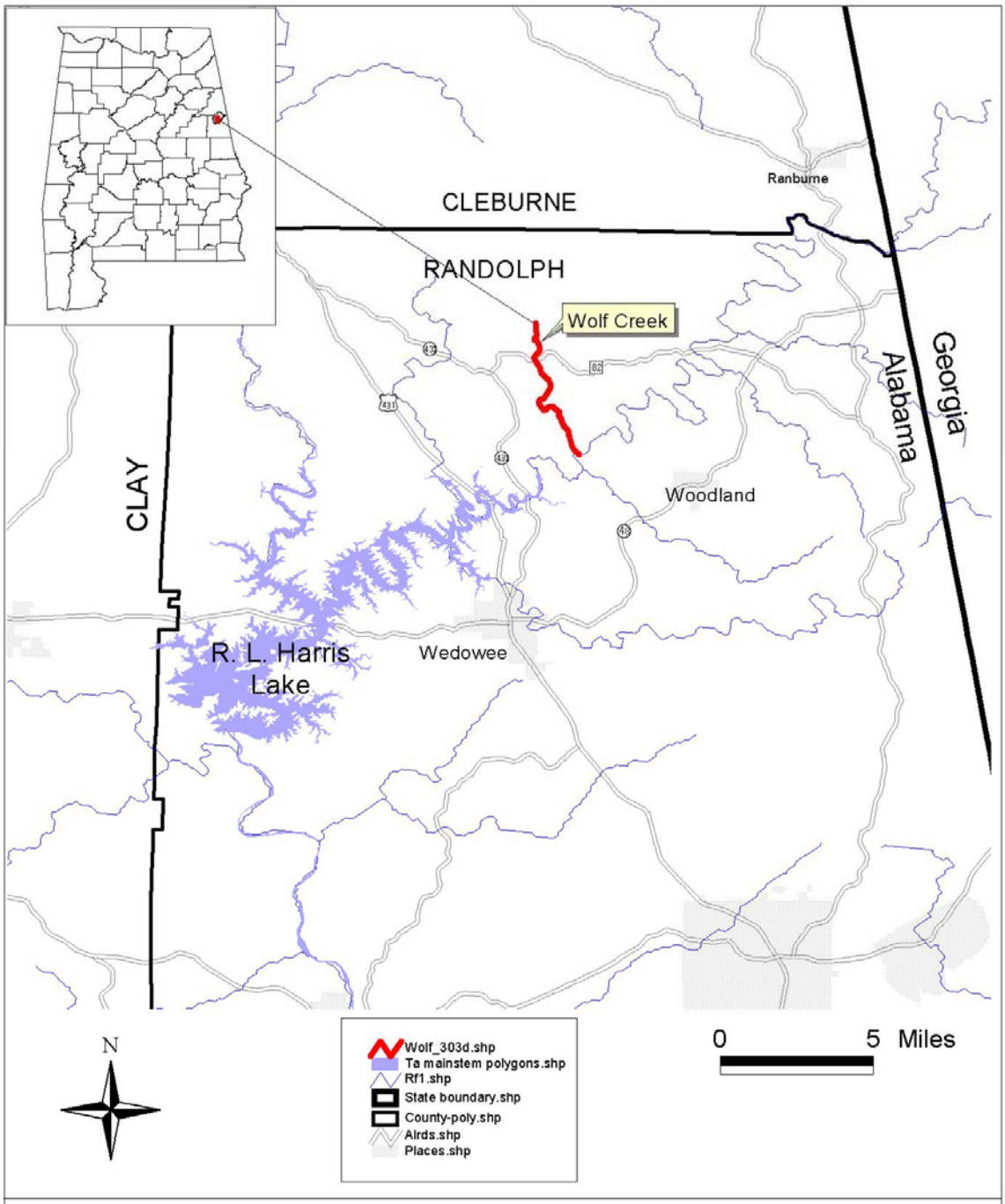
FINAL

Total Maximum Daily Load (TMDL)
for
Wolf Creek
Waterbody ID # AL/03150108-250_01
Pathogens (fecal coliform)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
July 2005



Wolf Creek in the Tallapoosa River Basin located in Randolph County, Alabama

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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 use 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).

