
# Final

## Total Maximum Daily Load (TMDL)

## For

# Swift Creek

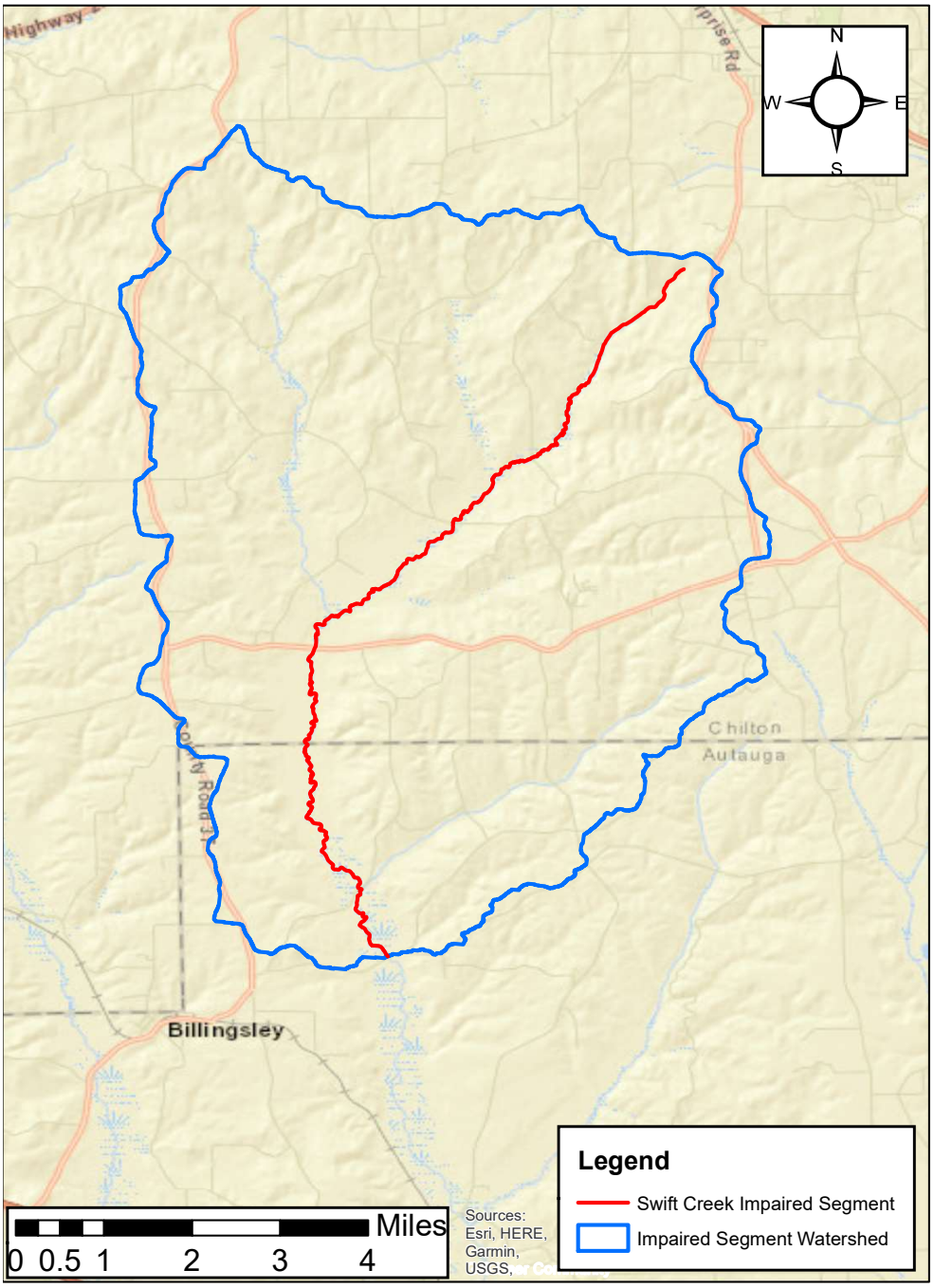
### Assessment Unit ID# AL03150201-0601-100

# Pathogens (*E. coli*)

### Autauga and Chilton Counties

Alabama Department of Environmental Management
Water Quality Branch
Water Division
June 2025

**Figure 1: Swift 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 wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Swift Creek, part of the Alabama River basin, begins south of Clanton, Alabama and flows south into the Alabama River (Woodruff Lake). Swift Creek is currently included on Alabama's §303(d) list as impaired for pathogens (*E. coli*) from its source to Autauga County Road 24. This segment of Swift Creek has a designated use classification of Swimming and Other Whole Body Water-Contact Sports/Fish and Wildlife (S/F&W). The total drainage area for the impaired portion of the Swift Creek watershed is approximately 41.7 square miles.

Swift Creek was first included on the §303(d) list as impaired for pathogens in 2020 based on data collected by the Alabama Department of Environmental Management (ADEM) in 2017. The exceedances were found at stations SWFC-1, SWFA-2, and SWFA-1. This data, which can be found in Appendix 7.2, indicated that Swift Creek was impaired for pathogens (*E. coli*).

In 2023, sampling studies were performed by ADEM on Swift Creek to further assess the water quality of the impaired stream. ADEM collected 14 samples at each of the three stations noted above. Geometric mean studies were also conducted at each station. For the purposes of this TMDL, the 2023 data will be used to assess the water quality of Swift Creek because it is the most current data and provides the best picture of the current water quality conditions 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. All the available and recent bacterial data is listed in the Appendix for reference. According to the collected data, Swift Creek was not meeting the pathogen criteria applicable to its use classification of S/F&W. Therefore, this TMDL has been developed for pathogens (*E. coli*) for Swift Creek.

