Draft

Total Maximum Daily Load (TMDL) for Slab Creek

Assessment Unit ID # AL03160111-0106-100

Blount and Marshall Counties

Pathogens (*E. coli*)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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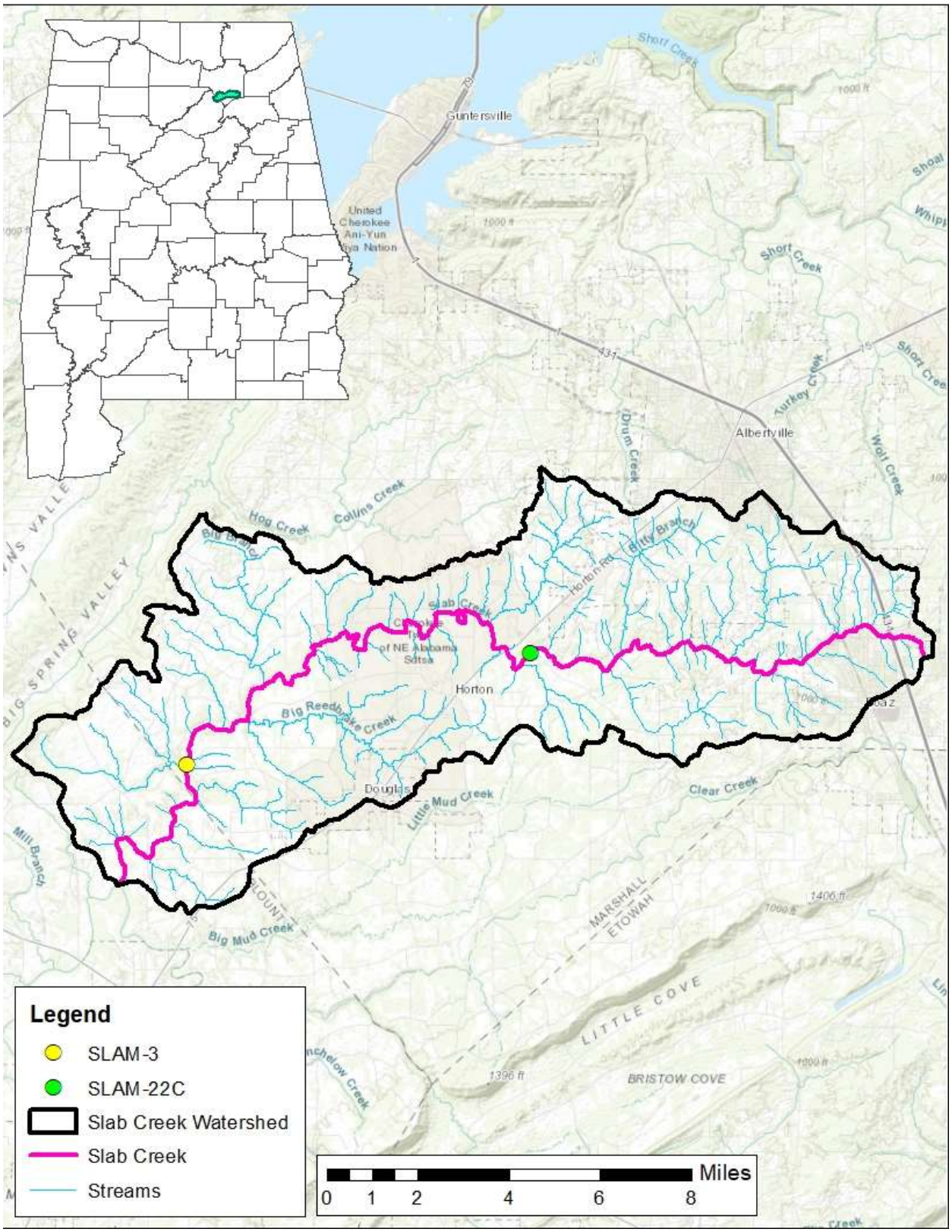
Figure 1-1 Map of the Slab Creek Watershed



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1.0 Executive Summary

Section 303(d) of the Clean Water Act and the Environmental Protection Agency (EPA) 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 waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Slab Creek, part of the Black Warrior River basin, is currently included on Alabama's §303(d) list for pathogens (*E. coli*) from its source to Locust Fork. Slab Creek's headwaters begin northeast of Boaz, Alabama, and it flows southwest to Locust Fork. The total length of Slab Creek is 24.98 miles, and the total drainage area of the Slab Creek watershed is 67.4 square miles. Slab Creek has a use classification of Fish and Wildlife (F&W).

Slab Creek was first included on the §303(d) list for pathogens in 2018 based on ADEM monitoring data collected in 2015 at station SLAM-22C. Slab Creek has subsequently been listed for pathogens on the 2020, 2022, and 2024 §303(d) lists of impaired waterbodies.

In 2020 and 2023-2024, sampling studies were performed by ADEM to further assess the water quality of the impaired stream. For the purposes of this TMDL, the 2020-2024 data will be used to assess the water quality of Slab Creek because it provides the best picture of the current water quality of the stream. The 2024 edition of *Alabama's Water Quality Assessment and Listing Methodology*, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody. This TMDL will be developed from *E. coli* data collected at stations SLAM-22C and SLAM-3. This bacterial data is listed in Appendix 7.2, Tables 7-2 and 7-3 for reference. ADEM collected 29 *E. coli* samples and conducted two geometric mean studies on Slab Creek during 2020-2024. According to the data, Slab Creek was not meeting the pathogen criteria applicable to its use classification of F&W. Therefore, this TMDL has been developed for pathogens (*E. coli*) for the listed reach.

A concentration/percent reduction approach was used for calculating the pathogen TMDL for Slab Creek. Typically, TMDLs are calculated using a mass balance approach and expressed on a mass loading basis (e.g., pounds per day). Pathogen loadings are calculated as the product of concentration times flow times the appropriate conversion factor; therefore, pathogen concentrations are directly proportional to pathogen loadings for a given flow condition. As a result, *E. coli* concentrations may be employed in lieu of loadings for a pathogen TMDL. In the case of Slab Creek, a concentration approach was deemed to be appropriate due to the disproportionate relationship between the ambient stream flow at the time of the highest *E. coli* exceedance and the design flow of the point source discharge in the watershed. Therefore, a percent reduction was based solely on the highest exceedance value measured in terms of concentration.

