FINAL

Total Maximum Daily Load (TMDL)
For
Collins Creek
Assessment Unit ID # AL03170008-0402-700
Pathogens (fecal coliform)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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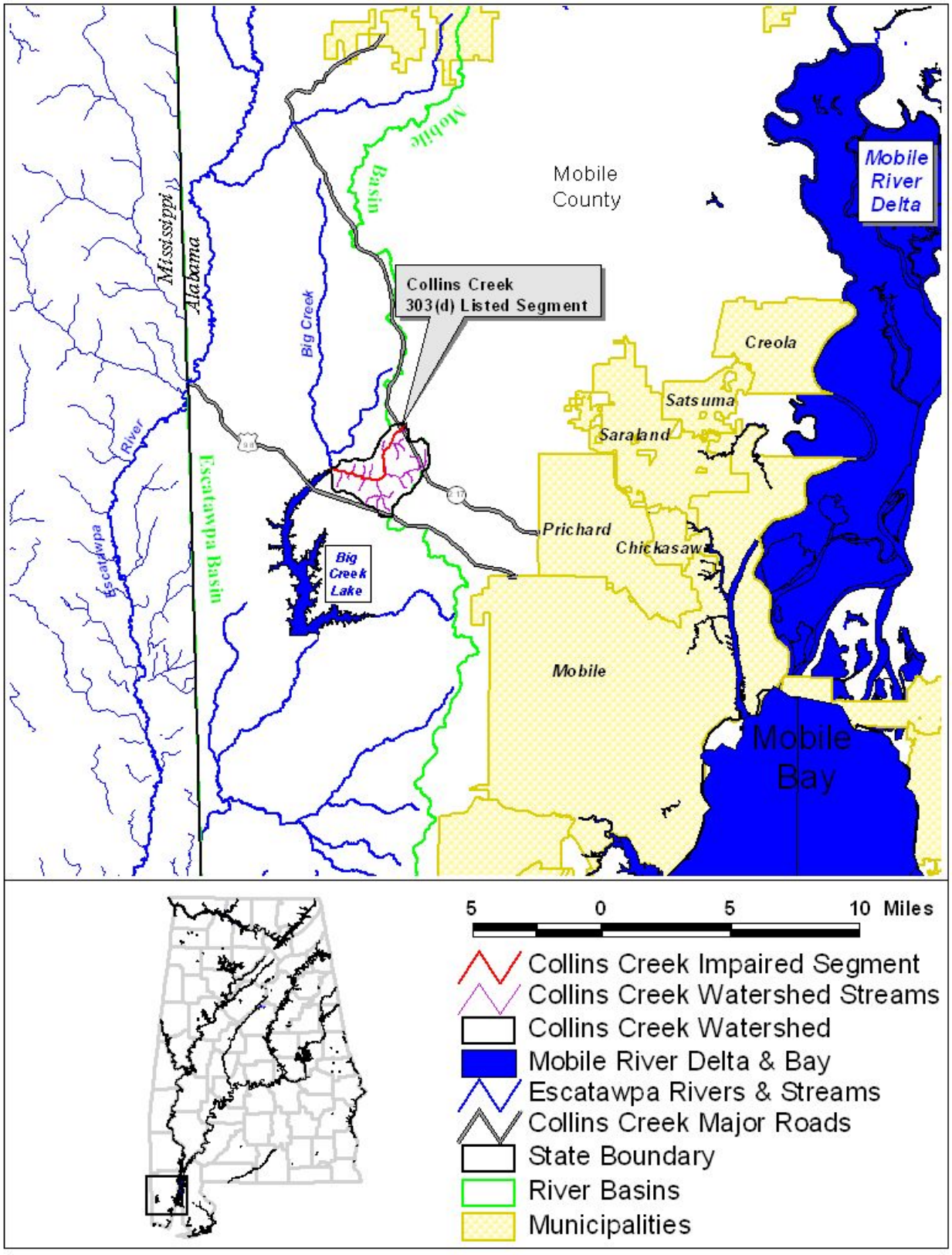
Figure 1-1. Listed Portion of Collins Creek in the Escatawpa River Basin



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1.0 Executive Summary

Section §303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A 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).