A mass balance approach was used for calculating the pathogen TMDL for Swift Creek. The mass balance approach utilizes the conservation of mass principle. The TMDL was calculated using the single sample or geometric mean sample exceedance event which resulted in the highest percent reduction. Existing loads were calculated by multiplying the *E. coli* concentrations times the respective in-stream flows and a conversion factor. In the same manner as existing loads were calculated, allowable loads were calculated for the single sample *E. coli* target of 211.5 colonies/100 ml (235 colonies/100ml – 10% Margin of Safety) and geometric mean *E. coli* target of 113.4 colonies/100 ml (126 colonies/100 ml – 10% Margin of Safety). In this case, it was determined that the highest percent reduction was

calculated from a single sample *E. coli* violation of 2419.6 colonies/100 ml on October 12, 2023. This violation calls for a reduction of 91%.

Table 1 is a summary of the estimated existing load, allowable load, and percent reduction for the single sample criterion and the geometric mean criterion. Table 2 lists the TMDL, defined as the maximum allowable *E. coli* loading under critical conditions for Swift Creek.

**Table 1. *E. coli* Loads and Required Reductions**

| Source | Existing Load (col/day) | Allowable Load (col/day) | Required Reduction (col/day) | % Reduction |
|---|---|---|---|---|
| Single Sample Load | 4.24E+12 | 3.71E+11 | 3.87E+12 | 91% |
| Geometric Mean Load | 2.87E+10 | 9.21E+9 | 1.95E+10 | 68% |

**Table 2. *E. coli* TMDL for Swift Creek**

| TMDL[e] | Margin of Safety (MOS) | Waste Load Allocation (WLA)[a] | | | Load Allocation (LA) | |
|---|---|---|---|---|---|---|
| | | WWTPs[b] | Stormwater (MS4s and other NPDES sources)[c] | Leaking Collection Systems[d] | | |
| (col/day) | (col/day) | (col/day) | % reduction | (col/day) | (col/day) | % reduction |
| 4.12E+11 | 4.12E+10 | N/A | N/A | 0 | 3.71E+11 | 91% |

Note: N/A = not applicable

a. There are no CAFOs in the Swift Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.

b. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.

c. Future MS4 areas and other National Pollutant Discharge Elimination System (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.

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 *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*.

e. TMDL was established using the single sample criterion of 235 colonies/100 ml.

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 to targeting the load reductions to improve water quality in the Swift Creek watershed. As additional data and/or

information become 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 in-stream 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 10.55-mile segment of Swift Creek from its source to Autauga County Road 24 as impaired for pathogens. Swift Creek was originally listed on Alabama's 2020 List of Impaired Waters for pathogens based on data collected in 2017. The source of the pathogens impairment is listed as pasture grazing on the current §303(d) list.

## 2.2 Problem Definition

| | |
|---|---|
| Waterbody Impaired: | Swift Creek – from its source to Autauga County Road 24 |
| Impaired Reach Length: | 10.55 miles |
| Impaired Drainage Area: | 41.7 square miles |
| Water Quality Standard Violation: | Pathogens (Single Sample Maximum, Geometric Mean) |
| Pollutant of Concern: | Pathogens (*E. coli*) |
| Water Use Classification: | Swimming and Other Whole Body Water-Contact Sports / Fish and Wildlife |

Usage Related to Classification:
The impaired stream segment is classified as Swimming and Other Whole Body Water-Contact Sports (S) and Fish and Wildlife (F&W). Usage of waters in the Swimming and Other Whole Body Water-Contact Sports classification is described in ADEM Admin. Code r. 335-6-10-.09(3)(a) and (b).

> *(a) Best usage of waters: swimming and other whole body water-contact sports.*

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

Usage of waters in the Fish and Wildlife 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.*

*E.coli* Criteria:
Criteria for acceptable bacteria levels for the Swimming and Other Whole Body Water-Contact Sports use classification are described in ADEM Admin. Code r. 335-6-10-.09(3)(c)6(i), (ii), and (iii) as follows:

*6. Bacteria:*

*(i) 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.*

*(ii) In all other areas, 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 235 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 104 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 mean bacterial 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.*

*(iii) The policy of nondegradation of high quality waters shall be stringently applied to bacterial quality of recreational waters.*

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

*7. Bacteria:*

*(i) In non-coastal waters, bacteria of the 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>
Swift Creek was first included on Alabama's §303(d) list for pathogens (*E. coli*) in 2020 based on data collected by ADEM in 2017 at stations SWFC-1, SWFA-2, and SWFA-1. Monitoring results indicated that the applicable single sample criterion was exceeded in four out of eight

samples at each of the three stations on Swift Creek. The listing data can be found in Appendix 7.2.

# 3.0 Technical Basis for TMDL Development

## 3.1 Water Quality Target Identification

For the purposes of this TMDL, a single sample maximum *E. coli* target of 211.5 colonies/100 ml will be used. This target was derived by using a 10% explicit margin of safety from the Swimming and Other Whole Body Water-Contact Sports single sample maximum criterion of 235 colonies/100 ml. This target is considered protective of water quality standards and should not allow the single sample maximum of 235 colonies/100 ml to be exceeded. In addition, a geometric mean *E. coli* 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 target was 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 of 126 colonies/100 ml to be exceeded.

## 3.2 Source Assessment

### 3.2.1 Point Sources in the Swift Creek Watershed

A point source can be defined as a discernible, 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 National Pollutant Discharge Elimination System (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.

There are currently no NPDES-regulated continuous point sources in the Swift Creek watershed. There are a small number of facilities with NPDES general permits in the watershed (construction and mining sites); 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 operations. No *E. coli* loading to the Swift Creek watershed will be attributed to these facilities, and they will not receive an allocation in this TMDL.

The Swift Creek watershed does not presently qualify as a municipal separate storm sewer system (MS4) area. There are also currently no Animal Feeding Operation/Concentrated

Animal Feeding Operation (AFO/CAFO) facilities located within the Swift Creek watershed. The ADEM AFO/CAFO rules prohibit discharges of pollutants from the facilities and their associated waste land application activities. As a result, future AFOs/CAFOs will receive a waste load allocation of zero.