Wolf Creek is a tributary of the Little Tallapoosa River and is located in Randolph County. Wolf Creek is part of the Cohobadiah Creek Subwatershed within the Tallapoosa River Basin. In 1996, Wolf Creek was placed on the State of Alabama's §303(d) List for ammonia, OE/DO (organic enrichment/dissolved oxygen), nutrients, and pathogens (fecal coliform). Its use classification is Fish and Wildlife (F&W). In October 1998, EPA approved the delisting of nutrients for Wolf Creek. In September 2002, the Alabama Department of Environmental Management (ADEM) proposed to delist Wolf Creek for ammonia and OE/DO and that decision is currently pending EPA approval. This report will only address the TMDL development for pathogens (fecal coliform). ADEM is uncertain as to how Wolf Creek was listed on the 1996 §303(d) list. The first record of Wolf Creek being impaired is noted in Alabama's 1992 Water Quality Report to Congress. The 1992 Report listed Wolf Creek as partially supporting its use classification caused by ammonia, OE/DO (organic enrichment/dissolved oxygen), nutrients, and pathogens (Fecal Coliform). However, no physical, chemical, or biological records could be found to substantiate the support status of Wolf Creek. The Department conducted a records search through historical nonpoint source complaint files and no information was yielded on Wolf Creek. Since no data could be located it is assumed that the listing of Wolf Creek was based on evaluations rather than actual water quality monitoring data.

Due to the lack of available data, ADEM conducted intensive monitoring of Wolf Creek for the period November 2001 through July 2002. A total of 49 fecal coliform samples were taken from Wolf Creek. None of the samples exceeded the single sample maximum criteria of 2000 col/100ml. In addition, geometric mean sampling did not violate ADEM's criteria of 1000 col/100ml for the months October through May. However, two out three geometric mean samples did exceed ADEM's F&W criteria of 200 col/100 ml for the months of June through September. As a result, a pathogens (fecal coliform) TMDL for Wolf Creek was developed based on the geometric mean criteria of 200 col/100 ml for the months of June through September.

A mass balance approach was used to calculate the TMDL for Wolf Creek. The mass balance approach utilizes the conservation of mass principle. Loads can be calculated by multiplying fecal coliform concentrations with respective instream flows. For this TMDL the current loading to Wolf Creek was calculated using the highest reported geometric mean concentration times the average of measured flows collected during the sampling event. The allowable loading was calculated using the same flow value times the fecal coliform criteria target of 180 col/100 ml (200 col/100ml – 10% MOS). 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, allowable loads and reductions needed to meet the applicable water quality standards for Wolf Creek. Table 1.2, shows the different components of the TMDL for Wolf Creek.

Table 1.1 – Current Loads, Allowable Loads, and Required Reductions

Source	Current Load (col/day)	Allowable Load with MOS (col/day)	Required Reduction with MOS (col/day)	Required Reduction with MOS (%)
NPS load	3.41E+09	1.32E+09	2.08E+09	61%
Point Source	0.00E+00	0.00E+00	0.00E+00	0%
Total load	3.41E+09	1.32E+09	2.08E+09	61%

Table 1.2 - TMDL for Wolf Creek

TMDL = WLA + LA + MOS			
TMDL	WLA	LA	MOS
(col/day)	(col/day)	(col/day)	(col/day)
1.47E+09	0.00E+00	1.32E+09	1.47E+08

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).

In 1996, Wolf Creek was placed on the State of Alabama's §303(d) List for ammonia, OE/DO (organic enrichment/dissolved oxygen), nutrients, and pathogens (fecal coliform). In October 1998, EPA approved the delisting of nutrients for Wolf Creek. In September 2002, ADEM proposed to delist Wolf Creek for ammonia and OE/DO and that decision is currently pending EPA approval. This report will only address the TMDL development for pathogens (fecal coliform). ADEM is uncertain as to how Wolf Creek was listed on the 1996 §303(d) list. The first record of Wolf Creek being impaired is noted in Alabama's 1992 Water Quality Report to Congress. The 1992 Report listed Wolf Creek as partially supporting its use classification caused by ammonia, OE/DO (organic enrichment/dissolved oxygen), nutrients, and pathogens (Fecal Coliform). However, no physical, chemical, or biological records could be found to substantiate the support status of Wolf Creek. The Department conducted a records search through historical nonpoint

source complaint files and no information was yielded on Wolf Creek. Since no data could be located it is assumed that the listing of Wolf Creek was based on evaluations rather than actual water quality monitoring data.

2.2 Problem Definition

Waterbody Impaired:	Wolf Creek-from the Little Tallapoosa River to its source.
Waterbody length:	4 miles
Waterbody drainage area:	5.2 square miles
Water Quality Standard Violation:	Fecal Coliform (June through September only)
Pollutant of Concern:	Pathogens (Fecal Coliform)
Water Use Classification:	Fish and Wildlife

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

(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:

(i) 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. 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 100 col/100 ml in coastal waters and 200 col/100 ml in other waters. 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 mean fecal 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:
ADEM conducted intensive monitoring of Wolf Creek for the period November 2001 through July 2002. A total of 49 fecal coliform samples were taken from Wolf Creek. None of the samples exceeded the single sample maximum criteria of 2000 col/100ml. In addition, geometric mean sampling did not violate ADEM's fecal coliform criteria of 1000 col/100ml for the months October through May. However, two out three geometric mean samples did exceed ADEM's F&W criteria of 200 col/100 ml for the months of June through September.