Collins Creek is on the §303(d) list for pathogens (fecal coliform) from its source to Big Creek. Collins Creek forms in west Mobile County, in the Escatawpa River Basin. It flows into the northern most part of the impounded portion of Big Creek (Big Creek Lake). The total length of Collins Creek is 5.15 miles, of which all is on the §303(d) list. The total drainage area of Collins Creek is 8.33 square miles, of which all drains to the impaired segment. Collins Creek has a use classification of Fish & Wildlife (F&W).

Collins Creek was first listed on the §303(d) list in 2000 based on data collected from 1996 through 1999 by the United States Geological Survey (USGS) which indicated the stream was impaired for pathogens (fecal coliform). The data was collected from station 2479950 and can be found in Appendix 7.2, Table 7-1. Collins Creek has subsequently been listed on the 2002, 2004, 2006, and 2008 §303(d) lists of impaired waterbodies.

In 2001-2002 and 2007, §303(d) sampling studies were performed by ADEM on Collins Creek to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2007 data will be used to assess the water quality of Collins Creek because it was collected less than six years ago and provides the most current representation of water quality conditions. The January 2008 edition of ***Alabama's Water Quality Assessment and Listing Methodology*** section 4.8.2, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody when that data indicates a change in water quality has occurred. The 2001-2002 data will be listed in Appendix 7.2 for reference. ADEM collected 14 samples from Collins Creek in 2007. According to the data collected in 2007, Collins Creek was not meeting the pathogen criterion applicable to its use classification of Fish and Wildlife. Therefore, a TMDL will be developed for pathogens on the listed reach.

A mass balance approach was used for calculating the pathogen TMDL for Collins Creek. The mass balance approach utilizes the conservation of mass principle. Loads were calculated by multiplying the fecal coliform concentrations times respective instream flows. The mass loading was calculated using the geometric mean sample exceedance since it was the only violation in 2007. In the same manner, an allowable load was calculated for the geometric mean criterion of 200 colonies/100 mL. The TMDL was based on this violation and resulted in a percent reduction of fecal coliform loading necessary to achieve applicable water quality for the geometric mean criterion.

The existing pathogen loading for this TMDL was calculated using the geometric mean exceedance concentration of 280 colonies/100 mL from August through September 2007 times the average flow of the five samples (6.96 cfs). The allowable loading, defined by the geometric

mean criterion including a margin of safety, was calculated using the same average flow value times the fecal coliform geometric mean target of 180 colonies/100 mL (200 colonies/100 mL – 10% Margin of Safety). The reduction required to meet the allowable loading was then calculated by subtracting the allowable loading from the existing loading.

Table 1-1 is a summary of estimated existing load, allowable load, and percent reduction for the geometric mean criterion. Table 1-2 lists the TMDL defined as the maximum allowable pathogen loading under critical conditions (summer months) for Collins Creek.

Table 1-1. 2007 Coliform Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
NPS Load Geometric Mean	4.77E+10	3.07E+10	1.70E+10	36%

Table 1-2. Fecal Coliform TMDL for Collins Creek

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation(LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	(% reduction)	(col/day)	(col/day)	(% reduction)
3.41E+10	3.41E+09	NA	NA	0	3.07E+10	36%

a. There are no CAFOs in the Collins Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum; NA = not applicable, no point sources. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. NA = not applicable, no regulated MS4 areas. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in fecal coliform loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for fecal coliform.

Compliance with the terms and conditions of existing and future NPDES permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria and we are committed towards targeting the load reductions to improve water quality in the Collins Creek watershed. As additional data and/or information becomes available, it may become necessary to revise and/or modify the TMDL accordingly.

2.0 Basis for §303(d) Listing

2.1 Introduction

Section §303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the total maximum daily load (TMDL) for pollutants causing use impairment. The TMDL process establishes the allowable loading of pollutants for a waterbody based on the relationship between pollution sources and instream water quality conditions, so that states can establish water-quality based controls to reduce pollution and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified the 5.15 miles of Collins Creek as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 2000 List of Impaired Waters based on USGS data collected between 1996 and 1999 and subsequently included on the 2002, 2004, 2006, and 2008 lists. The source of the impairment is listed on the 2008 §303(d) list as pasture grazing and on-site wastewater systems.