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

There are currently no registered sites in the Swift 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.

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 no recent SSOs have been reported in the Swift Creek watershed.

### 3.2.2 Nonpoint Sources in the Swift Creek Watershed

Nonpoint sources of bacteria do not have a defined discharge point, but rather occur over the entire length of a stream or waterbody. On the land surface, bacteria can accumulate over time and be washed into streams or waterbodies during rain events. Therefore, there is some net loading of bacteria into streams as dictated by the watershed hydrology.

Agricultural land can be a source of *E. coli* bacteria. Stormwater runoff from pastures and animal feeding areas can be a source of *E. coli*. In addition, improper land application of animal wastes and animals with direct access to streams are mechanisms that can contribute bacteria to waterbodies. To account for the potential influence from animals with direct access to stream reaches in the watershed, *E. coli* loads 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 will 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 developed areas is potentially attributable to multiple sources including storm water runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. On-site septic systems may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

## 3.3 Land Use Assessment

Land use for the Swift Creek watershed was determined using ArcMap with land use datasets derived from the 2021 National Land Cover Dataset (NLCD). The total drainage area of the Swift Creek watershed is approximately 41.7 square miles. Figures 2 and 3 and Table 3 depict the primary land uses in the Swift Creek watershed.

**Figure 2. Land Use in the Swift Creek Watershed**

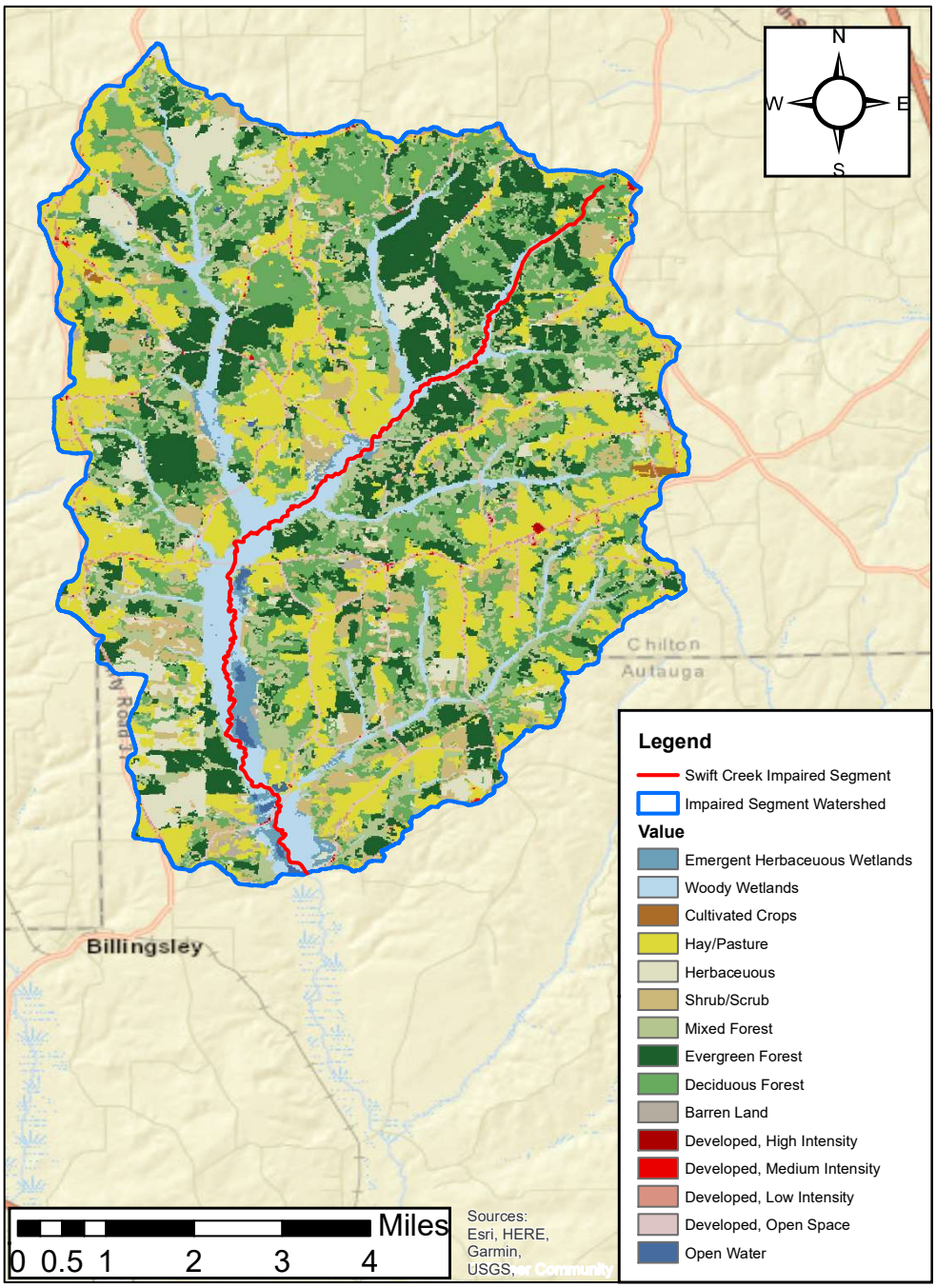
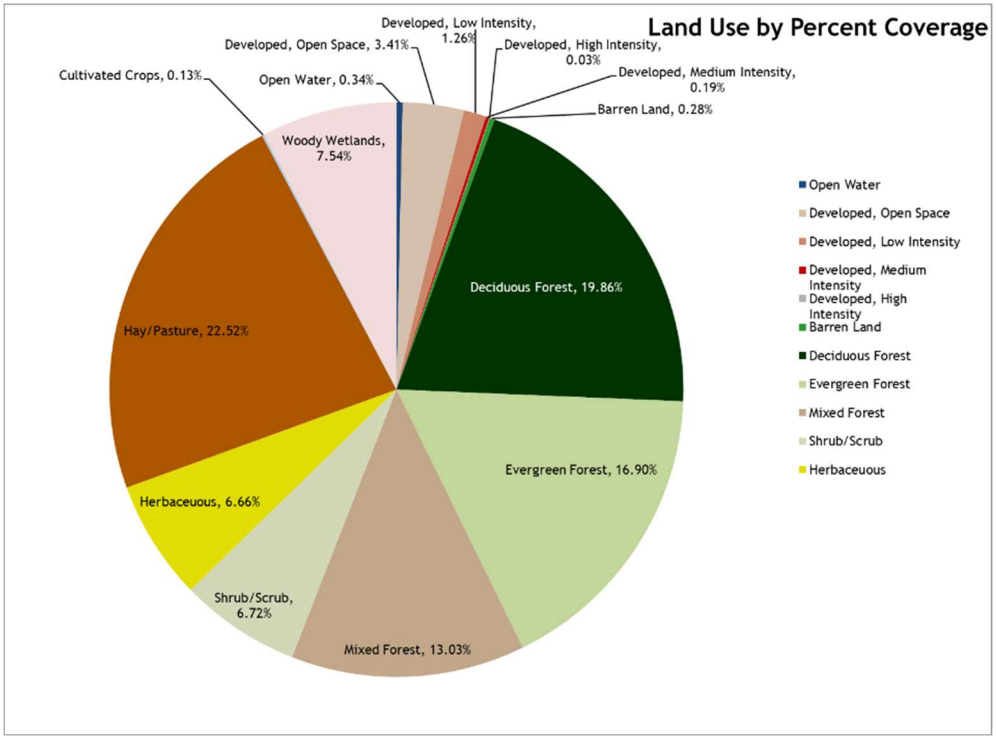


