



Final
Total Maximum Daily Load (TMDL)
For
Three Mile Branch

Assessment Unit ID # AL03150201-0104-302

Pathogens (*E. coli*)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
August 2019

Figure 1: Three Mile Branch Watershed

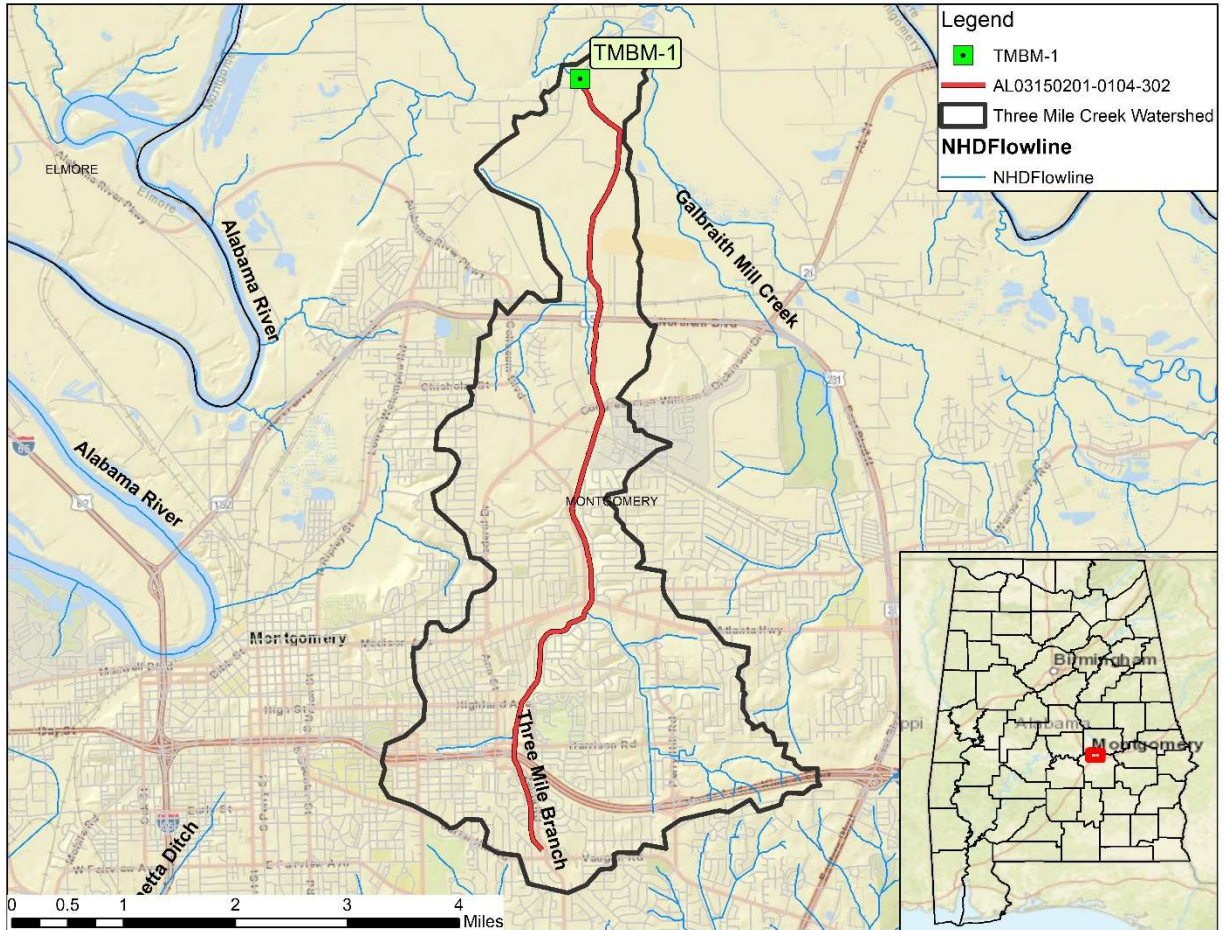


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1.0 Executive Summary

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A TMDL is the sum of individual waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS).

Three Mile Branch is currently included on Alabama's 2018 §303(d) list as impaired for pathogens (*E. coli*), pesticides (Dieldrin), and siltation from Lower Wetumpka Road to its source. This TMDL will address the pathogens (*E. coli*) impairment. The listed portion of Three Mile Branch has a designated use classification of Fish and Wildlife (F&W). The headwater source of Three Mile Branch begins in the city of Montgomery. Three Mile Branch flows north for a total length of 7.86 miles, ending at the confluence with Galbraith Mill Creek. The total drainage area for the Three Mile Branch watershed is approximately 12.79 square miles.