2.2 Problem Definition

Waterbody Impaired:	Collins Creek – From Big Creek to its source
Impaired Reach Length:	5.15 miles
Impaired Drainage Area:	8.32 square miles
Water Quality Standard Violation:	Fecal Coliform (single sample)
Pollutant of Concern:	Pathogens (fecal coliform)
Water Use Classification:	Fish and Wildlife

Usage Related to Classification:
The impaired stream segment is classified as Fish and Wildlife (F&W). 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 Criterion:
Criterion for acceptable bacteria levels for the F&W use classification is 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 col/100 mL; nor exceed a maximum of 2,000 col/100 mL in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 col/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 col/100 mL in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 col/100 mL nor exceed a maximum of 158 col/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) from 1996 to 1999 was used for listing Collins Creek 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 single sample data on Collins Creek at Glenwood Road (02479950) near Fairview, AL, from January 1996 through August 1999. According to the 2000 §303(d) list fact sheet, Collins Creek was listed as impaired because "Of 23 samples collected by USGS between 1996 and 1999 at station 2479950, 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 is considered protective of water quality standards and should not allow the geometric mean of 200 colonies/100 mL (summer F&W criteria) to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Collins Creek 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 found at 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.

Continuous Point Sources
There are no point sources in the Collins Creek watershed which would cause or contribute to the fecal coliform loading. Therefore, the WLA portion of the TMDL will not be applicable.

Any future NPDES regulated discharges that are considered by the Department to be a pathogen source will be required to meet the instream water quality criteria for pathogens at the point of discharge.

Non-Continuous Point Sources
Currently there are no Municipal Separate Stormwater Sewer System (MS4) areas located within the Ryan Creek watershed.

Also, there have been no reported sanitary sewer overflows (SSOs) that have occurred in the Collins Creek watershed. SSOs have the potential to severely impact water quality and can often result in the violation of water quality standards. It is the responsibility of the NPDES wastewater discharger, or collection system operator for non-permitted "collection only" systems, to ensure that releases do not occur. Unfortunately releases to surface waters from SSOs are not always preventable or reported

Future NPDES regulated stormwater discharges will be required to demonstrate consistency with the assumptions and requirements of this TMDL.

3.2.2 Nonpoint Sources in the Collins Creek 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.

Due to the absence of point sources, nonpoint sources are believed to be the primary source of fecal coliform bacteria in the Collins Creek watershed. Land use in this watershed is primarily rural, consisting of 10.13% developed, 19.58% agriculture (pasture/hay and row crops), and 35.08% forested.

Agricultural land can be a source of fecal coliform bacteria. Runoff from pastures, animal feeding areas, 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, turkey, 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.

- During a site visit on 2/11/2009 by ADEM personnel, the Collins Creek watershed was observed to have several agricultural and cattle operations. The one that was surveyed

was completely fenced in (Please see photo 7-1 in Appendix 7.3). Also, walking along Collins Creek one instance of animal waste was observed (Please see photo 7-2 in Appendix 7.3).

- At the sampling location (CLNM-1 at Glenwood Road) ADEM personnel, during a site visit, observed large amounts of stormwater runoff and large quantities of debris and trash in the stream (Please see photos 7-3, 7-4, and 7-5 in Appendix 7.3). Looking upstream from the sampling location, there was a dirt road on the north side of Collins Creek containing several subdivisions composed of mobile and manufactured homes. The stormwater from this area drains directly downhill and eventually ends up in Collins Creek (Please see photos 7-6, 7-7, and 7-8 in Appendix 7.3). Due to the location and the observations made, these dwellings more than likely utilize onsite septic systems which if not maintained properly can lead to elevated fecal coliform bacteria counts in Collins Creek during heavy rain events.

3.3 Land Use Assessment

Land use for the Collins Creek watershed was determined using ArcView with land use datasets derived from the 2001 National Land Cover Dataset (NLCD). Figure 3-1 and Table 3-1 display the land use areas for the Collins Creek watershed.

The Collins Creek watershed is clearly dominated by three land use categories. Approximately, 35% of the land use is forested, 23% of the watershed contains shrub/scrub, and 20% of the land use is agricultural. Overall, approximately 78% of the watershed is either barren or used for agricultural or silvicultural purposes with only around 22% of the land use as residential, commercial, wetlands, or other uses. If not managed properly, agriculture and silviculture can have significant nonpoint source impacts. Also, septic systems can be a main source of bacteria if not properly installed and maintained.