3.0 TMDL Technical Basis

3.1 Water Quality Target Identification

For the purpose of this TMDL a fecal coliform target level of 180 colonies/100 ml will be used. This target was derived by using a 10% margin of safety from the geometric mean criteria of 200 colonies/100 ml. This target level 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 Wolf Creek Watershed:
There are no point sources in this watershed. Any new point source discharge to this stream must meet a discharge limit of 200 col/100 ml for fecal coliform.

Nonpoint Sources in the Wolf Creek Watershed:

Based on site observations of the watershed and the fact that no point sources are located in the watershed, nonpoint sources are believed to be the primary source of fecal coliform bacteria in Wolf Creek. The land use in this watershed is approximately 15% agriculture (pasture/hay and row crops), 84% forest, and 1% other. The following are examples of how different landuses can contribute to fecal coliform bacterial loading:

- Agricultural land can be a source of fecal coliform bacteria. Runoff from pastures, animal operations, improper land application of animal wastes, and animals with access to streams are all mechanisms that can contribute fecal coliform bacteria to waterbodies. Cattle were observed to have access to Wolf Creek at sampling station WOLF-1 (see Photo 3-1). Fecal matter was evident along the creek bank and in the creek. This is the most upstream sampling station and the station that recorded the highest readings of fecal coliform. Wolf Creek is located just to the left of the wood line, pictured below.

Photo 3-1: Cattle pasture NE of Co. Rd. 82 @ WOLF Creek, ADEM Site Visit-Sept. 2002

- Fecal coliform bacteria can also originate from forested areas due to the presence of wild animals such as deer, raccoons, turkeys, waterfowl, etc. 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.
- Leaking septic systems can be another source of fecal coliform bacteria.

The nature and extent of fecal coliform different sources will be better identified during the implementation phase of the TMDL.

3.3 Landuse

Table 3.1 below provides the various landuses for the Wolf Creek Watershed. See Figure 3.1 on page 10, for a map of landuse in the Wolf Creek Watershed. The detailed landuse for this watershed was derived from EPA's Watershed Characterization System (WCS). The WCS is a software tool that provides a means to organize Geographical Information Systems (GIS) existing data on a spatial scale for a defined watershed. Landuse information for this assessment was derived from the Multiple Resolution Land Coverage (MRLC) 1990.

Table 3.1 Landuse in the Wolf Creek Watershed

Landuse	Acres	Sq. Miles	Percentage
Deciduous Forest	1295	2.02	38.95%
Evergreen Forest	717	1.12	21.56%
High Intensity Commercial/Industrial/Transportatio	5	0.01	0.15%
Low Intensity Residential	1	0.002	0.03%
Mixed Forest	772	1.21	23.22%
Open Water	14	0.02	0.42%
Other Grasses (Urban/recreational; e.g. parks law	2	0.003	0.06%
Pasture/Hay	348	0.54	10.47%
Row Crops	143	0.22	4.30%
Transitional	28	0.04	0.84%
Total	**3325**	**5.20**	**100.00%**

Grouped Landuses	Acres	Sq. Miles	Percentage
Agricultural	491	0.27	14.77%
Forest	2784	3.17	83.73%
Other	50	1.76	1.50%
Total	**3325**	**5.20**	**100.00%**

3.4 Linkage Between Numeric Targets and Sources:

The landuses in the Wolf Creek watershed indicate that the likely sources of fecal coliform bacteria are from forest and agricultural areas. Because this segment has such a small drainage area, (5.2 square miles) with diverse landuses, it was not considered practicable to calculate individual components of the nonpoint source (NPS) loading. There will not be individual loads or reductions calculated for different sources such as forest, agriculture, and septic systems. The loadings and reductions will only be calculated as a NPS total load. It is envisioned that the sources can be better defined during the implementation process.

3.5 Data Availability and Analysis:

Due to the lack of available data, ADEM conducted intensive monitoring of Wolf Creek for the period November 2001 through July 2002. A total of 49 fecal coliform samples were taken from Wolf Creek. None of the samples exceeded the single sample maximum criteria of 2000 col/100ml. In addition, geometric mean sampling did not violate ADEM's fecal coliform criteria of 1000 col/100ml for the months October through May. However, two out three geometric mean samples did exceed ADEM's F&W criteria of 200 col/100 ml for the months of June through September.