Three Mile Branch was first listed for pathogens on the §303(d) list in 2010 based on data collected by the Alabama Department of Environmental Management (ADEM) in 2005. The exceedances were found at stations TMBM-1 and TMBM-2. This data, which can be found in Table 3, indicated the stream was impaired for fecal coliform. The pathogen indicator for non-coastal waters was changed in December 2009 from fecal coliform to *Escherichia coli* (*E. coli*). Due to this change, Three Mile Branch was sampled in 2018 for *E. coli*, which will be the basis for this TMDL.

In 2018, §303(d) sampling studies were performed by ADEM on Three Mile Branch to further assess the water quality of the impaired stream. ADEM collected sixteen *E. coli* samples from Three Mile Branch at station TMBM-1. Review of the general water quality and intensive *E. coli* study revealed that the listed segment of Three Mile Branch was still not meeting the pathogen criteria applicable to its use classification (F&W).

A mass balance approach was used for calculating the pathogen TMDL for Three Mile Branch. The mass balance approach utilizes the conservation of mass principle. Existing loads were calculated by multiplying the *E. coli* concentrations times the respective in-stream flows and a conversion factor. The mass loading was calculated using the single sample or geometric mean sample exceedance event which resulted in the highest percent reduction. In this case, it was determined that the highest percent reduction was calculated from a single sample maximum *E. coli* exceedance at station TMBM-1 (September 25, 2018) with a value of 5001 colonies/100 ml. This violation calls for a reduction of 95%. In the same manner as existing loads were calculated, an allowable load was calculated for the single sample *E. coli* target of 268.2 colonies/100 ml (298 colonies/100 ml – 10% Margin of Safety).

Table 1.1 is a summary of the estimated existing load, allowable load, and percent reduction for the single sample criterion and the geometric mean criterion. Table 1.2 lists the TMDL, defined as the maximum allowable *E. coli* loading under critical conditions for Three Mile Branch.

Table 1.1: *E. coli* Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load - Single Sample	6.48×10^{11}	3.48×10^{10}	6.13×10^{11}	95%
Nonpoint Source Load - Geometric Mean	1.33×10^{11}	1.55×10^{10}	1.18×10^{11}	88%
Point Source Load (WWTPs)	NA ^a	NA ^a	NA ^a	NA ^a

a. No NPDES permitted WWTP outfalls in the watershed.

Table 1.2: *E. coli* TMDL for Three Mile Branch

TMDL ^e	Margin of Safety (MOS)	Waste Load Allocation (WLA) ^a			Load Allocation (LA)	
		WWTPs ^b	MS4s ^c	Leaking Collection Systems ^d		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
3.86×10^{10}	3.86×10^{09}	NA	95%	0	3.48×10^{10}	95%

Note: NA = not applicable

a. There are no CAFOs in the Three Mile Branch 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 would be required to demonstrate consistency with the assumptions and requirements of this TMDL.

d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *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 maximum criterion of 298 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 Three Mile Branch 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 7.65 miles of Three Mile Branch as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 2010 List of Impaired Waters based on data collected in 2005 and was included on all subsequent lists.

2.2 Problem Definition

Waterbody Impaired:	Three Mile Branch – from Lower Wetumpka Road to its source
Impaired Reach Length:	7.65 miles
Impaired Drainage Area:	12.79 sq. miles
Water Quality Standard Violation:	Pathogens (Single Sample Maximum, Geometric Mean)
Pollutant of Concern:	Pathogens (<i>E. coli</i>)
Water Use Classification:	Fish and Wildlife

Usage Related to Classification:

The impaired stream segment is classified as Fish and Wildlife (F&W). Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

(a) *Best usage of waters: fishing, propagation of fish, aquatic life, and wildlife.*

(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 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.*

Criteria Exceeded:

Three Mile Branch was placed on the §303(d) list for pathogens in 2010 based on data collected during 2005 at stations TMBM-1 and TMBM-2. Prior to Alabama's 2009 adoption of *E. coli* as the indicator to assess the levels of bacteria in freshwater, the applicable bacterial indicator was fecal coliform. The geometric mean criterion for noncoastal waters from June to September was 200

col/100 ml, and the single sample maximum criterion for fecal coliform was 2,000 col/100 ml. Monthly fecal coliform sampling at ADEM monitoring station TMBM-1 showed 2 out of 8 samples exceeding the single sample criterion. Also, at ADEM monitoring station TMBM-2, monthly fecal coliform sampling showed 3 out of 8 samples exceeding the single sample criterion. At the time of listing, the source of pathogens was linked to urban development. The qualifying data is summarized below in Table 2.2.1.