Figure 3-1. Land Use Map for the Collins Creek Watershed

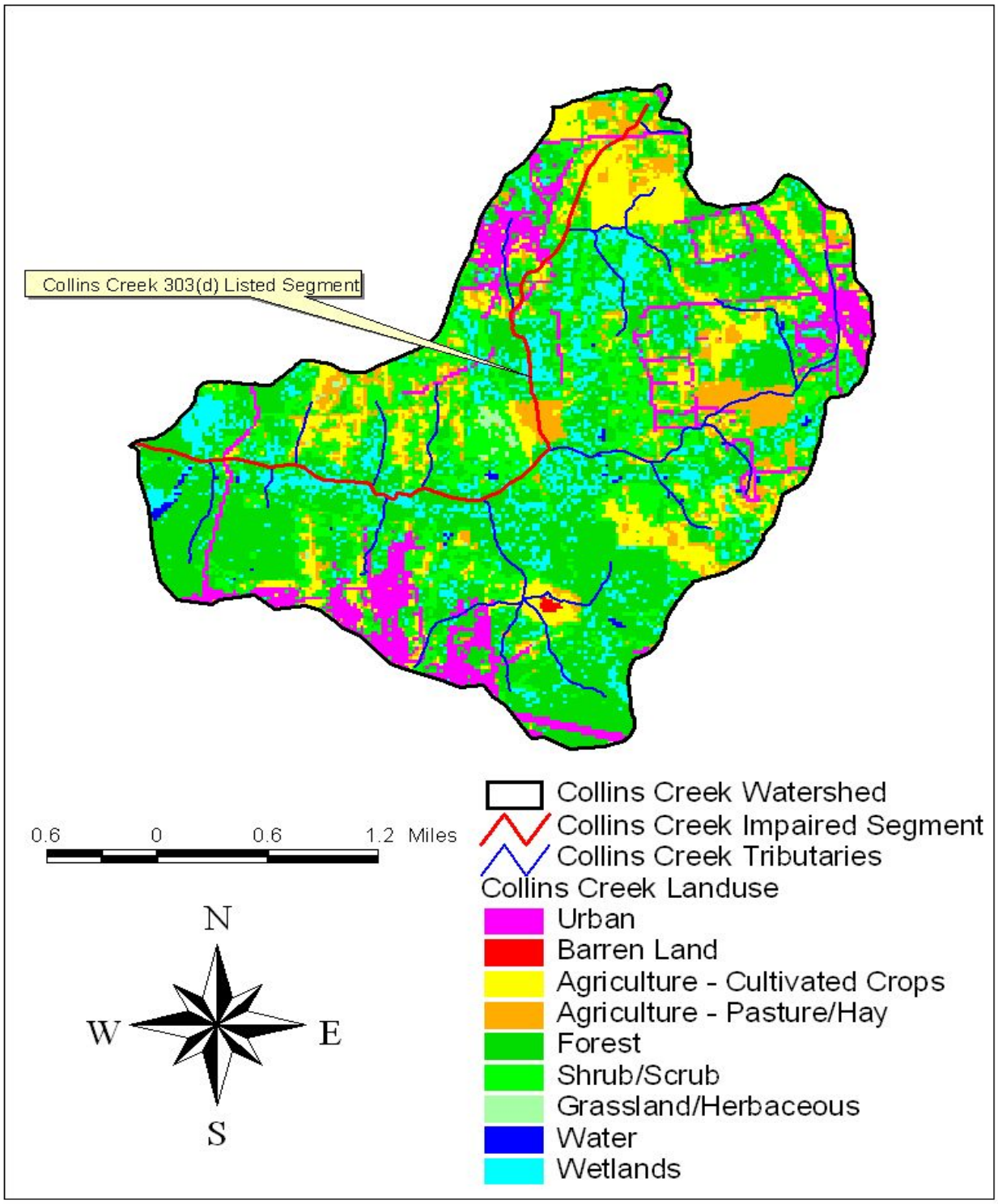

Table 3-1. Land Use Areas for the Collins Creek Watershed

Land Use	Sq. Meters	Acres	Sq. Miles	Percent
Open Water	79,200	19.57	0.03	0.37%
Developed, Open Space	1,956,600	483.49	0.76	9.08%
Developed, Low Intensity	195,300	48.26	0.08	0.91%
Developed, Medium Intensity	24,300	6.00	0.01	0.11%
Developed, High Intensity	5,400	1.33	0.00	0.03%
Barren Land (Rock/Sand/Clay)	19,800	4.89	0.01	0.09%
Deciduous Forest	369,900	91.40	0.14	1.72%
Evergreen Forest	6,071,400	1,500.27	2.34	28.19%
Mixed Forest	1,114,200	275.32	0.43	5.17%
Shrub/Scrub	4,907,700	1,212.72	1.89	22.78%
Grassland/Herbaceous	123,300	30.47	0.05	0.57%
Pasture/Hay	1,683,000	415.88	0.65	7.81%
Cultivated Crops	2,533,500	626.04	0.98	11.76%
Woody Wetlands	2,415,600	596.91	0.93	11.21%
Emergent Herbaceous Wetlands	40,500	10.01	0.02	0.19%
Total	**21,539,700**	**5,322.57**	**8.32**	**100.00%**
Grouped Landuses	Sq. Meters	Acres	Sq. Miles	Percent
Forest	7,555,500	1,867.00	2.92	35.08%
Shrub/Scrub	4,907,700	1,212.72	1.89	22.78%
Agriculture	4,216,500	1,041.92	1.63	19.58%
Wetlands	2,456,100	606.91	0.95	11.40%
Developed	2,181,600	539.08	0.84	10.13%
Other	222,300	54.93	0.09	1.03%
Total	**21,539,700**	**5,322.57**	**8.32**	**100.00%**

3.4 Linkage Between Numeric Targets and Sources

The Collins Creek watershed has three main landuses, namely forest, shrub/scrub, and agriculture. 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 Collins Creek are from the agricultural land uses and failing septic systems. It is not considered a logical approach 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