In this case, the existing concentration was based on the highest single sample exceedance which occurred in the past six years. The highest single sample exceedance of 648.8 colonies/100 ml was measured at station SLAM-22C on July 16, 2024. The allowable concentration (i.e., 268.2 colonies/100 ml) was calculated by subtracting a 10% margin of safety from the single sample

maximum criterion of 298 colonies/100 ml. The required percent reduction to meet the allowable concentration was then calculated by subtracting the allowable concentration from the existing concentration and then dividing that value by the existing concentration. The highest single sample violation calls for a reduction of 59%. Required geometric mean reductions were found to be less stringent than the required single sample reduction.

Table 1-1 is a summary of the existing concentration, allowable concentration, and percent reduction for the single sample and geometric mean criteria. Table 1-2 provides the details of the TMDL along with the corresponding reductions for Slab Creek, which are protective of the *E. coli* water quality criteria year-round.

Table 1-1 *E. coli* Concentrations and Required Reductions for Slab Creek

Source	Existing Concentration (col/100 ml)	Allowable Concentration (col/100 ml)	Required Reduction (col/100 ml)	% Reduction
Single Sample	648.8	268.2	380.6	59%
Geometric Mean	229.4	113.4	116.0	51%
Boaz Slab Creek WWTP (AL0049603)*	675	298	377	56%

*Point source existing concentration is based on the reported discharge values during the month of the highest instream *E. coli* exceedance, and allowable concentration is based on permit limits during the month of the highest instream *E. coli* exceedance. It is noted that changes to the permit limits are not required; compliance with the existing permit limits will result in compliance with the TMDL.

Table 1-2 *E. coli* TMDL for Slab Creek

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[c]			Load Allocation (LA)
		WWTPs[a]	Stormwater (MS4s and other NPDES sources)[b]	Leaking Collection Systems[c]	
(col/100 ml)	(col/100 ml)	(col/100 ml)	(% reduction)	(col/100 ml)	(% reduction)
298	29.8	298	59%	0	59%

a. Current and future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
b. Current and future MS4 areas and other NPDES stormwater sources will be required to demonstrate consistency with the assumptions and requirements of this TMDL through implementation and maintenance of BMPs on a case-by-case basis. For the purposes of this TMDL, the 59% reduction for MS4s and other stormwater sources should not be interpreted as a numeric permit limitation.
c. The objective for leaking collection systems is a wasteload allocation (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 *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for *E. coli*.
d. Current and future CAFOs will be assigned a WLA of zero.

Compliance with the terms and conditions of existing and future National Pollutant Discharge Elimination System (NPDES) permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required 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 to targeting the reductions to improve water quality in the Slab 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 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 24.98 miles of Slab Creek as impaired for pathogens. The §303(d) listing for pathogens was originally reported on Alabama's 2018 List of Impaired Waters based on ADEM monitoring data collected in 2015 and was subsequently included on the 2020, 2022, and 2024 lists.

2.2 Problem Definition

Waterbody Impaired:	Slab Creek – from its source to Locust Fork
Impaired Reach Length:	24.98 miles
Impaired Drainage Area:	67.4 square miles
Water Quality Standard Violation:	Pathogens (Single Sample, Geometric Mean)
Pollutant of Concern:	Pathogens (*E. coli*)
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 the F&W 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.

(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 year-round and whole body water-contact recreation during the months of May through October, 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 areas and will be considered satisfactory for swimming and other whole body water-contact sports.

<u>*E. coli* Criteria:</u>

Criteria for acceptable bacteria levels for the F&W 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 E. coli group shall not exceed a geometric mean of 548 colonies/100 ml; nor exceed a maximum of 2,507 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 whole body water-contact recreation during the months of May through October, 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 E. coli organism density does not exceed 126 colonies/100 ml nor exceed a maximum of 298 colonies/100 ml in any sample 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.

<u>Criteria Exceeded:</u>

Slab Creek was first included on the §303(d) list for pathogens in 2018 based on ADEM's *E. coli* data collected in 2015 at station SLAM-22C. Of the eight *E. coli* samples collected at station

SLAM-22C in 2015, three violated the applicable single sample maximum criterion of 298 colonies/100 ml. The listing data can be found in Appendix 7.2, Table 7-1.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

For the purpose of this TMDL, a single sample *E. coli* target of 268.2 colonies/100 ml will be used. This target was derived by using a 10% explicit margin of safety from the single sample maximum criterion of 298 colonies/100 ml. This target is considered protective of water quality standards and should not allow the single sample maximum criterion to be exceeded. In addition, a geometric mean target of 113.4 colonies/100 ml will be used for a series of at least five samples taken no less than 24 hours apart over the course of 30 days. This geometric mean target was also derived by using a 10% explicit margin of safety from the geometric mean criterion of 126 colonies/100 ml. This target is considered protective of water quality standards and should not allow the geometric mean criterion to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Slab 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 sewer systems in urban areas. Municipal wastewater treatment facilities are permitted through the NPDES process administered by ADEM. In urban settings, sewer lines typically run parallel to streams in the floodplain. If a leaking sewer line is present, high concentrations of bacteria can flow into the stream or leach into the groundwater. Illicit discharges are found at facilities that are discharging bacteria when not permitted, or when the pathogens criterion established in the issued NPDES permit is not being upheld.