Table 2.2.1 : Data for §303(d) Listing- Ambient Monitoring (2005)

Station ID	Visit Date	Fecal Col (col/100ml)	Fecal Col dc	Single Sample Criteria	Flow (cfs)	Flow Measured
TMBM-1	3/23/2005 9:50	2700	G	2000	16.3	Yes - ADEM
TMBM-1	4/13/2005 8:50	350		2000	11.6	Yes - ADEM
TMBM-1	5/11/2005 8:35	140		2000	5.9	Yes - ADEM
TMBM-1	6/13/2005 9:12	770		2000	4.7	Yes - ADEM
TMBM-1	7/12/2005 8:30	970		2000	11.1	Yes - ADEM
TMBM-1	8/18/2005 8:30	4500	G	2000	4	Yes - ADEM
TMBM-1	10/11/2005 8:40	90	J	2000	3.3	Yes - ADEM
TMBM-2	3/23/2005 11:43	2700	G	2000		No
TMBM-2	4/13/2005 11:10	130		2000	5.4	Yes - ADEM
TMBM-2	5/11/2005 10:15	110	J	2000	4.4	Yes - ADEM
TMBM-2	6/13/2005 10:40	610		2000	4.2	Yes - ADEM
TMBM-2	7/12/2005 10:15	2100		2000	3.5	Yes - ADEM
TMBM-2	8/18/2005 10:00	3100	G	2000	4.1	Yes - ADEM
TMBM-2	10/11/2005 10:15	150		2000	2.8	Yes - ADEM
<i>G denotes that the analyte is present, but is above an acceptable level for quantitation</i>						
<i>J Reported microbiological result is an estimate.</i>						

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

On December 11, 2009, the Alabama Environmental Management Commission (EMC) adopted the *E. coli* criteria as the bacterial indicator to assess the levels of bacteria in freshwater. Prior to the adoption of the *E. coli* criteria, fecal coliform was used by ADEM as the bacterial indicator for freshwater. The *E. coli* criteria were recommended by the EPA as a better correlation to swimming and incidental water contact associated health effects than fecal coliform in the 1986 publication *Quality Criteria for Water* (EPA 440/5-86-001). As a result of this bacterial indicator change, this TMDL will be developed from *E. coli* data collected at station TMBM-1, even though the 2010 data that prompted the listing of Three Mile Branch was based on the fecal coliform criteria.

For the purpose of this TMDL, a single sample maximum *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 five samples taken at least 24 hours apart over the course of 30 days. This 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

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.

3.2.1 Continuous Point Sources in the Three Mile Branch watershed

Currently, there are no NPDES regulated continuous point source discharges located within the Three Mile Branch watershed. Any future NPDES regulated discharges that are considered by the Department to be a pathogen source will be required to meet the in-stream water quality criteria for pathogens at the point of discharge.

3.2.2 Non-Continuous Point Sources in the Three Mile Branch watershed

There are currently seven general NPDES stormwater discharge permits within the Three Mile Branch watershed. See Table 3.2.2.1 below for a list of the non-continuous facilities located within the Three Mile Branch watershed. None of these facilities are considered to be a source of pathogens due to the lack of process discharges and the nature of their operations. As such, no *E. coli* loading to Three Mile Branch will be attributed to these facilities, nor will they receive an allocation in this TMDL.

Table 3.2.2.1 : Non-Continuous Point Sources in the Three Mile Branch watershed

Facility Name	Permit Number	Latitude	Longitude	Wastewater Type
IMO US Alabama	ALG141033	32.368101	-86.271296	Stormwater
Waste Away Group, Inc.	ALG160186	32.426667	-86.255611	Stormwater
Hicks Auto Repair & Sales	ALG180841	32.446667	-86.261667	Stormwater
LKQ Southeast Inc.	ALG180858	32.447236	-86.257231	Stormwater
Fruit of the Loom, Inc.	ALG240086	32.421417	-86.261089	Stormwater
Antea Group	ALG340524	32.366944	-86.244167	Stormwater
Promarketing, LLC	ALG340676	32.368019	-86.271528	Stormwater

3.2.3 Municipal Separate Storm Sewer Systems (MS4s)

Urban areas designated as part of the Municipal Separate Storm Sewer System (MS4) program are regulated by NPDES, and as such, are considered to be point sources by EPA and receive waste load allocations (WLAs) in TMDLs. The EPA defines an MS4 as “a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law);
- (ii) Designed or used for collecting or conveying stormwater;
- (iii) Which is not a combined sewer; and
- (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.”

During rain events in an urbanized watershed, stormwater runoff has the potential to collect pollutants which are transported through MS4 systems before discharging into state waters. Therefore, in 1990 the EPA developed the NPDES stormwater program, which promulgated rules, in two different phases, in order to address the potential negative water quality effects associated with stormwater runoff. In 1990, the EPA issued Phase I regulations under the NPDES stormwater program, which required both medium and large cities and also counties with populations of 100,000 or more to obtain NPDES permit coverage specifically for their stormwater discharges. In 1999, the second phase of the NPDES stormwater program amended existing regulations in addition to requiring NPDES permits for stormwater discharges from certain small MS4 systems.

The permittees that are addressed in the TMDL process include those Phase I and Phase II municipalities covered under the MS4 NPDES program whose boundaries of urban areas are located within the Three Mile Branch watershed. The tables below identify those specific permittees.