USGS collected monthly water quality data for Collins Creek at Station 2479950 at Glenwood Road from January 1996 through August 1999. The 2000 §303(d) fact sheet states that 23 fecal coliform samples were taken at this location by the USGS during this time period while, in fact, actually 26 samples were obtained. The 3 extra samples could have been the result of the 2000 §303(d) fact sheet being published before the remaining samples were collected. Of the 26 monthly samples that were collected between 1996 and 1999, 3 samples or 11.54% exceeded the 2000 colonies/100 mL single sample criterion for fecal coliform bacteria. Because the F&W fecal coliform single sample criterion was exceeded, Collins Creek was initially placed on the 2000 §303(d) list and subsequently listed on the 2002, 2004, 2006, and 2008 lists. This data can be viewed in Appendix 7.2, Table 7-1.

ADEM collected water quality data on Collins Creek in 2001-2002 and 2007 as part of Alabama's §303(d) Monitoring Program at Station CLNM-1 at Glenwood Road. As previously mentioned, the 2007 data will only be used for this assessment because it is less than 6 years old. Section 4.8.2 of ***Alabama's Water Quality Assessment and Listing Methodology*** provides the Department's rationale to use the most recent data to prepare a TMDL for an impaired waterbody when that data indicates a change in water quality has occurred. Figure 3-2 and Table 3-3 display locations and list descriptions for the USGS and ADEM stations. Both the USGS and ADEM stations are virtually located at the same location. CLNM-1 is the only ADEM sampling station on Collins Creek and is located near the mouth of the stream. Of the fecal coliform samples collected at CLNM-1 in 2007, none of them violated the single sample F&W maximum criterion of 2000 col/100 mL. Of the samples that qualified for a geometric mean calculation in 2007, one month (8/7/2007 through 9/5/2007) exceeded the criterion of 200 col/100 mL. Flow data was available for all five of the sampling events during this time period and averaged to obtain a flow to be used in calculating the fecal coliform loading and percent reduction for Collins Creek.