**Table 3: Land Use (2021) in the Swift Creek Watershed**

| Land Use | Miles$^2$ | Acres | Percent |
|---|---|---|---|
| Open Water | 0.14 | 91.18 | 0.34% |
| Developed, Open Space | 1.42 | 909.15 | 3.41% |
| Developed, Low Intensity | 0.52 | 335.37 | 1.26% |
| Developed, Medium Intensity | 0.08 | 49.37 | 0.19% |
| Developed, High Intensity | 0.01 | 7.34 | 0.03% |
| Barren Land | 0.12 | 74.06 | 0.28% |
| Deciduous Forest | 8.28 | 5298.78 | 19.86% |
| Evergreen Forest | 7.04 | 4508.61 | 16.90% |
| Mixed Forest | 5.43 | 3477.14 | 13.03% |
| Shrub/Scrub | 2.80 | 1792.72 | 6.72% |
| Herbaceous | 2.77 | 1775.82 | 6.66% |
| Hay/Pasture | 9.39 | 6008.89 | 22.52% |
| Cultivated Crops | 0.05 | 34.47 | 0.13% |
| Woody Wetlands | 3.14 | 2011.12 | 7.54% |
| Emergent Herbaceous Wetlands | 0.48 | 304.90 | 1.14% |
| Totals→ | **41.69** | **26678.93** | **100.00%** |
| **Class Description** | **Miles$^2$** | **Acres** | **Percent** |
| Open Water | 0.14 | 91.18 | 0.34% |
| Agricultural Lands | 9.44 | 6043.36 | 22.65% |
| Forested/Natural | 29.95 | 19169.10 | 71.85% |
| Developed Land (Grouped) | 2.15 | 1375.29 | 5.15% |
| **Totals→** | **41.69** | **26678.93** | **100.00%** |

**Figure 3: Pie Chart of Land Use Distribution in the Swift Creek Watershed**



Most of the Swift Creek watershed is comprised of forested and natural lands (71.85%) and agricultural lands (22.65%). The remaining land use is approximately 5.15% developed land and 0.34% open water. Developed land includes both commercial and residential land uses.

## 3.4 Linkage between Numeric Targets and Sources

The predominant land usage in the Swift Creek watershed is forested and natural lands, followed by agricultural lands. 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 Swift Creek are from the agricultural land uses and leaking or failing septic tanks. 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 the various nonpoint sources. The loadings will be calculated as a single total nonpoint source load and reduction.

## 3.5 Data Availability and Analysis

During 2023, ADEM conducted sampling on Swift Creek to further assess the water quality of the impaired stream. For purposes of this TMDL, the data from 2023 will be used to assess the water quality of Swift Creek because it is the most current data and provides the best picture of the current water quality conditions 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.

ADEM collected water quality data for the Swift Creek watershed at stations SWFC-1, SWFA-2, and SWFA-1. Descriptions of the station locations can be found in Table 4, and a map showing the station locations can be found in Figure 4. A total of 14 *E. coli* samples were collected at each station during 2023. There were multiple violations of the applicable single sample criterion at each station. In addition, there were geometric mean exceedances at each station in July 2023 and September 2023. A complete list of the data used in this report and photographs at each station can be found in Appendices 7.2 and 7.3, respectively.