Continuous Point Sources

There is one continuous NPDES-permitted facility in the Slab Creek watershed. This facility is shown in Table 3-1 and Figure 3-1. This facility has daily maximum and monthly average *E. coli* limits. The permit limits are the applicable pathogen criteria for the Fish and Wildlife use classification and are as follows:

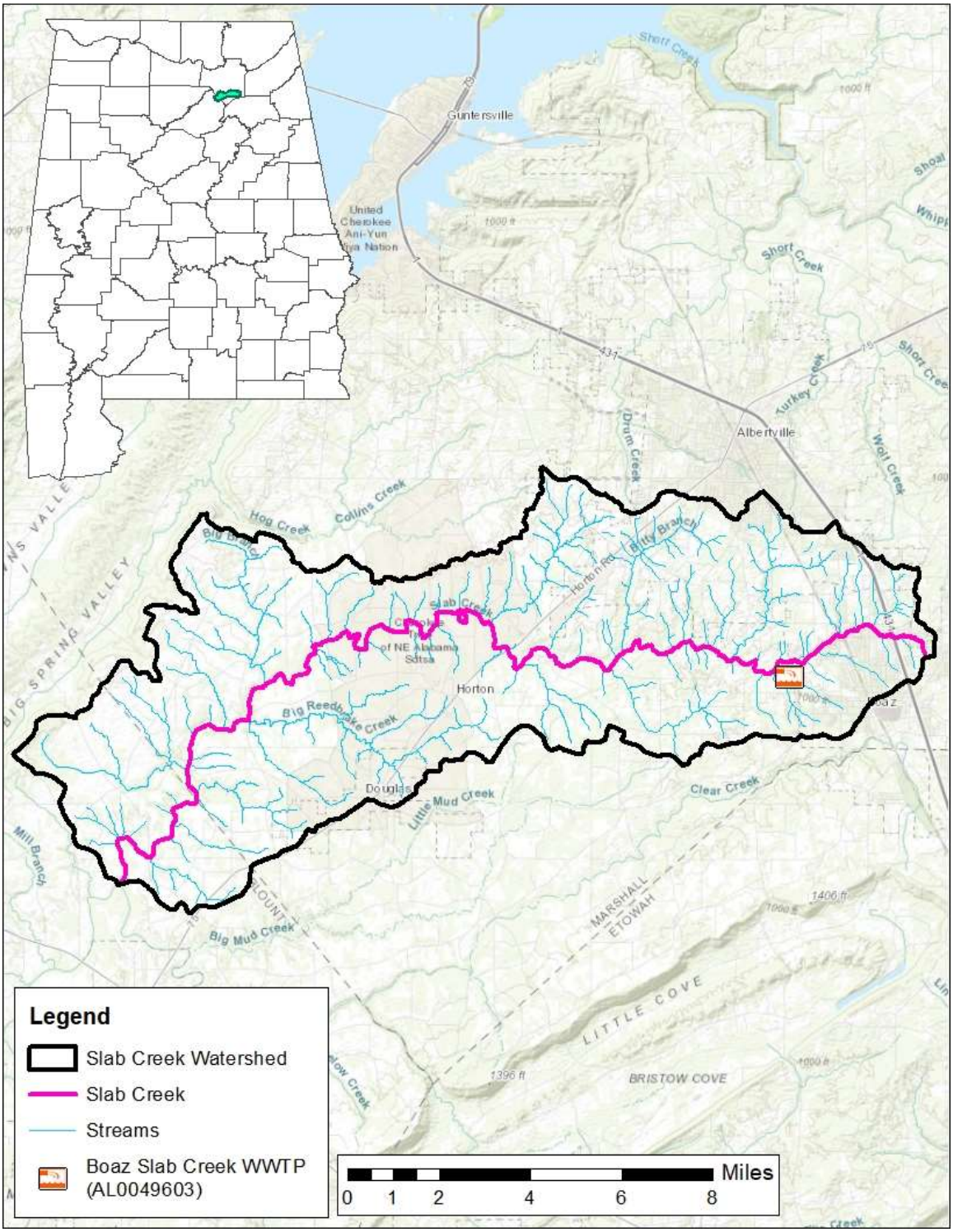
Monthly average (May-October): 126 colonies/100ml
Monthly average (November-April): 548 colonies/100ml
Daily maximum (May-October): 298 colonies/100ml
Daily maximum (November-April): 2507 colonies/100ml

Table 3-1 Continuous Point Source in the Slab Creek Watershed

Type	Permit Number	Facility Name	Receiving Stream	Design Flow (MGD)
Municipal	AL0049603	Boaz Slab Creek WWTP	Unnamed Tributary (UT) to Slab Creek	4.88

Any future NPDES-regulated, continuous 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.

Figure 3-1 Map of Continuous Point Source in the Slab Creek Watershed



Non-Continuous Point Sources

Boaz Slab Creek WWTP is also permitted through the NPDES program to discharge stormwater runoff in the Slab Creek watershed. This facility will be required to comply with the provisions of this TMDL through implementation of Best Management Practices (BMPs) for the permitted stormwater outfalls.

There are currently several NPDES-permitted non-continuous dischargers within the Slab Creek watershed, including facilities with NPDES general permits for activities such as construction, salvage and recycling, concrete, metals, etc. These facilities are not required to monitor for *E. coli* and are not considered to be a source of pathogens due to the nature of their processes; therefore, no *E. coli* loading to the watershed will be attributed to these facilities, and they will not receive an allocation in this TMDL.

The Slab Creek watershed does not presently qualify as a municipal separate storm sewer system (MS4) area.

There are currently several Animal Feeding Operations/Concentrated Animal Feeding Operations (AFOs/CAFOs) within the Slab Creek watershed, most of which are poultry farms. AFOs/CAFOs are required to implement and maintain effective BMPs that meet or exceed Natural Resources Conservation Service (NRCS) technical standards and guidelines. The ADEM AFO/CAFO rules prohibit point source discharges of pollutants from these facilities and their associated waste land application activities. As a result, current and future AFOs/CAFOs will receive a wasteload allocation of zero.

Any future NPDES-regulated discharger that is considered by the Department to be a pathogen source will be required to demonstrate consistency with the assumptions and requirements of this TMDL.

Sanitary sewer overflows (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. From review of ADEM files, it was found that numerous SSOs have been reported in the Slab Creek watershed in recent years. Since 2019, 30 SSOs within the watershed have been reported from Boaz Slab Creek WWTP (AL0049603) and MUB WWTP (AL0020192). The numerous SSOs are considered a source of pathogens to Slab Creek and are listed in Appendix 7.3, Table 7-4 along with a map of the SSO locations in Appendix 7.3, Figure 7-1.

There are currently no registered sites in the Slab Creek watershed where land application of by-products for beneficial use is present. Beneficial use sites are regulated by ADEM's Land Division and are required to implement appropriate BMPs and agronomic application rates to protect the environment.