Figure 3-2. Map of ADEM and USGS Sampling Stations on Collins Creek

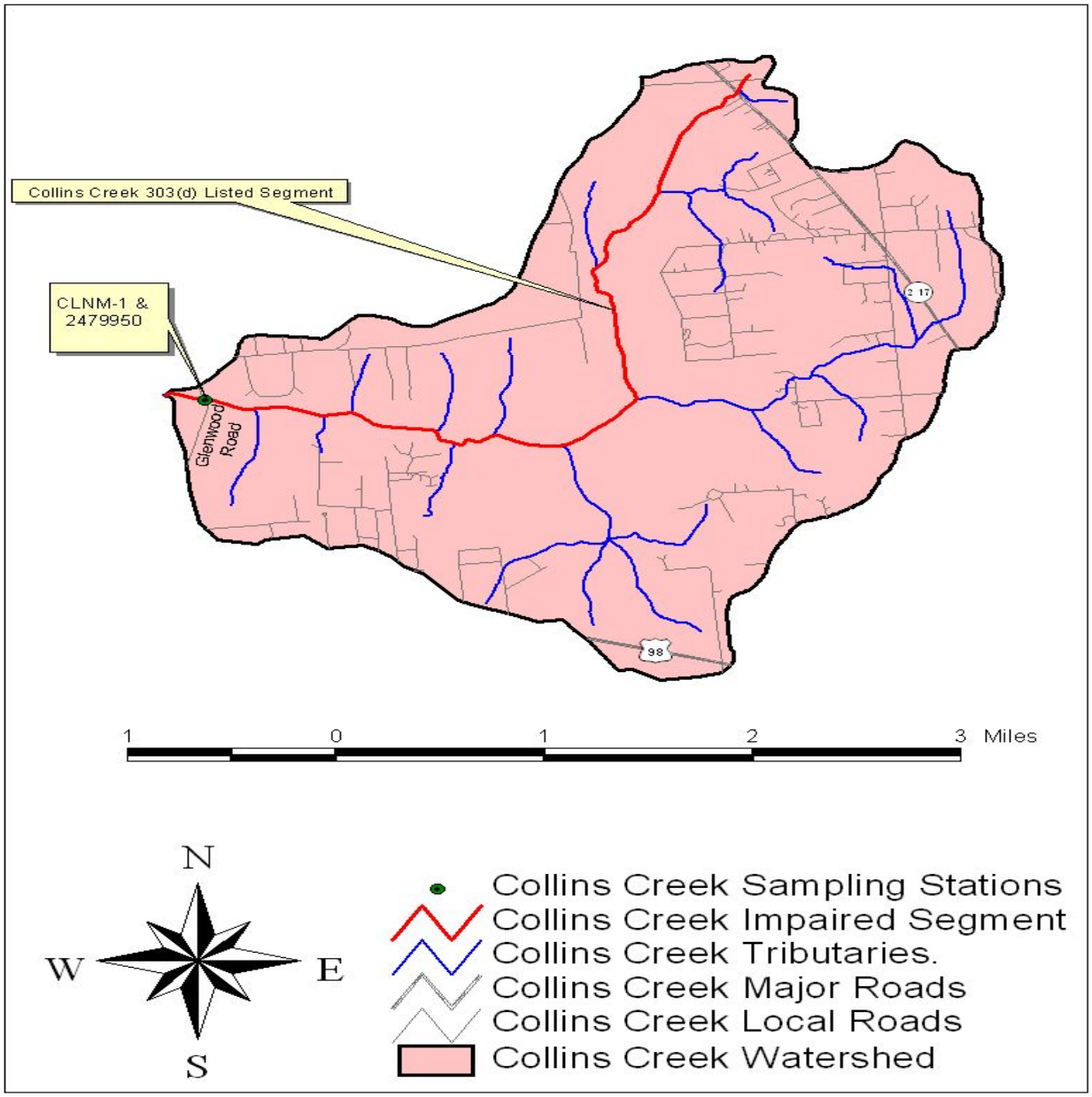

Table 3-2. Collins Creek Sampling Station Descriptions

Years	Station ID	Data Source	Station Location	Latitude	Longitude
1996 - 1999	2479950	USGS	Collins Creek at Glenwood Rd. near Fairview, AL	30.8111	-88.3158
2001, 2002, & 2007	CLNM-1	ADEM	Collins Creek at Glenwood Rd., north of Fairview, AL	30.8112	-88.3860

3.6 Critical Conditions

Summer months are generally considered critical conditions. This can be explained by the nature of storm events in the summer versus the winter. In summer, 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.

The impaired portion of the Collins Creek watershed generally follows the trends described above for the summer months of June through September. The critical condition for this pathogen TMDL was taken to be the one with the highest fecal geometric mean exceedance value. That value was 280 colonies/100 mL and occurred in August and September of 2007 at station CLNM-1. An average flow measurement of 6.96 cfs was obtained during these five (5) sampling events.

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 geometric mean criterion was reduced by ten percent to achieve a target concentration of 180 colonies/100 mL.