**Table 4: ADEM Sampling Stations in the Swift Creek Watershed**

| Station Name | Agency Name | Latitude | Longitude | Description |
|---|---|---|---|---|
| SWFC-1 | ADEM | 32.721466 | -86.691608 | Swift Creek at Chilton Co. Rd 24 near Billingsley |
| SWFA-2 | ADEM | 32.681722 | -86.68471 | Swift Creek at Autauga CR 67 |
| SWFA-1 | ADEM | 32.670577 | -86.679862 | Swift Creek at Autauga CR 24 |

**Figure 4: ADEM Sampling Stations in the Swift Creek Watershed**

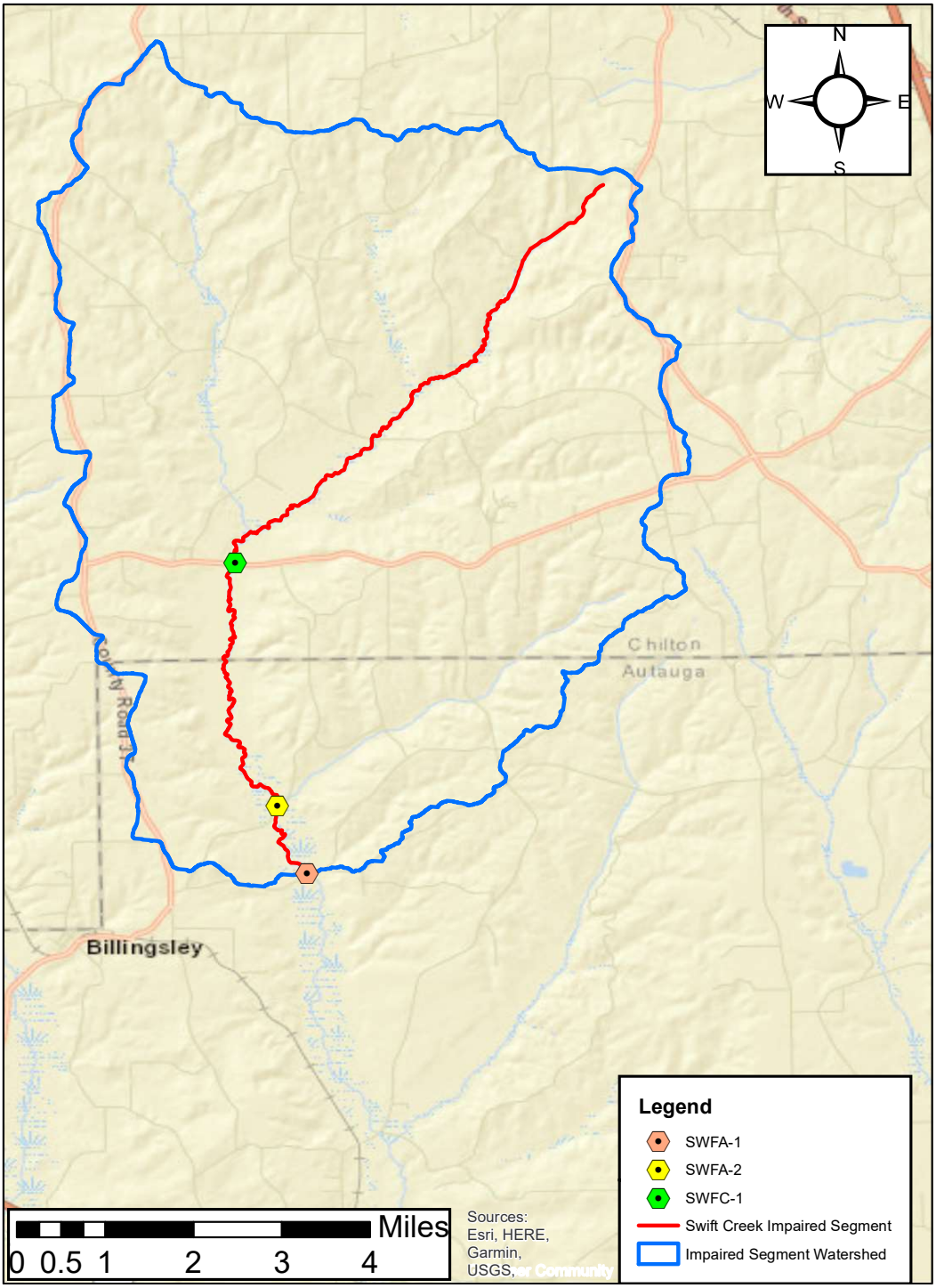


**Table 5: 2023 *E. coli* data at station SWFC-1**

| Station ID | 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) |
|---|---|---|---|---|---|---|---|
| SWFC-1 | 4/13/2023 | 980.4 | | 235 | | | 57.6 |
| SWFC-1 | 6/28/2023 | 387.3 | | 235 | | | |
| SWFC-1 | 7/17/2023 | 332.8 | | 235 | | | 26.2 |
| SWFC-1 | 7/19/2023 | 67.7 | | 235 | | | 14.7 |
| SWFC-1 | 7/24/2023 | 547.5 | | 235 | 294.1 | 126 | 15.1 |
| SWFC-1 | 7/26/2023 | 307.6 | | 235 | | | 10.9 |
| SWFC-1 | 7/31/2023 | 579.4 | | 235 | | | 13.4 |
| SWFC-1 | 8/3/2023 | 261.3 | | 235 | | | 5.2 |
| SWFC-1 | 9/5/2023 | 275.5 | | 235 | | | 4.0 |
| SWFC-1 | 9/7/2023 | 387.3 | | 235 | | | 4.3 |
| SWFC-1 | 9/19/2023 | 488.4 | | 235 | 353.7 | 126 | 2.7 |
| SWFC-1 | 9/21/2023 | 290.9 | | 235 | | | 2.5 |
| SWFC-1 | 9/26/2023 | 365.4 | | 235 | | | 3.1 |
| SWFC-1 | 10/12/2023 | 2419.6 | G | 235 | | | |
| *G denotes that the actual number was probably greater than the number reported. | | | | | | | |