3.2.2 Nonpoint Sources in the Slab Creek Watershed

Nonpoint sources of *E. coli* bacteria do not have a defined discharge point but rather occur over the entire length of a stream or waterbody. On the land surface, *E. coli* 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 *E. coli* bacteria are collected and carried to the stream or waterbody. Therefore, there is some net loading of *E. coli* bacteria into the stream as dictated by the watershed hydrology.

Agricultural land can be a source of *E. coli* 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 *E. coli* bacteria to waterbodies. To account for the potential influence from animals with direct access to stream reaches in the watershed, *E. coli* concentrations can be calculated as a direct source into the stream.

E. coli 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.

E. coli loading from urban areas is potentially attributable to multiple sources including stormwater runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. Septic systems may be direct or indirect sources of bacterial pollution via ground and surface waters. Onsite septic systems have the potential to deliver *E. coli* bacteria to surface waters due to system failure and malfunction.

3.3 Land Use Assessment

Land use for the Slab Creek watershed was determined using ArcMap with land use datasets derived from the 2021 National Land Cover Dataset (NLCD). Figure 3-2 and Table 3-2 display the land use areas for the Slab Creek watershed.

The majority of the Slab Creek watershed is agriculture (53.56%). Other land uses include forested/natural (26.78%) and developed land (19.15%). If not managed properly, agriculture can have significant nonpoint source impacts. Also, septic systems can be a main source of bacteria if not properly installed and maintained.

Figure 3-2 Land Use Map for the Slab Creek Watershed

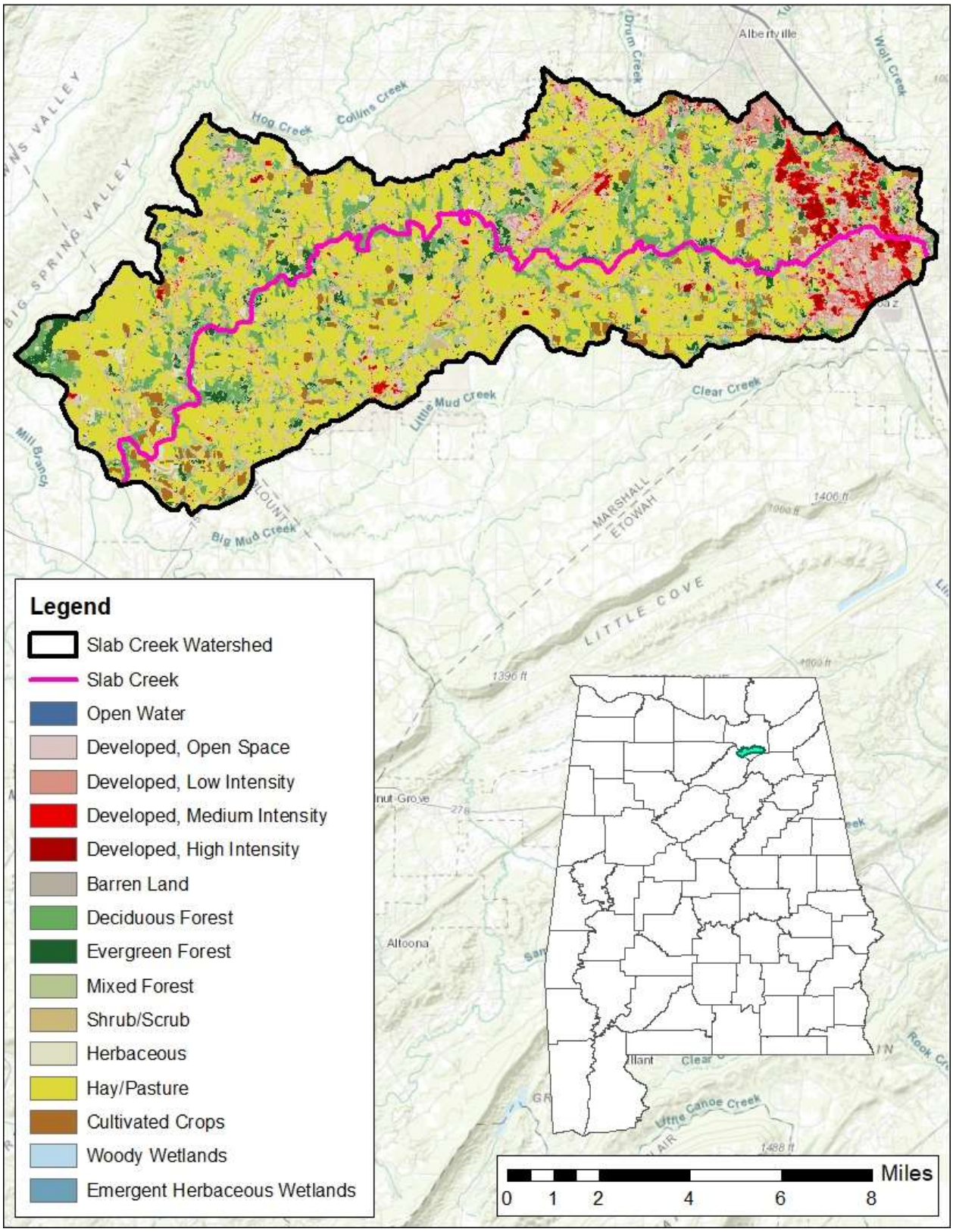
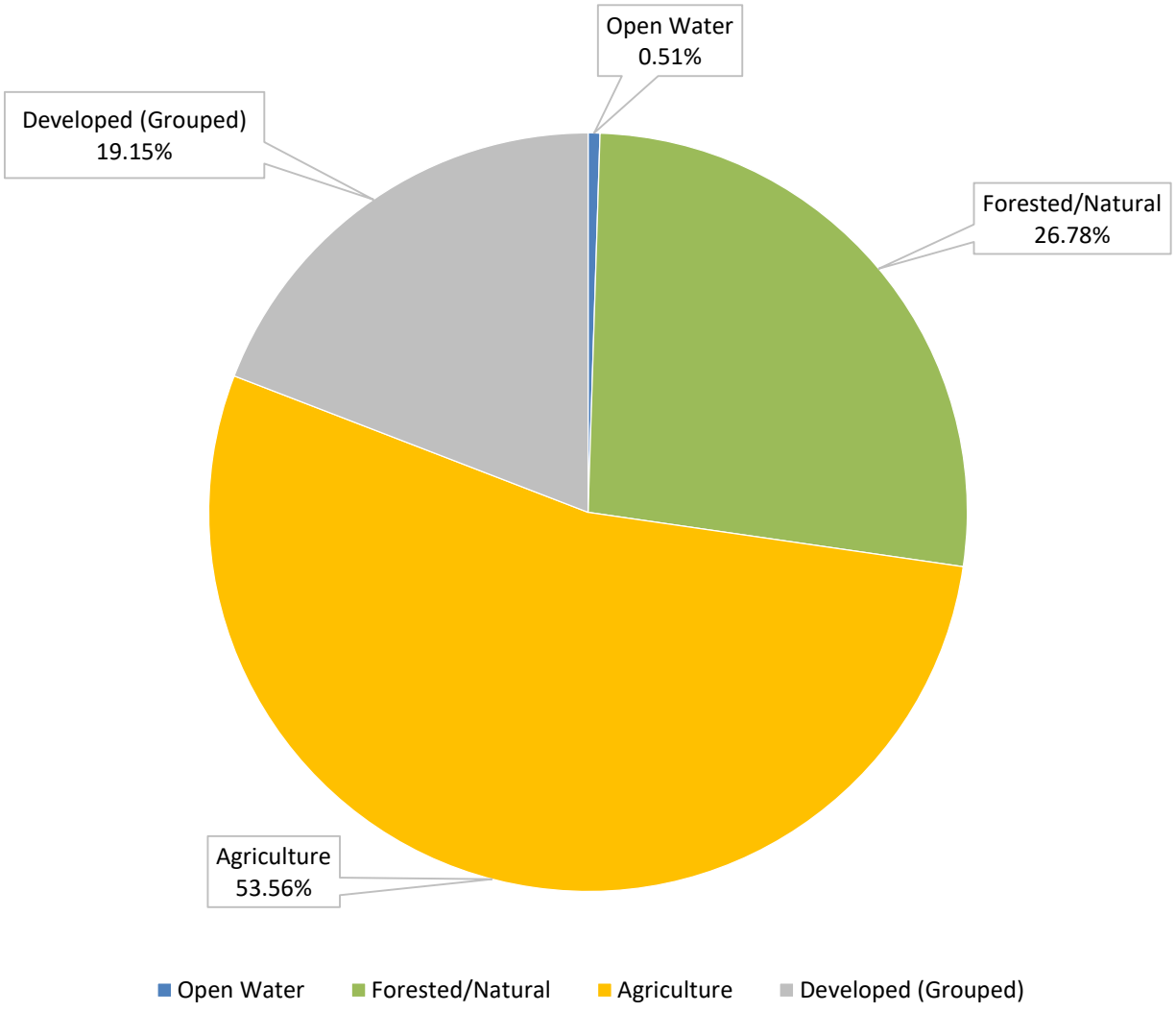