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 Collins Creek. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the fecal coliform concentration times the instream flow. The existing load was calculated for the sole violation in 2007 which was a geometric mean exceedance. In the same manner, the allowable load was calculated for the geometric mean criterion of 200 colonies/100 mL. Since there was only one violation in 2007, the TMDL was based on this calculated fecal coliform load percent reduction to achieve applicable water quality criteria.

Existing Conditions

The **geometric mean** mass loading was calculated by multiplying the geometric mean exceedance concentration of 280 colonies/100 ml times the average flow of the five samples. This concentration was calculated based on measurements at CLNM-1 between August 7 and September 5, 2007, and can be found in Table 7-2, Appendix 7.2. The average stream flow was determined to be 6.96 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of fecal coliform to Collins Creek under the geometric mean exceedance condition.

$$\frac{6.96\,\text{ft}^3}{\text{s}} \times \frac{280\,\text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{4.77 \times 10^{10}\ \text{colonies}}{\text{day}}$$

Allowable Conditions

The **allowable load** to the watershed was calculated under the same physical conditions as discussed above for the geometric mean criterion. This is done by taking the product of the average flow used for the violation event times the conversion factor times the allowable concentration.

For the **geometric mean** fecal coliform concentration of 180 colonies/100 mL. The allowable fecal coliform loading is:

$$\frac{6.96\ \text{ft}^3}{\text{s}} \times \frac{180\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.07 \times 10^{110}\ \text{colonies}}{\text{day}}$$

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

$$\frac{6.96\,\text{ft}^3}{\text{s}} \times \frac{20\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.41 \times 10^{9}\ \text{colonies}}{\text{day}}$$

The difference in the pathogen loading between the existing condition (violation event) and the allowable condition converted to a percent reduction represents the total load reduction needed to achieve the fecal coliform water quality criterion. The TMDL was calculated as the total daily fecal coliform load to Collins Creek as evaluated at station CLNM-1. Table 4-1 shows the result of the fecal coliform TMDL and percent reduction for the geometric mean criterion.

Table 4-1. 2007 Fecal Coliform Load and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction %
NPS Load Geometric Mean	4.77E+10	3.07E+10	1.70E+10	36%

From Table 4-1, compliance with the geometric mean criterion of 200 colonies/100 mL requires a reduction in the fecal coliform load of 36%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable fecal coliform criterion are provided in Table 4-2 below.

Table 4-2. Fecal Coliform TMDL for Collins Creek

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation(LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	(% reduction)	(col/day)	(col/day)	(% reduction)
3.41E+10	3.41E+09	NA	NA	0	3.07E+10	36%

a. There are no CAFOs in the Collins Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum; NA = not applicable, no point sources. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. NA = not applicable, no regulated MS4 areas. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in fecal coliform loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for fecal coliform.

4.3 TMDL Summary

Collins Creek was placed on Alabama's §303(d) list in 2000 based on data collected by the USGS between 1996 and 1999. In 2001 through 2002 and 2007, ADEM collected additional water quality data which confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the fecal coliform TMDL for Collins Creek. Based on the TMDL analysis, it was determined that a 36% reduction in fecal coliform loading was necessary to achieve compliance with applicable water quality standards.

Compliance with the terms and conditions of existing and future NPDES sanitary and stormwater permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed towards targeting the load reductions to improve water quality in the Collins Creek watershed. As additional data and/or information becomes available, it may become necessary to revise and/or modify the TMDL accordingly.

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, ADEM's 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
Tennessee	2009
Alabama / Coosa / Tallapoosa	2010
Escatawpa / Mobile / Lower Tombigbee / Upper Tombigbee	2011
Black Warrior/Cahaba	2012
Chattahoochee / Chipola / Choctawhatchee / Perdido-Escambia	2013

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.

7.0 Appendices

Appendix 7.1
References

ADEM Administrative Code, 2008. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2008. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

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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 Geological Survey, 2008. http://nwis.waterdata.usgs.gov/al/nwis/qwdata.

Water Quality Report to Congress, For Calendar Years 1990-1991. Alabama Department of Environmental Management, Montgomery, Alabama, June 1996. ADEM, 1992.