All of the data mentioned above can be found in Appendix B. Sample locations are shown on Figure 3.2, page 11.

3.6 Critical Conditions:

Normally summer months (June - September) are generally considered critical conditions for fecal coliform. 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 lower than the winter criterion due to incidental water contact and recreation. This seems to hold true for the Wolf Creek watershed.

Figure 3.1 – Landuse Map of Wolf Creek Watershed

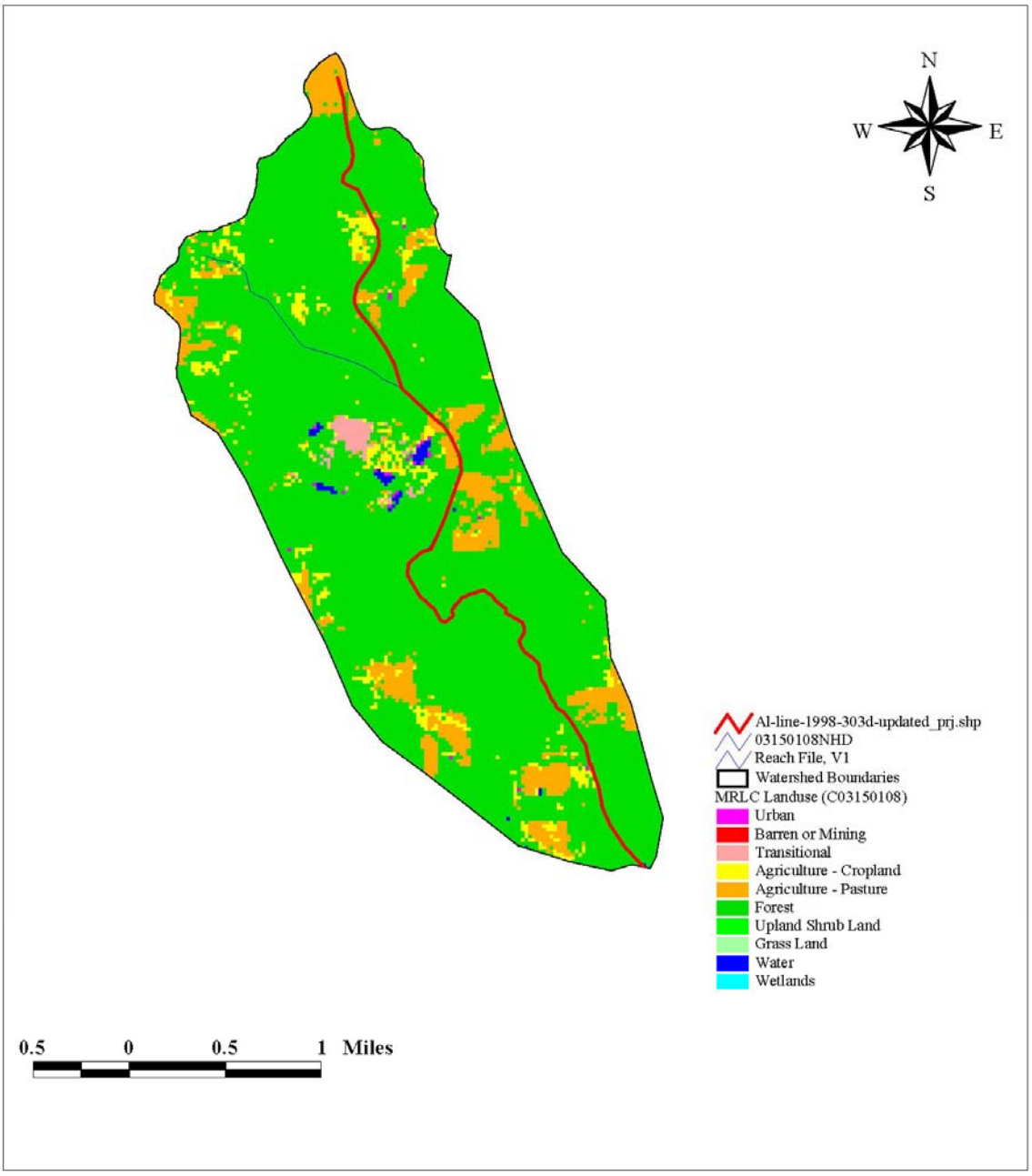
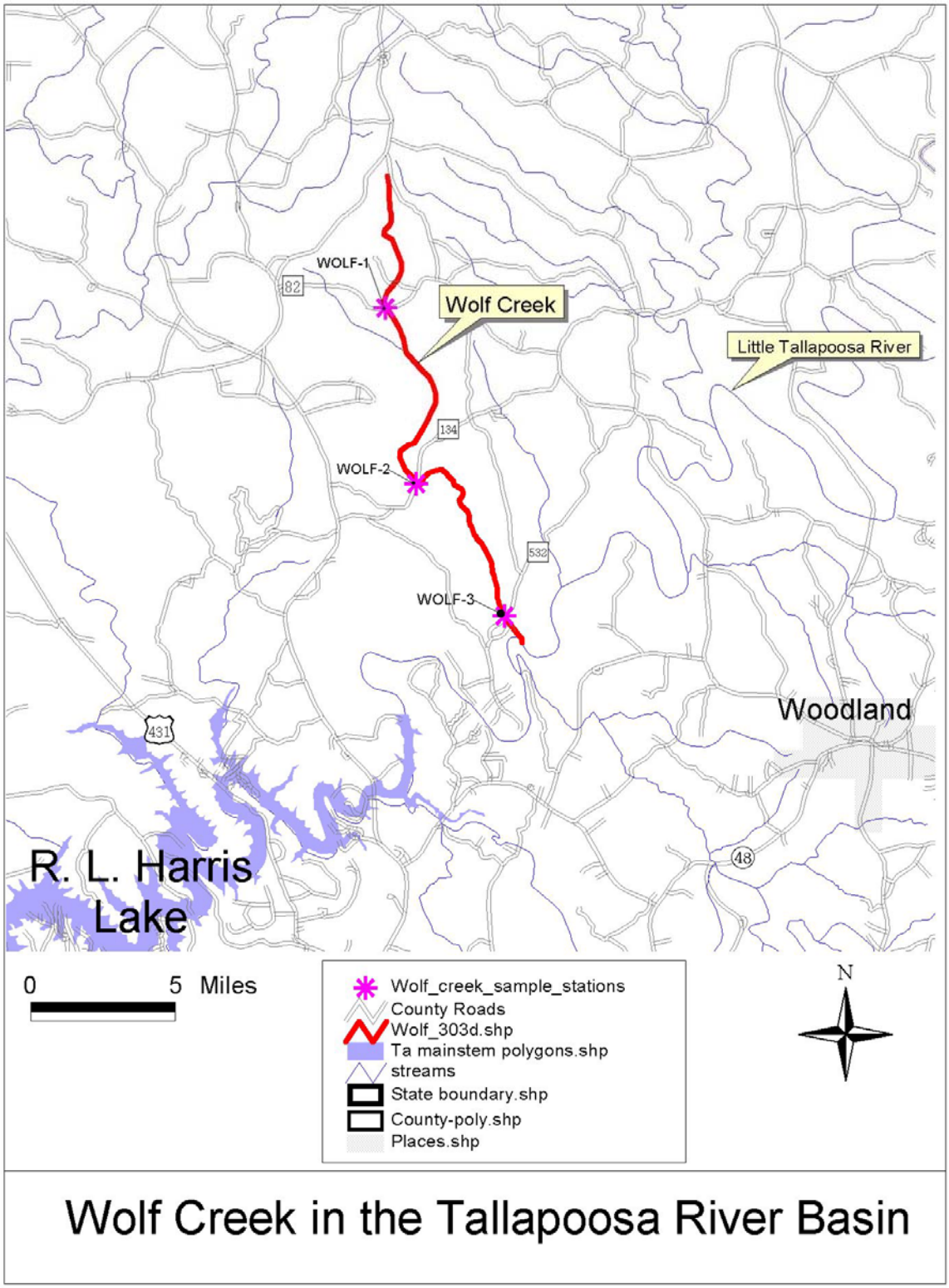