Table 3-2 Land Use Areas for the Slab Creek Watershed

Cumulative Land Use	Square Miles (mi^2)	Acres	Percent
Open Water	0.35	221.31	0.51%
Forested/Natural	18.05	11,551.29	26.78%
Agriculture	36.10	23,105.91	53.56%
Developed (Grouped)	12.90	8,258.77	19.15%
Total	**67.40**	**43,137.28**	**100.00%**

Figure 3-3 Primary Land Uses in the Slab Creek Watershed



3.4 Linkage Between Numeric Targets and Sources

The Slab Creek watershed's primary land use is agriculture, followed by forested/natural and developed land. 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 pathogens in Slab Creek are from agricultural land uses, illicit discharges, unpermitted discharges of wastewater, urban runoff, and failing septic systems. It is not considered a logical approach to calculate individual components for nonpoint source contributions. Hence, there will not be individual reductions calculated for the various nonpoint sources. The reductions will only be calculated as a single total nonpoint source reduction.

3.5 Data Availability and Analysis

To further assess the impaired segment, ADEM collected water quality data on Slab Creek at station SLAM-22C in 2023-2024 and at station SLAM-3 in 2020. Figure 1-1 and Table 3-3 display the locations and descriptions, respectively, for the ADEM sampling stations. The 2020-2024 data listed in Tables 3-4 and 3-5 will be used for this TMDL. The January 2024 edition of *Alabama's Water Quality Assessment and Listing Methodology,* prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody.

Table 3-3 Slab Creek Sampling Station Descriptions

Station ID	Station Location	Latitude	Longitude
SLAM-22C	Unnamed Marshall County Rd. Near Douglas	34.212261	-86.272319
SLAM-3	Slab Creek at Welcome Home Church Rd.	34.18304	-86.38111

One of the 29 *E. coli* samples collected at stations SLAM-22C and SLAM-3 in 2020-2024 violated the summer single sample maximum criterion of 298 colonies/100 ml for the Fish and Wildlife use classification. Geometric means were calculated based on data collected at station SLAM-22C in July 2024 and September/October 2024; the geometric mean exceeded the *E. coli* criterion of 126 colonies/100 ml during July 2024. This data can be viewed in Table 3-4 and Table 3-5.

Table 3-4 2023-2024 *E. coli* Data at Station SLAM-22C

Station SLAM-22C						
Visit Date	***E. coli* (col/100 ml)**	***E. coli* dc***	***E. coli* Criterion (col/100 ml)**	**Geometric Mean (col/100 ml)**	**Geometric Mean Criterion (col/100 ml)**	**Flow (cfs)**
4/11/2023	488.4		2507			72.3
6/7/2023	114.5	H	298			9.7
8/7/2023	98.8	H	298			
10/18/2023	238.2	H	298			
3/19/2024	131.7	H	2507			
4/9/2024	2419.6	H	2507			
5/15/2024	127.4	H	298			9.5
6/10/2024	101.4	H	298			6.6
7/2/2024	238.2		298			2.2
7/9/2024	193.5		298			1.8
7/16/2024	648.8	H	298	229.4	126	3.5
7/18/2024	105.4		298			3.4
7/23/2024	201.4		298			2.1
8/13/2024	32.3	H	298			1.7
9/10/2024	30.1	H	298			
9/24/2024	178.5		298			0.5
9/26/2024	104.3		298			4.3
10/1/2024	166.4		298	108.5	126	1.1
10/4/2024	81.6		298			1.4
10/8/2024	59.4		298			
10/16/2024	28.8	H	298			1.4

*H denotes that the analytical holding times for analysis were exceeded.