Table 3.2.3.1 NPDES Phase I MS4 Municipalities in the Three Mile Branch watershed

Permittee Name	NPDES Permit
City of Montgomery	ALS000004

Table 3.2.3.2 NPDES Phase II MS4 Municipalities in the Three Mile Branch watershed

Permittee Name	NPDES Permit
Maxwell Air Force Base	ALR040035

3.2.4 Nonpoint Sources in the Three Mile Branch 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 is commonly a large source of *E. coli* bacteria. Confined livestock or concentrated animal feeding operations (CAFOs) can produce a considerable amount of waste in a limited area. 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 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 stormwater runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, sewer overflows, and domestic animals. On-site septic systems are common in unincorporated portions of the watershed and may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

The nature and extent of bacteria sources in the watershed will be identified more specifically during the implementation phase of the TMDL.

3.3 Land Use Assessment

Land use percentages for the Three Mile Branch watershed were determined from the 2011 National Land Cover Dataset (NLCD). The total drainage area of the Three Mile Branch watershed is approximately 12.79 square miles. Table 3.3.1 lists the various land uses and their associated percentages for the Three Mile Branch watershed. A pie chart illustrating the major cumulative land use types for the Three Mile Branch watershed is shown in Figure 3.3.1.

Table 3.3.1: Three Mile Branch Watershed Landuse (2011 NLCD)

2011 NLCD Land Cover	NLCD Legend	Area (miles ²)	Percentage (%)
Open Water	11	0.01	0.08%
Developed, Open Space	21	3.71	29.04%
Developed, Low Intensity	22	3.66	28.63%
Developed, Medium Intensity	23	1.82	14.25%
Developed, High Intensity	24	0.67	5.24%
Barren Land	31	0.01	0.10%
Deciduous Forest	41	0.40	3.11%
Evergreen Forest	42	0.22	1.74%
Mixed Forest	43	0.49	3.81%
Shrub/Scrub	52	0.19	1.46%
Herbaceous	71	0.01	0.05%
Hay/Pasture	81	0.40	3.15%
Cultivated Crops	82	0.39	3.03%
Woody Wetlands	90	0.78	6.12%
Emergent Herbaceous Wetlands	95	0.02	0.17%

Cumulative Land Cover	NLCD Legend	Area (miles ²)	Percentage (%)
Open Water	11	0.01	0.08%
Developed	21,22,23,24	9.87	77.15%
Barren Land	31	0.01	0.10%
Forested	41,42,43	1.11	8.66%
Grassland/Shrub	52,71	0.19	1.51%
Agriculture	81,82	0.79	6.18%
Wetlands	90,95	0.81	6.30%