Appendix 7.2
Water Quality Data

Table 7-1. USGS Pathogen Data Collected on Collins Creek (1996-1998)

Station ID	Date	Fecal Coliform (col/100ml)	Fecal Coliform oor	Flow (cfs)
2479950	1/24/1996	1200	greater than	31
2479950	3/13/1996	110		16
2479950	6/5/1996	210		16
2479950	8/6/1996	240		20
2479950	10/29/1996	380		13
2479950	11/21/1996	400		12
2479950	12/11/1996	130		9.6
2479950	1/9/1997	1200	E	19
2479950	2/27/1997	960		37
2479950	3/18/1997	210		15
2479950	4/17/1997	220		15
2479950	5/22/1997	370		14
2479950	6/25/1997	10000	E	88
2479950	8/13/1997	570		
2479950	9/19/1997	120		14
2479950	10/14/1997	3000	E	90
2479950	11/20/1997	240		15
2479950	12/15/1997	140		18
2479950	1/13/1998	1000		39
2479950	2/26/1998	87		23
2479950	3/18/1998	510		27
2479950	5/21/1998	130		16
2479950	6/24/1998	140		14
2479950	9/3/1998	160		15
2479950	12/10/1998	110		18
2479950	2/24/1999	57	E	15
2479950	8/25/1999	4200	E	19

E = Estimated Value.

Table 7-2. ADEM Pathogen Data Collected on Collins Creek

Station_ID	Date	Time (24hr)	Turb-Field (NTU)	Stream Flow (cfs)		Fecal Coliform (col/100ml)	Fecal Coliform oor	Geometric Mean
CLNM001	5/16/2001	0940	---	---		110	---	
CLNM001	5/21/2001	0945	---	---		180	---	
CLNM001	5/21/2001	0946	---	---		170	---	
CLNM001	5/23/2001	1035	---	---		120	---	
CLNM001	5/30/2001	1005	---	---		150	---	
CLNM001	6/4/2001	1325	---	---		200	---	
CLNM001	6/13/2001	1130	---	---		420	---	
CLNM001	6/13/2001	1131	---	---		310	---	
CLNM001	7/10/2001	0935	---	---		170	---	
CLNM001	9/10/2001	1115	---	---		410	---	
CLNM001	10/10/2001	1200	---	---		150	---	
CLNM001	10/10/2001	1201	---	---		200	---	
CLNM001	10/16/2001	1310	---	---		160	---	
CLNM001	10/31/2001	1020	---	---		180	---	
CLNM001	11/7/2001	1130	---	---		130	---	
CLNM001	11/8/2001	1325	---	---		200	---	
CLNM001	12/3/2001	1210	---	---		150	---	
CLNM001	2/13/2002	1030	---	---		64	---	
CLNM001	3/26/2002	1100	---	---		2000	---	
CLNM-1	3/21/2007	1140	8	6.9		110	---	
CLNM-1	4/24/2007	1100	10	8.6		74	---	
CLNM-1	5/24/2007	1135	4	8.2		160	---	
CLNM-1	6/12/2007	1110	4	6.6		180	---	
CLNM-1	6/26/2007	1005	6	6.7		240	---	
CLNM-1	6/27/2007	1015	6	6.7		46	---	131
CLNM-1	7/10/2007	1110	7.7	7		120	---	
CLNM-1	7/12/2007	1130	9.1	9.3		160	---	
CLNM-1	8/7/2007	1050	4	6		240	---	
CLNM-1	8/13/2007	1045	4.1	6.2	**AVG =**	290	---	
CLNM-1	8/23/2007	1025	3.4	5.8	**6.96**	430	---	280
CLNM-1	8/30/2007	1150	3	8.3		260	---	
CLNM-1	9/5/2007	1115	8	8.5		220	---	
CLNM-1	10/25/2007	1115	5.8	11.1		190	---	

Appendix 7.3
Site Visit Photos

Photo 7-1: Fenced in Agricultural/Pasture Land

Photo 7-2: Animal Feces on Collins Creek Bank

Photo 7-3: Stormwater Draining into Collins Creek at CLNM-1

Photo 7-4: Debris in Collins Creek Looking Upstream at CLNM-1

Photo 7-5: Debris in Collins Creek Looking Downstream at CLNM-1

Photo 7-6: Mobile Homes and Drainage Ditch on North Bank of Collins Creek

Photo 7-7: Looking Toward Collins Creek from Residential Area

Photo 7-8: Drainage Ditch and Home on North Bank of Collins Creek