Table 3-5 2020 *E. coli* Data at Station SLAM-3

Station SLAM-3				
Visit Date	***E. coli* (col/100 ml)**	***E. coli* dc***	***E. coli* Criterion (col/100 ml)**	**Flow (cfs)**
5/21/2020	64.4		298	20.7
6/11/2020	114.5		298	22
7/7/2020	104.6		298	6.9
8/6/2020	161.6		298	1.1
9/23/2020	111.2	H	298	3.6
10/28/2020	238.2	H	298	28.4
11/18/2020	98.7		2507	35.1
12/3/2020	105.4		2507	37.6

*H denotes that the analytical holding times for analysis were exceeded.

3.6 Critical Conditions/Seasonal Variation

Critical conditions typically occur during the summer months (May-October). 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 bacteria into streams, resulting in spikes of bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up of bacteria on the land surface, resulting in a more uniform loading rate.

Slab Creek generally follows the trends described above for the summer months of May through October. The critical condition for this pathogen TMDL was taken to be the one with the highest *E. coli* single sample exceedance value. The highest single sample maximum concentration of 648.8 colonies/100 ml was collected on July 16, 2024 at station SLAM-22C. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in Slab Creek year-round.

3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: 1) by implicitly incorporating 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.

The MOS accounts for the uncertainty associated with the limited availability of *E. coli* data used in this analysis. An explicit MOS was applied to the TMDL by reducing the appropriate target criterion concentration by 10%. The single sample *E. coli* maximum value of 298 colonies/100 ml was reduced by 10% to 268.2 colonies/100 ml, while the geometric mean criterion of 126 colonies/100 ml was also reduced by 10% to 113.4 colonies/100 ml.

4.0 TMDL Development

4.1 Definition of a TMDL

A TMDL is the sum of individual wasteload allocations (WLAs) for point sources, 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:

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

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). For pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i). In this instance, a concentration approach was deemed to be appropriate due to the disproportionate relationship between the ambient stream flow at the time of the highest *E. coli* exceedance and the design flow of the point source discharge in the watershed. Therefore, a percent reduction was based solely on the highest exceedance value measured in terms of concentration.

4.2 Calculations

A concentration/percent reduction approach was used to calculate the pathogen TMDL for Slab Creek. The following equation was used to calculate the appropriate reduction:

$$\%\ Reduction = \frac{[Highest\ Exceedance - (Sample\ Criterion - MOS)]}{Highest\ Exceedance} \times 100$$

The TMDL was based on the violation event that produced the highest percent reduction of *E. coli* necessary to achieve applicable water quality criteria, whether it be the single sample or geometric mean.

Single Sample:
The required percent reduction was calculated by subtracting the single sample *E. coli* target of 268.2 colonies/100 ml from the highest single sample exceedance of 648.8 colonies/100 ml and then dividing the difference by the highest single sample exceedance. The violation event occurred at Station SLAM-22C on July 16, 2024.

$$\frac{\left[\frac{648.8\ colonies}{100\ ml} - \left(\frac{298\ colonies}{100\ ml} - \frac{29.8\ colonies}{100\ ml}\right)\right]}{\frac{648.8\ colonies}{100\ ml}} \times 100 = 59\%$$

Geometric Mean:

The required percent reduction was calculated by subtracting the geometric mean *E. coli* target of 113.4 colonies/100 ml from the highest geometric mean exceedance of 229.4 colonies/100 ml and then dividing the difference by the highest geometric mean exceedance. The violation event occurred at station SLAM-22C between July 2, 2024 and July 23, 2024.

$$\frac{\left[\frac{229.4\ colonies}{100\ ml} - \left(\frac{126\ colonies}{100\ \text{ml}} - \frac{12.6\ colonies}{100\ ml}\right)\right]}{\frac{229.4\ colonies}{100\ ml}} \times 100 = 51\%$$

Boaz Slab Creek WWTP (AL0049603):

The WLA was calculated by subtracting the applicable instream single sample *E. coli* criterion from the reported maximum daily *E. coli* value for the month of July 2024 (since this is when the exceedance occurred) and then dividing the difference by the reported maximum daily *E. coli* value. It is noted that the facility exceeded their permitted limit for the month of July 2024.

$$\frac{\left[\frac{675\ colonies}{100\ ml} - \frac{298\ colonies}{100\ ml}\right]}{\frac{675\ colonies}{100\ ml}} \times 100 = 56\%$$

The difference in the pathogen concentrations between the existing condition (i.e., the violation event) and the allowable condition converted to a percent reduction represents the total reduction needed to achieve the *E. coli* water quality criteria. The TMDL was calculated as the *E. coli* concentration in Slab Creek as evaluated at station SLAM-22C. Table 4-1 shows the existing and allowable *E. coli* concentrations and required reductions for the Slab Creek watershed.

Table 4-1 *E. coli* Concentrations and Required Reductions for Slab Creek

Source	Existing Concentration (col/100 ml)	Allowable Concentration (col/100 ml)	Required Reduction (col/100 ml)	% Reduction
Single Sample	648.8	268.2	380.6	59%
Geometric Mean	229.4	113.4	116.0	51%
Boaz Slab Creek WWTP (AL0049603)*	675	298	377	56%

*Point source existing concentration is based on the reported discharge values during the month of the highest instream *E. coli* exceedance, and allowable concentration is based on permit limits during the month of the highest instream *E. coli* exceedance. It is noted that changes to the permit limits are not required; compliance with the existing permit limits will result in compliance with the TMDL.

From Table 4-1, compliance with the single sample criterion of 298 colonies/100 ml requires a reduction in the *E. coli* concentration of 59%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criterion are provided in Table 4-2.