Figure 3.3.1: Three Mile Branch Watershed cumulative landuse types

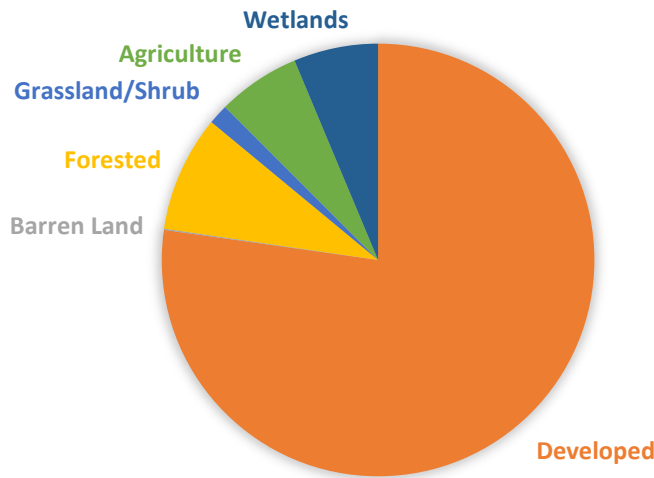
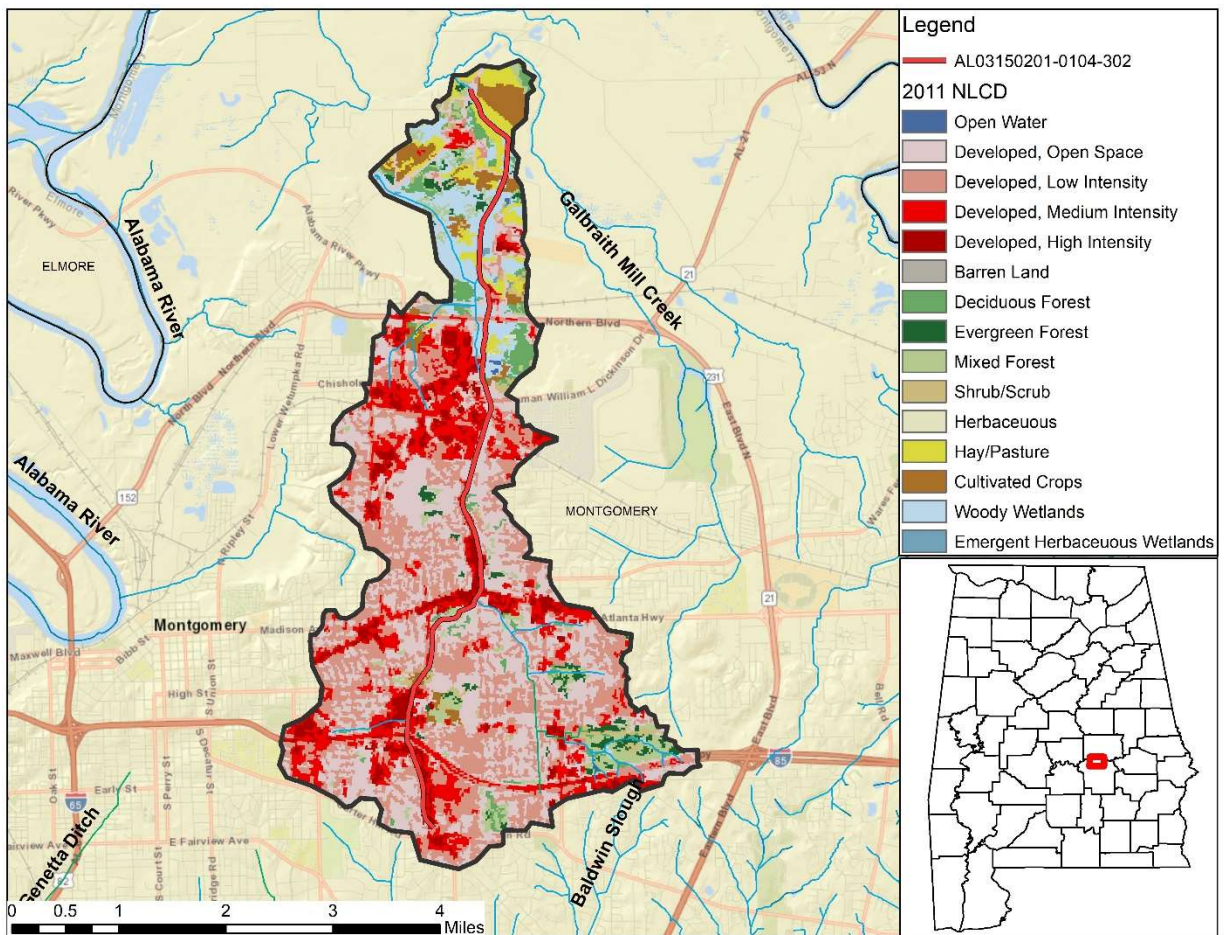


Figure 3.3.2: 2011 NLCD Map of the Three Mile Branch watershed



As can be seen from an inspection of the table and map, developed land is the predominant land use in the watershed at 77 percent. Developed land represents both commercial and residential urbanized land uses, and includes the following individual land use categories: Developed – Open Space, Developed – Low Intensity, Developed – Medium Intensity, and Developed – High Intensity.

3.4 Linkage between Numeric Targets and Sources

The predominate land use coverage in the Three Mile Branch watershed is developed, or urban. The most likely sources of pathogen loadings in Three Mile Branch are from urban run-off from rain events, unpermitted discharges of wastewater, and failing septic systems. As can be seen in Figure 3.3.2, most of the impaired segment runs directly through the developed areas of the watershed. Pollutant loadings from agricultural land uses may also be contributing to the pathogen impairment, particularly in the downstream reaches near the confluence with Galbraith Mill Creek. 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 and reductions will only be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

In 2018, §303(d) sampling studies were performed by ADEM on Three Mile Branch to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2018 data will be used to assess the water quality of Three Mile Branch because it is the most current data and provides the best picture of the current water quality conditions of the stream. The 2018 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. Also, as a result of the EMC's adoption of the *E. coli* criteria as the new bacterial indicator, this TMDL will be developed from *E. coli* data.

In 2018, ADEM collected monthly water quality data for the Three Mile Branch watershed at the station TMBM-1. Sampling efforts included collecting water quality samples each month from March through October. Two intensive bacteria studies were also conducted at station TMBM-1 during 2018. Each intensive bacteria study consisted of collecting five *E. coli* bacteria samples over a thirty day time window, with a minimum of 24 hours between each sample collection. A geometric mean was calculated from each intensive bacteria study. The individual samples and geometric mean were evaluated against the applicable *E. coli* bacteria criteria to determine if Three Mile Branch is supporting its designated use.

A total of sixteen *E. coli* samples were collected at station TMBM-1 during 2018. Intensive bacteria studies were performed during the months of July and September. Of the sixteen total *E. coli* samples, eleven samples exceeded the single sample maximum criterion of 298 colonies/100 ml. Furthermore, both the July and September *E. coli* geometric means violated the

geometric mean criterion of 126 colonies/100 ml. A summary of the *E. coli* results is provided below in Table 3.5.2. All *E. coli* criteria exceedances are highlighted in red.

