600	G	OK		
FLIM-1	6/21/2004	11:20	6.1	81.5	89.7	33	---	OK	67	OK
FLIM-1	6/23/2004	11:10	11.7	flow conditions dangerous	84.9	240	---	OK		
FLIM-1	6/28/2004	9:20	22.5	flow conditions dangerous	398.0	280	---	OK		
FLIM-1	7/1/2004	8:56	9.2	flow conditions dangerous	314.0	580	---	OK		
FLIM-1	7/8/2004	9:50	53.0	not wadeable (too deep)	495.0	600	G	OK		
FLIM-1	8/16/2004	10:00	3.6	108.6	91.2	18	---	OK		
FLIM-1	8/17/2004	11:15	3.3	88.7	87.0	26	---	OK		
FLIM-1	8/19/2004	10:47	4.0	57.5	81.7	26	---	OK	35	OK
FLIM-1	8/30/2004	11:05	18.0	not wadeable (too deep)	135.6	140	---	OK		
FLIM-1	9/1/2004	11:05	5.5	85.5	116.4	32	---	OK		
FLIM-2	6/1/2004	9:25	19.0	not wadeable (too deep)	258.6	1	<MDL	OK		
FLIM-2	6/8/2004	10:30	38.6	226.2	191.8	164	---	OK		
FLIM-2	6/21/2004	10:30	11.2	177	144.1	44	---	OK	43	OK
FLIM-2	6/23/2004	10:45	6.3	flow conditions dangerous	136.4	92	---	OK		
FLIM-2	6/28/2004	9:00	27.6	flow conditions dangerous	638.9	220	---	OK		
FLIM-2	7/1/2004	9:20	11.2	not wadeable (too deep)	504.0	62	---	OK		
FLIM-2	7/8/2004	10:10	47.0	not wadeable (too deep)	794.7	600	G	OK		
FLIM-2	8/16/2004	9:35	3.2	197.8	146.3	40	---	OK		
FLIM-2	8/17/2004	10:40	4.0	181	139.6	51	---	OK		
FLIM-2	8/19/2004	10:05	3.4	122.6	129.0	58	---	OK	89	OK
FLIM-2	8/30/2004	10:40	70.0	flow conditions dangerous	219.2	600	G	OK		
FLIM-2	9/1/2004	10:05	7.9	184.4	189.1	80	---	OK		

*G - The actual number was probably greater than the number reported

*<MDL - Less than method detection limit

Table 7-3. Pathogen Data Collected by ADEM at Station FLIM-2A

Station ID	Date	Time (24hr)	Turb-Field (NTU)	USGS Flow (cfs)	Stream Flow (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor*	Daily Criterion
FLIM-2A	3/15/2005	10:35	6.5	510	499	8	---	OK
FLIM-2A	4/26/2005	10:35	4.7	455	441	51	---	OK
FLIM-2A	5/12/2005	9:35	2.8	254	241	27	---	OK
FLIM-2A	6/9/2005	9:35	421.0	803	791	600	G	OK
FLIM-2A	7/14/2005	9:35	13.4	208	191	117	---	OK
FLIM-2A	8/17/2005	9:05	10.2	126	139	340	---	OK
FLIM-2A	9/21/2005	10:05	9.3	117	111 (estimated)	45	---	OK
FLIM-2A	10/19/2005	9:05	6.6	103	105	20	---	OK
FLIM-2A	11/1/2005	10:45	5.1	99	107	25	JH	OK
FLIM-2A	12/14/2005	10:07	5.0	226	235	37	JH	OK
FLIM-2A	1/23/2006	16:05	129.0	4743	699	4300	JH	VIOLATION
FLIM-2A	2/21/2006	10:05	7.0	505	501	24	JH	OK

*G - The actual number was probably greater than the number reported
*JH - Reported microbiological result is an estimate. The analytical holding time for analysis was exceeded.

Table 7-4. Pathogen Data Collected by ADEM at Station BFFM-5

Station_ID	Date	Time (24hr)	Turb-Field (NTU)	Stream Flow (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor
BFFM-5	11/28/2001	7:20	5.27	125.80	85	---
BFFM-5	1/9/2002	15:55	5.86	flow conditions dangerous	57	---
BFFM-5	1/23/2002	14:25	353	not wadeable	1800	---
BFFM-5	2/12/2002	9:00	3.66	not wadeable	21	---
BFFM-5	4/2/2002	15:30	12.2	not wadeable	108	---
BFFM-5	4/24/2002	16:00	229	not wadeable	20	---
BFFM-5	5/22/2002	15:30	5.59	not wadeable	35	---
BFFM-5	6/12/2002	15:20	3.96	no visible flow	104	---

Table 7-5. Pathogen Data Collected by ADEM at Station MTNM-1

Station ID	Date	Time (24hr)	Turb-Field (NTU)	Stream Flow (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor	Fecal Geomean (col/100ml)
MTNM-1	7/10/2003	10:05	39.3	not wadeable (too deep)	40	---	304
MTNM-1	7/14/2003	10:50	17.2	not wadeable (too deep)	470	---	
MTNM-1	7/15/2003	11:10	153.0	not wadeable (too deep)	1780	---	
MTNM-1	7/16/2003	11:15	50.8	not wadeable (too deep)	250	---	
MTNM-1	7/17/2003	11:20	32.5	not wadeable (too deep)	310	---	
MTNM-1	9/4/2003	11:45	20.5	visible but not detectable	1300	---	246
MTNM-1	9/10/2003	11:45	7.0	no visible flow	580	---	
MTNM-1	9/11/2003	11:47	6.4	no visible flow	152	---	
MTNM-1	9/18/2003	11:20	50.2	no visible flow	62	---	
MTNM-1	9/30/2003	11:00	13.2	visible but not detectable	128	---	
MTNM-1	6/10/2004	9:30	38.1	not wadeable (too deep)	196	---	181
MTNM-1	6/14/2004	9:40	12.9	visible but not detectable	188	---	
MTNM-1	6/16/2004	9:00	13.4	not wadeable (too deep)	188	---	
MTNM-1	6/17/2004	9:15	13.1	not wadeable (too deep)	140	---	
MTNM-1	6/21/2004	9:45	12.2	visible but not detectable	200	---	
MTNM-1	7/6/2004	10:05	32.1	not wadeable (too deep)	320	---	
MTNM-1	7/7/2004	10:10	116.9	not wadeable (too deep)	1	---	
MTNM-1	8/18/2004	9:55	7.6	no visible flow	112	---	
MTNM-1	9/2/2004	9:10	86.5	not wadeable (too deep)	1500	---	
MTNM-1	9/8/2004	10:35	13.3	no visible flow	220	---	