**Table 6: 2023 *E. coli* data at station SWFA-2**

| Station ID | 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) |
|---|---|---|---|---|---|---|---|
| SWFA-2 | 4/13/2023 | 172.3 | | 235 | | | 50.1 |
| SWFA-2 | 6/28/2023 | 31.8 | | 235 | | | 7.6 |
| SWFA-2 | 7/17/2023 | 689.6 | | 235 | | | 42.3 |
| SWFA-2 | 7/19/2023 | 63.1 | | 235 | | | 23.3 |
| SWFA-2 | 7/24/2023 | 209.8 | | 235 | 141.5 | 126 | 24.1 |
| SWFA-2 | 7/26/2023 | 55.6 | | 235 | | | 18.0 |
| SWFA-2 | 7/31/2023 | 111.9 | | 235 | | | 19.6 |
| SWFA-2 | 8/3/2023 | 53.8 | | 235 | | | |
| SWFA-2 | 9/5/2023 | 206.4 | | 235 | | | 8.8 |
| SWFA-2 | 9/7/2023 | 387.3 | | 235 | | | 6.9 |
| SWFA-2 | 9/19/2023 | 328.2 | | 235 | 281.2 | 126 | 5.6 |
| SWFA-2 | 9/21/2023 | 209.8 | | 235 | | | 5.6 |
| SWFA-2 | 9/26/2023 | 319.4 | | 235 | | | 4.9 |
| SWFA-2 | 10/12/2023 | 2419.6 | G | 235 | | | |
| *G denotes that the actual number was probably greater than the number reported. | | | | | | | |

**Table 7: 2023 *E. coli* data at station SWFA-1**

| Station ID | 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) |
|---|---|---|---|---|---|---|---|
| SWFA-1 | 4/13/2023 | 240 | | 235 | | | 71.7 |
| SWFA-1 | 6/28/2023 | 129.1 | | 235 | | | 4.9 |
| SWFA-1 | 7/17/2023 | 551 | | 235 | | | 51.0 |
| SWFA-1 | 7/19/2023 | 131.4 | | 235 | | | 29.6 |
| SWFA-1 | 7/24/2023 | 325.5 | | 235 | 195.5 | 126 | 29.2 |
| SWFA-1 | 7/26/2023 | 74.9 | | 235 | | | 18.9 |
| SWFA-1 | 7/31/2023 | 161.6 | | 235 | | | 20.4 |
| SWFA-1 | 8/3/2023 | 81.6 | | 235 | | | 10.7 |
| SWFA-1 | 9/5/2023 | 160.7 | | 235 | | | 10.8 |
| SWFA-1 | 9/7/2023 | 129.6 | | 235 | | | 9.0 |
| SWFA-1 | 9/19/2023 | 325.5 | | 235 | 306.8 | 126 | 7.2 |
| SWFA-1 | 9/21/2023 | 410.6 | | 235 | | | 6.4 |
| SWFA-1 | 9/26/2023 | 976.8 | | 235 | | | 7.2 |
| SWFA-1 | 10/12/2023 | 2419.6 | G | 235 | | | |
| *G denotes that the actual number was probably greater than the number reported. | | | | | | | |

## 3.6 Critical Conditions/Seasonal Variation

The *E. coli* single sample maximum criterion of 235 colonies/100 ml and geometric mean criterion of 126 colonies/100 ml for the Swimming and Other Whole Body Water-Contact Sports use classification are applicable year-round. 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 2419.6 colonies/100 ml was collected on October 12, 2023, at all three stations. A flow of 71.7 cfs was estimated for station SWFA-1 (the most downstream station) during this sampling event. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in Swift Creek year-round.

## 3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the TMDL 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 data used in this analysis. An explicit MOS was applied to the TMDL by reducing the appropriate target criterion concentration by ten percent and calculating a mass loading target with measured or calculated flow data. The single sample maximum *E. coli* criterion of 235 colonies/100 ml was reduced by 10% to 211.5 colonies/100 ml, while the geometric mean criterion of 126 colonies/100 ml was reduced in the same fashion to 113.4 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 (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, 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 Swift Creek. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the *E. coli* concentration times the in-stream flow times a conversion factor. Existing loads were calculated for the highest single sample exceedance and the highest geometric mean sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion and geometric mean criterion. The TMDL was based on the violation that produced the highest percent reduction of *E. coli* loads necessary to achieve applicable water quality criteria, whether it was the single sample or geometric mean.

### 4.2.1 Existing Conditions

The **single sample** mass loading was calculated by multiplying the highest single sample *E. coli* concentration of 2419.6 colonies/100 ml times the estimated flow at the time the sample was taken. This concentration was based on a measurement at station SWFA-1 on October 12, 2023, and can be seen above in Table 7. The flow was not measured on this date due to hazardous flow conditions. Therefore, the highest measured flow at station SWFA-1 in 2023 was used as an estimate of the flow on October 12, 2023. The product of the concentration, estimated flow, and a conversion factor gives the total mass loading (colonies per day) of *E. coli* to Swift Creek under the single sample exceedance condition.

$$\frac{71.7\ \text{ft}^3}{\text{s}} \times \frac{2419.6\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{4.24 \times 10^{12}\text{colonies}}{\text{day}}$$

The **geometric mean** mass loading was calculated by multiplying the highest geometric mean exceedance concentration of 353.7 colonies/100 ml times the average of the measured flows taken during the geometric mean sampling period. This concentration was calculated based on measurements at station SWFC-1 between September 5, 2023, and September 26, 2023, and can be found in Table 5. The average stream flow was determined to be 3.32 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Swift Creek under the geometric mean exceedance condition.

$$\frac{3.32\ \text{ft}^3}{\text{s}} \times \frac{353.7\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.87 \times 10^{10}\text{colonies}}{\text{day}}$$

### 4.2.2 Allowable Conditions

The **allowable load** to the watershed was calculated under the same physical conditions as discussed above for the single sample and geometric mean criteria. This was done by taking the product of the measured or estimated flow for the violation event, the allowable concentration, and the conversion factor.