Table 3.5.1: Station Description

Station	Agency	Latitude	Longitude	Description
TMBM-1	ADEM	32.45358	-86.25758	Three Mile Branch at Lower Wetumpka Road

Figure 3.5.1: ADEM sampling stations in the Three Mile Branch watershed

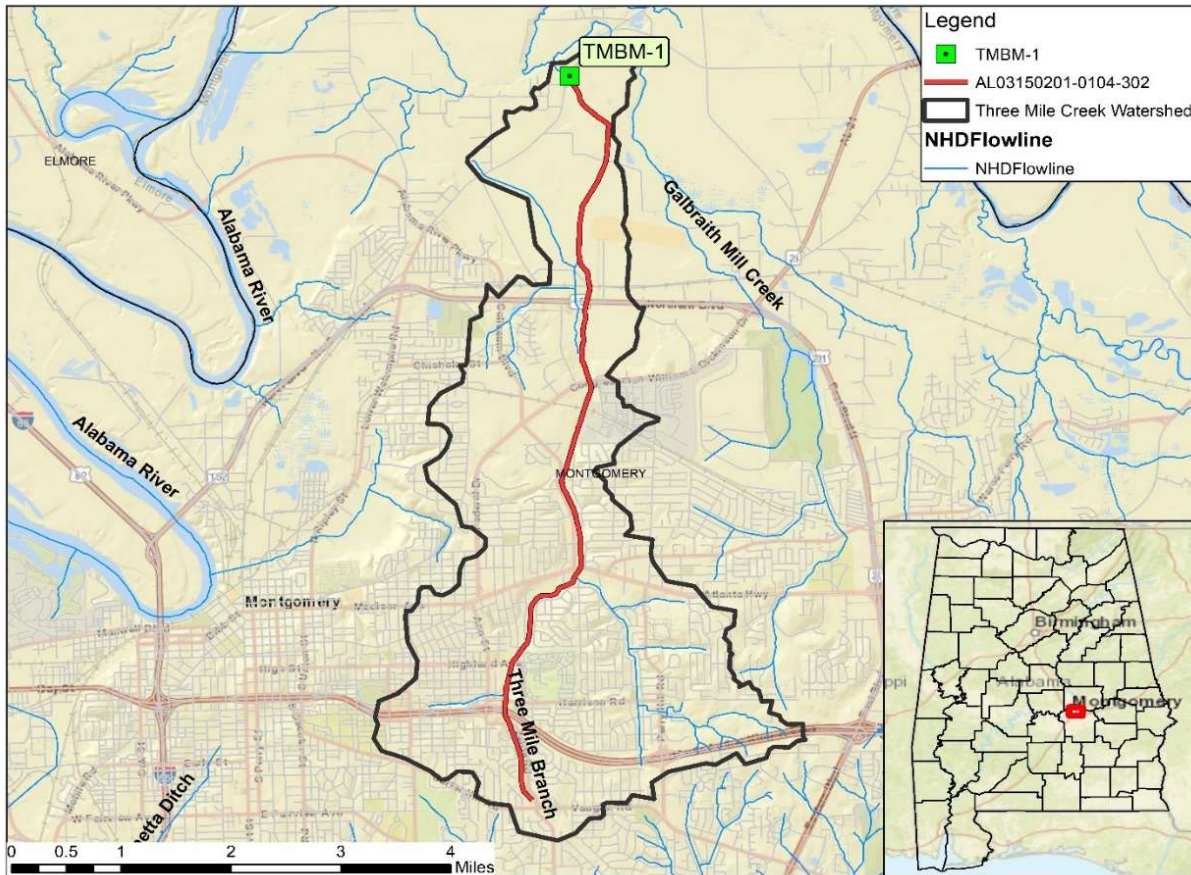


Table 3.5.2: 2018 *E. coli* Data for Three Mile Branch

Station ID	VISIT_DATE	Flow cfs	<i>E. coli</i> (colonies/100ml)	Single Sample Criterion (colonies/100ml)	<i>E. coli</i> Geometric mean (colonies/100ml)	Geometric mean Criterion (colonies/100ml)
TMBM-1	3/13/2018 10:02	7.8	435.2	2507		
TMBM-1	4/3/2018 9:42	4.9	141.4	2507		
TMBM-1	5/1/2018 9:37	3.9	86	298		
TMBM-1	6/5/2018 10:19	4	141.4	298		
TMBM-1	7/2/2018 12:39	8	410.6	298	439.8	126
TMBM-1	7/9/2018 13:14	7.1	365.4	298		
TMBM-1	7/17/2018 9:37	5.9	517.2	298		
TMBM-1	7/19/2018 14:04	5.2	387.3	298		
TMBM-1	7/24/2018 13:42	5.1	547.5	298		
TMBM-1	8/7/2018 10:00	3.4	365.4	298		
TMBM-1	9/11/2018 9:31	12.7	2419.6	298	970.8	126
TMBM-1	9/17/2018 13:14	3.8	362.5	298		
TMBM-1	9/20/2018 13:27	3.1	402.8	298		
TMBM-1	9/24/2018 13:28	3.1	488	298		
TMBM-1	9/25/2018 13:32	5.3	5001	298		
TMBM-1	10/9/2018 10:11	3.2	262	298		

3.6 Critical Conditions

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.