Figure 3.2 Sampling Locations of Wolf Creek



3.7 Margin of Safety (MOS)

There are two methods for incorporating a 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.

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 target criterion concentration by ten percent and calculating a load duration target with corresponding measured flow data. For this TMDL, the summer geometric mean criterion was reduced by ten percent to achieve the target concentrations of 180 colonies/100ml, which yields a MOS equal to 20 colonies/100ml.

4.0 TMDL Development

4.1 Definition of a TMDL

Total maximum daily loads (TMDLs) are 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. 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.

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 (col/day), in accordance with 40 CFR 130.2(i).

4.2 Load Calculations

A mass balance approach was used to calculate the TMDL for Wolf Creek. The mass balance approach utilizes the conservation of mass principle. Loads can be calculated by multiplying the fecal coliform concentration versus the flow. For this TMDL, since the only criteria exceeded was the geometric mean of 200 col/100 ml for the months of June through September, the current loading to Wolf Creek was calculated using the highest geometric mean sampled versus the average flow from the same sampling event. The allowable loading was calculated using the same flow versus the geometric mean criteria minus a 10% margin of safety. Reductions to meet the allowable loading were then calculated by subtracting the allowable loading from the current loading. These calculations can be seen in Table 4.1 on the next page.

Table 4.1

Load calculation compared to the geomean criteria of "200 col/100 ml" for Wolf Creek

Average Flow measured at WOLF-1 for Geomean Samples:	0.3 cfs	
Geometric Mean Fecal coliform concentration measured:	464 col/100 mL	
Allowable fecal coliform maximum concentration with MOS:	180 col/100mL	=200 - 10%
Margin of saftey for the geometric mean criteria	20 col/100mL	=10% of criteria

Load Calculations:

Load = Fecal Coliform * measured flow * Conversion Factor

Load in (col of Fecal Coliform/day)

Fecal Coliform in (col/100 mL)

Measured Flow in (cfs)

Conversion Factor = 24468984 (ml-s/ft3-day)

Current Load:			conversion		flow		concentration
The current total load =	3.41E+09	col/day -->	Total Load = 24468984	*	0.3	*	464
Point source	0.00E+00	col/day -->	there are no point sources in this watershed				

Allowable Load:			conversion		flow		concentration
Allowable total load =	1.32E+09	col/day -->	Total Load = 24468984	*	0.3	*	180
Point source	0.00E+00	col/day -->	There are no point sources in this watershed				

Margin of Saftey			conversion		flow		concentration
MOS load =	1.47E+08	col/day -->	Total Load = 24468984	*	0.3	*	20

Source	Current Load (col/day)	Allowable Load with MOS (col/day)	Required Reduction with MOS (col/day)	Required Reduction with MOS (%)
NPS load	3.41E+09	1.32E+09	2.08E+09	61%
Point Source	0.00E+00	0.00E+00	0.00E+00	0%
Total load	3.41E+09	1.32E+09	2.08E+09	61%

TMDL = WLA + LA + MOS

TMDL	WLA	LA	MOS
(col/day)	(col/day)	(col/day)	(col/day)
1.47E+09	0.00E+00	1.32E+09	1.47E+08

Percent Reduction to Achieve the Fecal Coliform Standard:

Total reduction: 61% = (current load - allowable load) / current load

The following assumptions are made for calculating the allowable load.

The water quality criteria for fecal coliform for summer geomeans is 200 col/100 mL.

To account for an explicit Margin of Safety (MOS) a target concentration of 180 col/100 ml was used to calculate the allowable load compared to the maximum criteria which = 200- 10%

4.3 TMDL Implementation

Wolf Creek is impaired for fecal coliform solely by nonpoint sources. For 303(d) listed waters impaired solely or primarily by Nonpoint source (NPS) pollutants, necessary reductions will be sought during TMDL implementation using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired water. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. Therefore, TMDL implementation activities will be coordinated through interaction with local entities in conjunction with Alabama's Clean Water Partnership efforts.

The primary TMDL implementation mechanism used will employ concurrent education and outreach, training, technology transfer, and technical assistance with incentive-based pollutant management measures. The ADEM Office of Education and Outreach (OEO) will assist in the implementation of TMDLs in cooperation with public and private stakeholders. Planning and oversight will be provided by or coordinated with the Alabama Department of Environmental Management's (ADEM) Section 319 Nonpoint Source Grant Program in conjunction with other local, state, and federal resource management and protection programs and authorities. The CWA Section 319 Grant Program may provide limited funding to specifically ascertain NPS pollution sources and causes, identify and coordinate management programs and resources, present education and outreach opportunities, promote pollution prevention, and implement needed management measures to restore impaired waters.

Depending on the pollutant of concern, resources for corrective actions may be provided, as applicable, by the Alabama Cooperative Extension System (education and outreach); the USDA-Natural Resources Conservation Service (NRCS) (technical assistance) and Farm Services Agency (FSA) (federal cost-share funding); and the Alabama Soil and Water Conservation Committee (state agricultural cost share funding and management measure implementation assistance) through local Soil and Water Conservation Districts, or Resource Conservation and Development Councils (funding, project implementation, and coordination). Additional assistance from such agencies as the Alabama Department of Public Health (septic systems), Alabama Department of Agriculture and Industries (pesticides), and the Alabama Department of Industrial Relations and Dept of Interior - Office of Surface Mining (abandoned minelands), Natural Heritage Program and US Fish and Wildlife Service (threatened and endangered species), may also provide practical TMDL implementation delivery systems, programs, and information. Landuse and urban sprawl issues will be addressed through the Nonpoint Source for Municipal Officials (NEMO) education and outreach program. Memorandums of Agreements (MOAs) may be used as a tool to formally define roles and responsibilities.