For the **single sample** *E. coli* target concentration of 211.5 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{71.7\ \text{ft}^3}{\text{s}} \times \frac{211.5\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.71 \times 10^{11}\text{colonies}}{\text{day}}$$

The explicit margin of safety of 23.5 colonies/100 ml equals a daily loading of:

$$\frac{71.7\ \text{ft}^3}{\text{s}} \times \frac{23.5\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{4.12 \times 10^{10}\text{colonies}}{\text{day}}$$

For the **geometric mean** *E. coli* target concentration of 113.4 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{3.32\ \text{ft}^3}{\text{s}} \times \frac{113.4\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{9.21 \times 10^{9}\text{colonies}}{\text{day}}$$

The explicit margin of safety of 12.6 colonies/ 100 ml equals a daily loading of:

$$\frac{3.32\ \text{ft}^3}{\text{s}} \times \frac{12.6\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.02 \times 10^{9}\text{colonies}}{\text{day}}$$

The difference between the existing conditions (violation event) and the allowable conditions converted to a percent reduction represents the total load reduction needed to achieve the *E. coli* water quality criteria. The TMDL was calculated as the total daily *E. coli* load to Swift Creek. Table 8 shows the existing and allowable *E. coli* loads and required reductions for the Swift Creek watershed.

**Table 8: *E. coli* Loads and Required Reductions**

| Source | Existing Load (col/day) | Allowable Load (col/day) | Required Reduction (col/day) | % Reduction |
|---|---|---|---|---|
| Single Sample Load | 4.24E+12 | 3.71E+11 | 3.87E+12 | 91% |
| Geometric Mean Load | 2.87E+10 | 9.21E+9 | 1.95E+10 | 68% |

From Table 8, compliance with the single sample criterion of 235 colonies/100 ml requires a reduction of 91% in the *E. coli* load. The TMDL, WLA, LA, and MOS values necessary to achieve the applicable *E. coli* criteria are provided below in Table 9.

**Table 9: *E. coli* TMDL for Swift Creek**

| TMDL[e] | Margin of Safety (MOS) | Waste Load Allocation (WLA)[a] | | | Load Allocation (LA) | |
|---|---|---|---|---|---|---|
| | | WWTPs[b] | Stormwater (MS4s and other NPDES sources)[c] | Leaking Collection Systems[d] | | |
| (col/day) | (col/day) | (col/day) | % reduction | (col/day) | (col/day) | % reduction |
| 4.12E+11 | 4.12E+10 | N/A | N/A | 0 | 3.71E+11 | 91% |

Note: N/A = not applicable
a. There are no CAFOs in the Swift Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. 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.
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 *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*.
e. TMDL was established using the single sample criterion of 235 colonies/100 ml.

## 4.3 TMDL Summary

Swift Creek was placed on Alabama's §303(d) list for pathogens in 2020 based on data collected in 2017. Additional water quality data was collected by ADEM during 2023, which confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the *E. coli* TMDL for Swift Creek. Based on the TMDL analysis, it was determined that a 91% reduction in *E. coli* loading was necessary to achieve compliance with applicable water quality standards.

Compliance with the terms and conditions of existing and future NPDES sanitary and storm water 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 will be implemented through voluntary measures/best management practices (BMPs). Cooperation and active participation by the general public and various other 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 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 load reductions to improve water quality in the Swift Creek watershed. As additional data and/or information become 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 load reductions in the watershed. This monitoring will occur in each basin according to the schedule shown in Table 10.

**Table 10: 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 was placed on public notice and made available for review and comment. The public notice was prepared and published in four newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL were made available on ADEM's website: www.adem.alabama.gov. The public could 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 was given an opportunity to review the TMDL and submit comments to the Department in writing. No written comments were received during the public notice period.

# 7.0 Appendices

## 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. 2017, 2023. ADEM.

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

Alabama's §303(d) List and Fact Sheet. 2020, 2022, 2024. 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 11: 2023 *E. coli* Data for Station SWFC-1**

| Station ID | 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) |
|---|---|---|---|---|---|---|---|
| SWFC-1 | 4/13/2023 | 980.4 | | 235 | | | 57.6 |
| SWFC-1 | 6/28/2023 | 387.3 | | 235 | | | |
| SWFC-1 | 7/17/2023 | 332.8 | | 235 | | | 26.2 |
| SWFC-1 | 7/19/2023 | 67.7 | | 235 | | | 14.7 |
| SWFC-1 | 7/24/2023 | 547.5 | | 235 | 294.1 | 126 | 15.1 |
| SWFC-1 | 7/26/2023 | 307.6 | | 235 | | | 10.9 |
| SWFC-1 | 7/31/2023 | 579.4 | | 235 | | | 13.4 |
| SWFC-1 | 8/3/2023 | 261.3 | | 235 | | | 5.2 |
| SWFC-1 | 9/5/2023 | 275.5 | | 235 | | | 4.0 |
| SWFC-1 | 9/7/2023 | 387.3 | | 235 | | | 4.3 |
| SWFC-1 | 9/19/2023 | 488.4 | | 235 | 353.7 | 126 | 2.7 |
| SWFC-1 | 9/21/2023 | 290.9 | | 235 | | | 2.5 |
| SWFC-1 | 9/26/2023 | 365.4 | | 235 | | | 3.1 |
| SWFC-1 | 10/12/2023 | 2419.6 | G | 235 | | | |
| *G denotes that the actual number was probably greater than the number reported. | | | | | | | |

**Table 12. Station SWFC-1 *E. coli* Listing Data (2017)**

| Station ID | Visit Date | *E. coli* (col/100 ml) | *E. coli* Criterion (col/100 ml) | Flow (cfs) |
|---|---|---|---|---|
| SWFC-1 | 3/20/2017 | 201.4 | 235 | 30.4 |
| SWFC-1 | 4/11/2017 | 137.6 | 235 | 24.0 |
| SWFC-1 | 5/8/2017 | 148.3 | 235 | 22.0 |
| SWFC-1 | 6/13/2017 | 238.2 | 235 | 18.4 |
| SWFC-1 | 7/10/2017 | 178.2 | 235 | 19.0 |
| SWFC-1 | 8/7/2017 | 770.1 | 235 | 20.3 |
| SWFC-1 | 9/5/2017 | 290.9 | 235 | 9.4 |
| SWFC-1 | 10/31/2017 | 235.9 | 235 | 15.7 |