The impaired portion of Three Mile Branch generally follows the trends described above for the summer months of May through October. The single sample maximum concentration of 5001 colonies/100 ml collected on September 25, 2018 at station TMBM-1 will be used to estimate the TMDL pathogen loadings to the Three Mile Branch under critical conditions. A streamflow of 5.3 cfs was measured at station TMBM-1 during this sampling event.

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.

Both an explicit and implicit MOS were incorporated into this TMDL. 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 flow data. 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 was reduced in the same fashion to 113.4 colonies/100 ml. An implicit MOS was also incorporated in the TMDL by basing the existing condition on the highest measured *E. coli* concentration that was collected during critical conditions.

4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (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). 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 both explicit and implicit in this TMDL. A TMDL can be denoted by the equation:

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

The TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions. Pathogen 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 Three Mile Branch. 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 geometric mean sample exceedance and the highest single sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion of 298 col/100 ml and the geometric mean criterion of 126 col/100 ml. 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 be the single sample or geometric mean.

Existing Conditions

The **single sample** mass loading was calculated by multiplying the highest *E. coli* single sample exceedance concentration of 5001 colonies/100 ml by the measured flow on the day of the

exceedance. The calculation for the existing condition was based on the measurement at TMBM-1 on September 25, 2018, which can be found above in Table 3.5.2. The product of the concentration, measured flow, and a conversion factor gives the total mass loading (colonies per day) of *E. coli* to Three Mile Branch under the single sample exceedance condition.

$$\frac{5.3 \text{ ft}^3}{\text{s}} \times \frac{5,001 \text{ colonies}}{100 \text{ ml}} \times \frac{24,465,755 * 100 \text{ ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{6.48 \times 10^{11} \text{ colonies}}{\text{day}}$$

The **geometric mean** mass loading was calculated by multiplying the highest geometric mean exceedance concentration of 970.8 colonies/100 ml times the average of the five measured streamflows. This concentration was calculated based on measurements at TMBM-1 between September 11, 2018, and September 25, 2018, and can be found above in Table 3.5.2. The average stream flow was determined to be 5.6 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Three Mile Branch under the geometric mean exceedance condition.

$$\frac{5.6 \text{ ft}^3}{\text{s}} \times \frac{970.8 \text{ colonies}}{100 \text{ ml}} \times \frac{24,465,755 * 100 \text{ ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.33 \times 10^{11} \text{ colonies}}{\text{day}}$$

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 flow for the violation event, the allowable concentration, and the conversion factor.

For the **single sample** *E. coli* target concentration of 268.2 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{5.3 \text{ ft}^3}{\text{s}} \times \frac{268.2 \text{ colonies}}{100 \text{ ml}} \times \frac{24,465,755 * 100 \text{ ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.48 \times 10^{10} \text{ colonies}}{\text{day}}$$

The explicit margin of safety of 29.8 colonies/100 ml equals a daily loading of:

$$\frac{5.3 \text{ ft}^3}{\text{s}} \times \frac{29.8 \text{ colonies}}{100 \text{ ml}} \times \frac{24,465,755 * 100 \text{ ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.86 \times 10^{09} \text{ colonies}}{\text{day}}$$

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

$$\frac{5.6 \text{ ft}^3}{\text{s}} \times \frac{113.4 \text{ colonies}}{100 \text{ mL}} \times \frac{24,465,755 * 100 \text{ mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.55 \times 10^{10} \text{ colonies}}{\text{day}}$$

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

$$\frac{5.6 \text{ ft}^3}{\text{s}} \times \frac{12.6 \text{ colonies}}{100 \text{ mL}} \times \frac{24,465,755 * 100 \text{ mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.73 \times 10^{09} \text{ colonies}}{\text{day}}$$

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 Three Mile Branch as evaluated at station TMBM-1. Table 4.2.1 below depicts the existing and allowable *E. coli* loads and required reductions for the Three Mile Branch watershed.

Table 4.2.1: *E. coli* Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load - Single Sample	6.48 x 10 ¹¹	3.48 x 10 ¹⁰	6.13 x 10 ¹¹	95%
Nonpoint Source Load - Geometric Mean	1.33 x 10 ¹¹	1.55 x 10 ¹⁰	1.18 x 10 ¹¹	88%
Point Source Load (WWTPs)	NA ^a	NA ^a	NA ^a	NA ^a

a. No NPDES permitted WWTP outfalls in the watershed.