Additional public/private assistance is available through the Alabama Clean Water Partnership Program (CWP). The CWP program uses a local citizen-based environmental

protection approach to coordinate efforts to restore and protect the state's resources in accordance with the goals of the Clean Water Act. Interaction with the state or river basin specific CWP will facilitate TMDL implementation by providing improved and timely communication and information exchange between community-based groups, units of government, industry, special interest groups, and individuals. The CWP can assist local entities to plan, develop, and coordinate restoration strategies that holistically meet multiple needs, eliminate duplication of efforts, and allow for effective and efficient use of available resources to restore the impaired waterbody or watershed.

Other mechanisms that are available and may be used during implementation of this TMDL include local regulations or ordinances related to zoning, land use, or storm water runoff controls. Local governments can provide funding assistance through general revenues, bond issuance, special taxes, utility fees, and impact fees. If applicable, reductions from point sources will be addressed by the NPDES permit program. The Alabama Water Pollution Control Act empowers ADEM to monitor water quality, issue permits, conduct inspections, and pursue enforcement of discharge activities and conditions that threaten water quality. In addition to traditional "end-of-pipe" discharges, the ADEM NPDES permit program addresses animal feeding operations and land application of animal wastes. For certain water quality improvement projects, the State Clean Water Revolving Fund (SRF) can provide low interest loans to local governments.

Long-term physical, chemical, and biological improvements in water quality will be used to measure TMDL implementation success. As may be indicated by further evaluation of stream water quality, the effectiveness of implemented management may necessitate revisions of this TMDL. The ADEM will continue to monitor water quality according to the rotational river basin monitoring schedule as allowed by resources. In addition, assessments may include local citizen-volunteer monitoring through the Alabama Water Watch Program and/or data collected by agencies, universities, or other entities using standardized monitoring and assessment methodologies. Core management measures will include but not be limited to water quality improvements and designated use support, preserving and enhancing public health, enhancing ecosystems, pollution prevention and load reductions, implementation of NPS controls, and public awareness and attitude/behavior changes.

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 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 to the schedule shown in Table 5.1 on page 17.

Table 5.1 Major River Basin Sampling Schedule

River Basin Group	Schedule
Choctawhatchee / Chipola / Perdido-Escambia / Chattahoochee	2004
Tallapoosa / Alabama / Coosa	2005
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2006
Cahaba / Black Warrior	2007
Tennessee	2008

6.0 Public Participation

As part of the public participation process, this TMDL was be 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 clj@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 A

References

USEPA. 2001. *Protocol for Developing Pathogen TMDLs*. EPA 841-R-00-001. U.S. Environmental Protection Agency, Office of Water, Washington DC.

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

Alabama Department of Environmental Management's 303(d) Monitoring Program. 2001-2002.

ADEM Administrative Code, 2002. Water Quality Program, Chapter 335-6-10, Water Quality Criteria, and Chapter 335-6-11 Use Classifications for Interstate and Intrastate Waters.

Alabama Clean Water Strategy Water Quality Assessment Report, December 1992, ADEM