Table 4-2 *E. coli* TMDL for Slab Creek

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[d]			Load Allocation (LA)
		WWTPs[a]	Stormwater (MS4s and other NPDES sources)[b]	Leaking Collection Systems[c]	
(col/100 ml)	(col/100 ml)	(col/100 ml)	(% reduction)	(col/100 ml)	(% reduction)
298	29.8	298	59%	0	59%

a. Current and future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
b. Current and future MS4 areas and other NPDES stormwater sources will be required to demonstrate consistency with the assumptions and requirements of this TMDL through implementation and maintenance of BMPs on a case-by-case basis. For the purposes of this TMDL, the 59% reduction for MS4s and other stormwater sources should not be interpreted as a numeric permit limitation.
c. The objective for leaking collection systems is a wasteload allocation (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 *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for *E. coli*.
d. Current and future CAFOs will be assigned a WLA of zero.

4.3 TMDL Summary

Slab Creek was first included on the §303(d) list for pathogens in 2018 based on ADEM's *E. coli* data collected in 2015 at station SLAM-22C. In 2020 and 2023-2024, ADEM collected water quality data that confirmed the pathogen impairment and provided the basis for TMDL development.

A concentration/percent reduction approach was used to calculate the *E. coli* TMDL for Slab Creek. Based on the TMDL analysis, it was determined that a 59% reduction in *E. coli* concentrations 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 reductions in the load allocation portion of this TMDL will be implemented through voluntary measures/best management practices (BMPs). Cooperation and active participation by the public and various other groups are 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 for nonpoint sources will be coordinated through interaction with local entities and may be eligible for CWA §319 grants through the Department's Nonpoint Source Unit.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed to targeting the reductions to improve water quality in the Slab 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 monitoring, an approach that divides Alabama's sixteen major river basins into three groups. Each year, ADEM's water quality resources are concentrated in one of the three basin groups and are divided among multiple priorities including §303(d) listed waterbodies, waterbodies with active TMDLs, and other waterbodies as determined by the Department. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices and reductions in the watershed. This monitoring will occur in each basin according to the schedule shown in Table 5-1.

Table 5-1 Follow-up Monitoring Schedule

River Basin Group	Years to be Monitored
Coosa, Escatawpa, Tennessee (Guntersville), Tombigbee	2025/2028
Alabama, Cahaba, Mobile, Tallapoosa, Tennessee (Pickwick and Wilson)	2026/2029
Black Warrior, Blackwater, Chattahoochee, Chipola, Choctawhatchee, Escambia, Perdido, Tennessee (Wheeler), Yellow	2027/2030

6.0 Public Participation

As part of the public participation process, this TMDL will be placed on public notice and made available for review and comment. The public notice and subject TMDL will be made available on ADEM's website: www.adem.alabama.gov. In addition, the public notice will be submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. The public may also request paper or electronic copies of the TMDL by contacting Ms. Kimberly Minton at 334-271-7826 or kminton@adem.alabama.gov. The public will be 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 will become part of the administrative record. ADEM will consider all comments received by the public prior to final completion of this TMDL and subsequent submission to EPA Region 4 for final approval.

7.0 Appendix

7.1 References

ADEM Administrative Code, 2021. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2021. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's Monitoring Program. 2015-2024. ADEM.

Alabama Department of Environmental Management (ADEM), *Alabama's Water Quality Assessment and Listing Methodology*, January 2024.

Alabama Department of Environmental Management, 2018, 2020, 2022 & 2024 §303(d) Lists and Fact Sheets. ADEM.

Alabama Department of Environmental Management (ADEM), Laboratory Data Qualification SOP #4910 Revision 7.2, 2022.

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, 1986. *Quality Criteria for Water.* Office of Water. EPA 440/4-91-001.

7.2 Water Quality Data

Table 7-1 2015 ADEM Pathogen Data Collected on Slab Creek (Listing Data)

Station SLAM-22C				
Visit Date	***E. coli* (col/100 ml)**	***E. coli* dc***	***E. coli* Criterion (col/100 ml)**	**Flow (cfs)**
3/17/2015	62.4		2507	43.4
4/8/2015	135.4	H	2507	33
5/7/2015	344.8		298	13.3
6/9/2015	307.8		298	11.1
7/9/2015	73.3		298	3.8
7/29/2015	67.7		298	
9/15/2015	65		298	1.9
10/20/2015	344.8		298	

*H denotes that the analytical holding times for analysis were exceeded.

Table 7-2 2020 ADEM Pathogen Data Collected on Slab Creek

Station SLAM-3				
Visit Date	***E. coli* (col/100 ml)**	***E. coli* dc***	***E. coli* Criterion (col/100 ml)**	**Flow (cfs)**
5/21/2020	64.4		298	20.7
6/11/2020	114.5		298	22
7/7/2020	104.6		298	6.9
8/6/2020	161.6		298	1.1
9/23/2020	111.2	H	298	3.6
10/28/2020	238.2	H	298	28.4
11/18/2020	98.7		2507	35.1
12/3/2020	105.4		2507	37.6

*H denotes that the analytical holding times for analysis were exceeded.

Table 7-3 2023-2024 ADEM Pathogen Data Collected on Slab Creek

Station SLAM-22C				
Visit Date	***E. coli* (col/100 ml)**	***E. coli* dc***	***E. coli* Criterion (col/100 ml)**	**Flow (cfs)**
4/11/2023	488.4		2507	72.3
6/7/2023	114.5	H	298	9.7
8/7/2023	98.8	H	298	
10/18/2023	238.2	H	298	
3/19/2023	131.7	H	2507	
4/9/2023	2419.6	H	2507	
5/15/2024	127.4	H	298	9.5
6/10/2024	101.4	H	298	6.6
7/2/2024	238.2		298	2.2
7/9/2024	193.5		298	1.8
7/16/2024	648.8	H	298	3.5
7/18/2024	105.4		298	3.4
7/23/2024	201.4		298	2.1
8/13/2024	32.3	H	298	1.7
9/10/2024	30.1	H	298	
9/24/2024	178.5		298	0.5
9/26/2024	104.3		298	4.3
10/1/2024	166.4		298	1.1
10/4/2024	81.6		298	1.4
10/8/2024	59.4		298	
10/16/2024	28.8	H	298	1.4