**Table 13: 2023 *E. coli* data for station SWFA-2**

| Station ID | 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) |
|---|---|---|---|---|---|---|---|
| SWFA-2 | 4/13/2023 | 172.3 | | 235 | | | 50.1 |
| SWFA-2 | 6/28/2023 | 31.8 | | 235 | | | 7.6 |
| SWFA-2 | 7/17/2023 | 689.6 | | 235 | | | 42.3 |
| SWFA-2 | 7/19/2023 | 63.1 | | 235 | | | 23.3 |
| SWFA-2 | 7/24/2023 | 209.8 | | 235 | 141.5 | 126 | 24.1 |
| SWFA-2 | 7/26/2023 | 55.6 | | 235 | | | 18.0 |
| SWFA-2 | 7/31/2023 | 111.9 | | 235 | | | 19.6 |
| SWFA-2 | 8/3/2023 | 53.8 | | 235 | | | |
| SWFA-2 | 9/5/2023 | 206.4 | | 235 | | | 8.8 |
| SWFA-2 | 9/7/2023 | 387.3 | | 235 | | | 6.9 |
| SWFA-2 | 9/19/2023 | 328.2 | | 235 | 281.2 | 126 | 5.6 |
| SWFA-2 | 9/21/2023 | 209.8 | | 235 | | | 5.6 |
| SWFA-2 | 9/26/2023 | 319.4 | | 235 | | | 4.9 |
| SWFA-2 | 10/12/2023 | 2419.6 | G | 235 | | | |
| *G denotes that the actual number was probably greater than the number reported. | | | | | | | |

**Table 14: Station SWFA-2 *E. coli* Listing Data (2017)**

| Station ID | Visit Date | *E. coli* (col/100 ml) | *E. coli* Criterion (col/100 ml) | Flow (cfs) |
|---|---|---|---|---|
| SWFA-2 | 3/20/2017 | 186 | 235 | 36.1 |
| SWFA-2 | 4/11/2017 | 153.9 | 235 | 33.6 |
| SWFA-2 | 5/8/2017 | 142.1 | 235 | 24.1 |
| SWFA-2 | 6/13/2017 | 172.2 | 235 | 17.6 |
| SWFA-2 | 7/10/2017 | 275.5 | 235 | 19.7 |
| SWFA-2 | 8/7/2017 | 727 | 235 | 30.5 |
| SWFA-2 | 9/5/2017 | 307.6 | 235 | 9.7 |
| SWFA-2 | 10/31/2017 | 920.8 | 235 | 18.1 |

**Table 15: 2023 *E. coli* Data for station SWFA-1**

| Station ID | 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) |
|---|---|---|---|---|---|---|---|
| SWFA-1 | 4/13/2023 | 240 | | 235 | | | 71.7 |
| SWFA-1 | 6/28/2023 | 129.1 | | 235 | | | 4.9 |
| SWFA-1 | 7/17/2023 | 551 | | 235 | | | 51.0 |
| SWFA-1 | 7/19/2023 | 131.4 | | 235 | | | 29.6 |
| SWFA-1 | 7/24/2023 | 325.5 | | 235 | 195.5 | 126 | 29.2 |
| SWFA-1 | 7/26/2023 | 74.9 | | 235 | | | 18.9 |
| SWFA-1 | 7/31/2023 | 161.6 | | 235 | | | 20.4 |
| SWFA-1 | 8/3/2023 | 81.6 | | 235 | | | 10.7 |
| SWFA-1 | 9/5/2023 | 160.7 | | 235 | | | 10.8 |
| SWFA-1 | 9/7/2023 | 129.6 | | 235 | | | 9.0 |
| SWFA-1 | 9/19/2023 | 325.5 | | 235 | 306.8 | 126 | 7.2 |
| SWFA-1 | 9/21/2023 | 410.6 | | 235 | | | 6.4 |
| SWFA-1 | 9/26/2023 | 976.8 | | 235 | | | 7.2 |
| SWFA-1 | 10/12/2023 | 2419.6 | G | 235 | | | |
| *G denotes that the actual number was probably greater than the number reported. | | | | | | | |

**Table 16: Station SWFA-1 *E. coli* Listing Data (2017)**

| Station ID | Visit Date | *E. coli* (col/ 100 mL) | *E. coli* Criterion (col/100 ml) | Flow (cfs) |
|---|---|---|---|---|
| SWFA-1 | 3/20/2017 | 365.4 | 235 | 53.0 |
| SWFA-1 | 4/11/2017 | 130.9 | 235 | 35.4 |
| SWFA-1 | 5/8/2017 | 83 | 235 | 31.9 |
| SWFA-1 | 6/13/2017 | 224.7 | 235 | 23.9 |
| SWFA-1 | 7/10/2017 | 133.3 | 235 | 29.5 |
| SWFA-1 | 8/7/2017 | 648.8 | 235 | 42.6 |
| SWFA-1 | 9/5/2017 | 365.4 | 235 | 20.1 |
| SWFA-1 | 10/31/2017 | 613.1 | 235 | 23.9 |

## 7.3 Swift Creek Photos

**Figure 5. At Station SWFC-1: Upstream View of Swift Creek (7/1/2023)**

**Figure 6. At Station SWFC-1: Downstream View of Swift Creek (7/1/2023)**

**Figure 7. At Station SWFA-1: Upstream View of Swift Creek (7/1/2023)**

**Figure 8. At Station SWFA-1: Downstream View of Swift Creek (7/1/2023)**