Alabama Clean Water Strategy Water Quality Assessment Report, 1996, ADEM

Appendix B
Fecal Coliform and Flow Data 2001-2002 303 (d) Monitoring Program

Station_ID	Date	Time (24hr)	Flow (cfs)	Fecal Coliform col/100 ml
WOLF-1	11/8/2001	1040		64.00
WOLF-1	12/3/2001	1115		103.00
WOLF-1	12/12/2001	1330	0.30	168.00
WOLF-1	12/13/2001	950	0.70	1960.00
WOLF-1	12/27/2001	1600	0.40	180.00
WOLF-1	1/9/2002	1235	0.40	74.00
WOLF-1	1/10/2002	1100	0.40	39.00
WOLF-1	2/14/2002	1130	0.60	25.00
WOLF-1	3/25/2002	1110	0.50	57.00
WOLF-1	4/23/2002	1130	0.60	680.00
WOLF-1	6/5/2002	1435	0.90	290.00
WOLF-1	6/25/2002	1345		540.00
WOLF-1	7/11/2002	1025	0.50	370.00
WOLF-1	7/16/2002	1000	0.30	1260.00
WOLF-1	7/17/2002	950	0.20	570.00
WOLF-1	7/29/2002	1020	0.20	150.00
WOLF-2	11/8/2001	1135	1.60	38.00
WOLF-2	12/3/2001	1200	2.20	80.00
WOLF-2	12/12/2001	1310	2.20	176.00
WOLF-2	12/13/2001	845	4.20	360.00
WOLF-2	12/27/2001	1115	4.30	24.00
WOLF-2	1/9/2002	1155	2.70	16.00
WOLF-2	1/10/2002	1020	2.80	18.00
WOLF-2	2/14/2002	1310	3.60	10.00
WOLF-2	3/25/2002	1200	3.40	26.00
WOLF-2	4/23/2002	1230	2.70	62.00
WOLF-2	6/5/2002	????	2.80	200.00
WOLF-2	6/5/2002	1345	2.80	340.00
WOLF-2	6/25/2002	1245		197.00
WOLF-2	7/11/2002	1100	1.90	113.00
WOLF-2	7/16/2002	915	2.00	128.00
WOLF-2	7/17/2002	910	1.70	128.00
WOLF-2	7/29/2002	1120	2.20	100.00
WOLF-3	11/8/2001	1240	2.90	133.00
WOLF-3	12/3/2001	1250	2.90	80.00
WOLF-3	12/12/2001	1250	3.40	204.00
WOLF-3	12/13/2001	740	7.90	1240.00
WOLF-3	12/27/2001	1020	3.90	22.00
WOLF-3	1/9/2002	1125	3.70	92.00
WOLF-3	1/10/2002	945	3.60	164.00
WOLF-3	2/14/2002	1340	5.30	40.00
WOLF-3	3/25/2002	1240	5.20	73.00
WOLF-3	4/23/2002	1310	4.60	73.00
WOLF-3	6/5/2002	1255	3.90	190.00
WOLF-3	6/25/2002	1155		197.00
WOLF-3	7/11/2002	1130	1.60	240.00
WOLF-3	7/16/2002	755	2.20	244.00
WOLF-3	7/17/2002	810		216.00
WOLF-3	7/29/2002	1145	2.20	170.00

Summer Season Geometric Mean Data Sets

Station I.D.	Date	Time	Fecal Coliform (col/100 ml)		Stream Flow (cfs)
Wolf-1	06/25/02	1345	540		
Wolf-1	07/11/02	1025	370		0.5
Wolf-1	07/16/02	1000	1260		0.3
Wolf-1	07/17/02	0950	570		0.2
Wolf-1	07/29/02	1020	150		0.2
		Fecal Geomean	**464**	**average flow**	**0.3**

Station I.D.	Date	Time	Fecal Coliform (col/100 ml)		Stream Flow (cfs)
Wolf-2	06/25/02	1245	143		
Wolf-2	07/11/02	1100	113		1.9
Wolf-2	07/16/02	0915	128		2
Wolf-2	07/17/02	0910	128		1.7
Wolf-2	07/29/02	1120	100		2.2
		Fecal Geomean	**121**	**average flow**	**2.0**

Station I.D.	Date	Time	Fecal Coliform (col/100 ml)		Stream Flow (cfs)
Wolf-3	06/25/02	1155	197		
Wolf-3	07/11/02	1130	240		1.6
Wolf-3	07/16/02	0755	244		2.2
Wolf-3	07/17/02	0810	216		
Wolf-3	07/29/02	1145	170		2.2
		Fecal Geomean	**212**	**average flow**	**2**

Winter Season Geometric Mean Data Sets

Station I.D.	Date	Time	Fecal Coliform (col/100 ml)		Stream Flow (cfs)
Wolf-1	12/12/01	1020	168		0.3
Wolf-1	12/13/01	0950	1,960		0.7
Wolf-1	12/27/01	1200	180		0.4
Wolf-1	01/09/02	1235	74		0.4
Wolf-1	01/10/02	1100	39		0.4
		Fecal Geomean	**176**	**average flow**	**0.4**

Station I.D.	Date	Time	Fecal Coliform (col/100 ml)		Stream Flow (cfs)
Wolf-2	12/12/01	0825	176		2.2
Wolf-2	12/13/01	0845	360		4.2
Wolf-2	12/27/01	1115	24		4.3
Wolf-2	01/09/02	1155	16		2.7
Wolf-2	01/10/02	1020	18		2.8
		Fecal Geomean	**53**	**average flow**	**3.2**

Station I.D.	Date	Time	Fecal Coliform (col/100 ml)		Stream Flow (cfs)
Wolf-3	12/12/01	0910	204		3.4
Wolf-3	12/13/01	0740	1,240		7.9
Wolf-3	12/27/01	1020	22		3.9
Wolf-3	01/09/02	1125	92		3.7
Wolf-3	01/10/02	0945	164		3.6
		Fecal Geomean	**153**	**average flow**	**4.5**