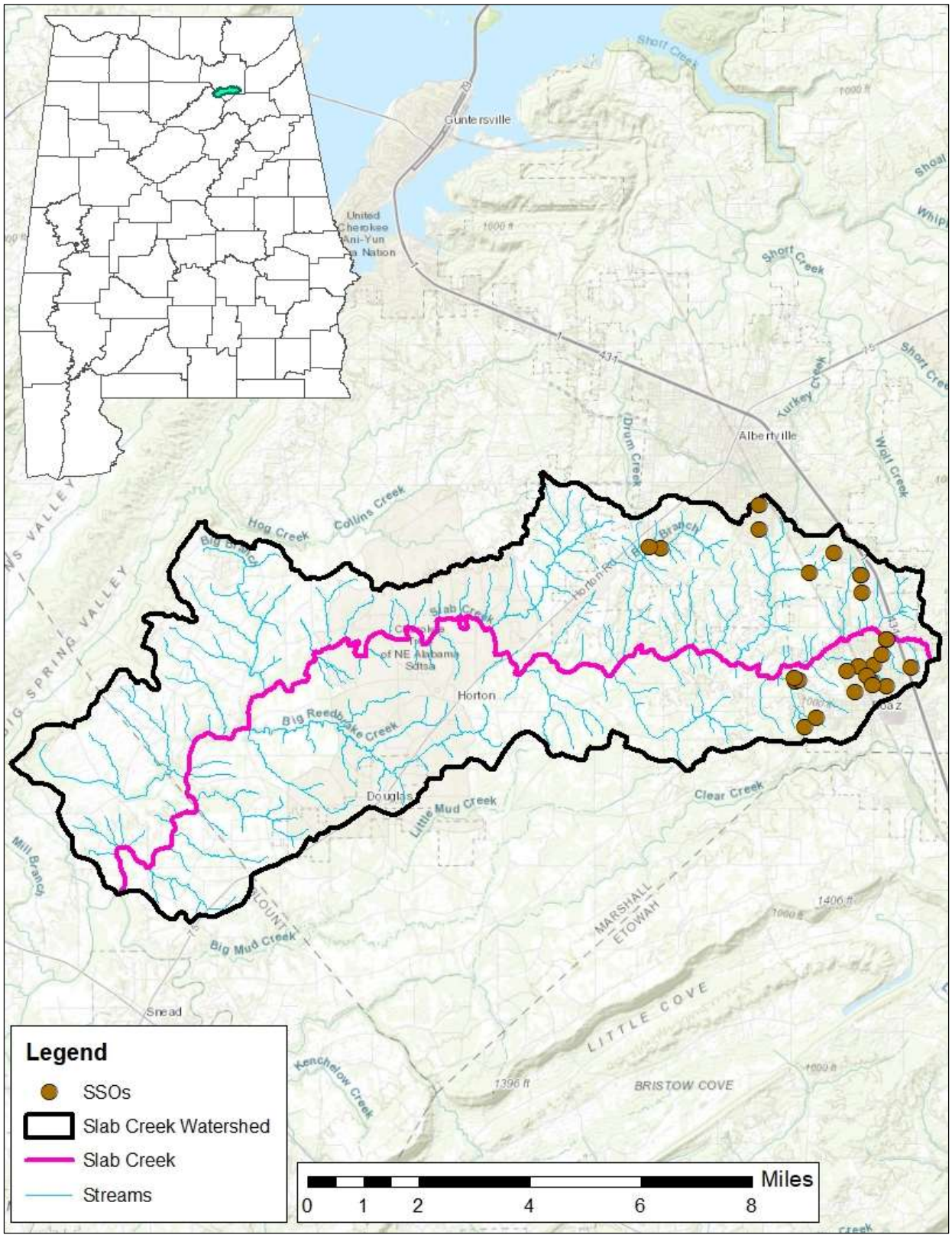
*H denotes that the analytical holding times for analysis were exceeded.

7.3 Sanitary Sewer Overflows (SSOs)

Table 7-4 Reported SSOs in the Slab Creek Watershed

	SSO Began Date	Estimated Release Volume (gallons)	Duration (hours)
Boaz Slab Creek WWTP (AL0049603)	2/6/2020	25,000 – 50,000	17
	2/19/2021	≤ 1,000	2
	2/26/2021	≤ 1,000	8
	3/25/2021	1,000 – 10,000	22
	3/31/2021	1,000 – 10,000	40
	5/31/2021	1,000 – 10,000	2
	6/21/2021	10,000 – 25,000	1
	11/23/2021	1,000 – 10,000	25
	2/23/2022	10,000 – 25,000	9
	7/5/2022	10,000 – 25,000	2
	7/21/2022	1,000 – 10,000	2
	8/8/2022	10,000 – 25,000	20
	11/22/2022	1,000 – 10,000	2
	11/27/2022	10,000 – 25,000	3
	12/5/2022	1,000 – 10,000	1
	12/15/2022	25,000 – 50,000	3
	3/3/2023	1,000 – 10,000	1
	5/9/2024	400,000	3
	11/12/2024	10,000 – 25,000	19
	12/30/2024	1,000 – 10,000	2
MUB WWTP (AL0020192)	4/24/2019	1,000 – 10,000	1
	8/23/2019	≤ 1,000	1
	10/2/2019	1,000 – 10,000	0
	1/16/2020	1,000 – 10,000	16
	10/19/2020	≤ 1,000	0
	2/5/2021	≤ 1,000	0
	3/8/2021	≤ 1,000	0
	11/29/2023	200	0
	2/17/2024	≤ 1,000	2
	7/6/2024	75,000 – 100,000	0

Figure 7-1 Map of Reported SSOs in the Slab Creek Watershed



7.4 Slab Creek Watershed Photos (June 18, 2020)

Figure 7-2 Slab Creek at Welcome Home Church Rd. (SLAM-3), Looking Upstream

Figure 7-3 Slab Creek at Welcome Home Church Rd. (SLAM-3), Looking Downstream

7.5 Slab Creek Watershed Photos (April 11, 2023)

Figure 7-4 Slab Creek at Unnamed Marshall County Rd. (SLAM-22C), Looking Upstream

Figure 7-5 Slab Creek at Unnamed Marshall County Rd. (SLAM-22C), Looking Downstream

7.6 Slab Creek Watershed Photos (October 8, 2024)

Figure 7-6 Slab Creek at Unnamed Marshall County Rd. (SLAM-22C), Looking Upstream

Figure 7-7 Slab Creek at Unnamed Marshall County Rd. (SLAM-22C), Looking Downstream