From Table 4.2.1, compliance with the single sample maximum criterion of 298 colonies/100 ml requires a reduction of 95% in the *E. coli* load. The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criteria are provided in Table 4.2.2 below.

Table 4.2.2: *E. coli* TMDL for Three Mile Branch

TMDL ^e (col/day)	Margin of Safety (MOS) (col/day)	Waste Load Allocation (WLA) ^a			Load Allocation (LA)	
		WWTPs ^b (col/day)	MS4s ^c % reduction	Leaking Collection Systems ^d (col/day)	(col/day)	% reduction
3.86 x 10 ¹⁰	3.86 x 10 ⁰⁹	NA	95%	0	3.48 x 10 ¹⁰	95%

Note: NA = not applicable

a. There are no CAFOs in the Three Mile Branch 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 would be required to demonstrate consistency with the assumptions and requirements of this TMDL.

d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *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 maximum criterion of 298 colonies/100 ml.

4.3 TMDL Summary

Three Mile Branch was placed on Alabama's §303(d) list in 2010 based on data collected in 2005 at stations TMBM-1 and TMBM-2. In 2018, ADEM collected additional water quality data with *E. coli* serving as the primary pathogen indicator. The data collected by ADEM in 2018 confirmed the pathogen impairment and provided the basis for TMDL development. A mass balance approach was used to calculate the *E. coli* TMDL for Three Mile Branch. Based on the TMDL analysis, it was determined that a 95% 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 stormwater permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed to targeting the load reductions to improve water quality in the Three Mile Branch 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 statewide approach to water quality management. Each year, ADEM's water quality resources are divided among multiple priorities statewide 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.

6.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL 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. 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 final completion of this TMDL and subsequent submission to EPA Region 4 for final approval.

7.0 Appendices

7.1 References

ADEM Administrative Code, 2017. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2017. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2018. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, 2018.

Alabama's §303(d) List and Fact Sheet. 2010, 2012, 2014, 2016, 2018. ADEM.

Alabama Department of Environmental Management (ADEM), Laboratory Data Qualification SOP #4910 Revision 6.2, 2016.

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 Three Mile Branch Watershed Photos

Figure 7.2.1: At Station TMBM-1: Upstream View of Three Mile Branch @ Lower Wetumpka Road (3/13/2018)

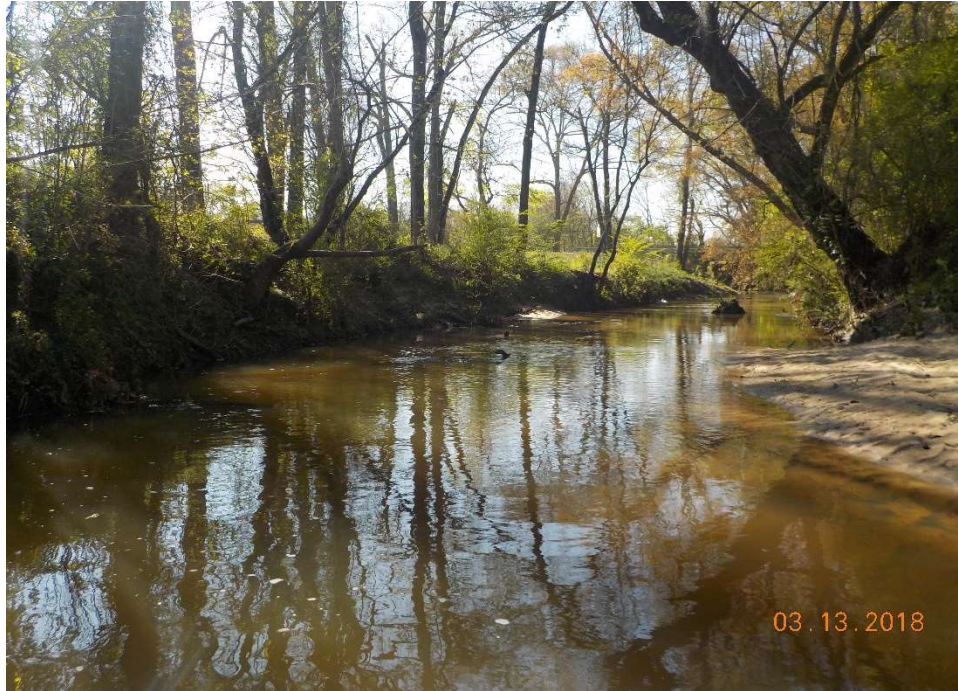


Figure 7.2.2: At Station TMBM-1: Downstream View of Three Mile Branch @ Lower Wetumpka Road (3/13/2018)



Figure 7.2.3: At Station TMBM-1: Upstream View of Three Mile Branch @ Lower Wetumpka Road (4/3/2018)



Figure 7.2.4: At Station TMBM-1: Downstream View of Three Mile Branch @ Lower Wetumpka Road (4/3/2018)

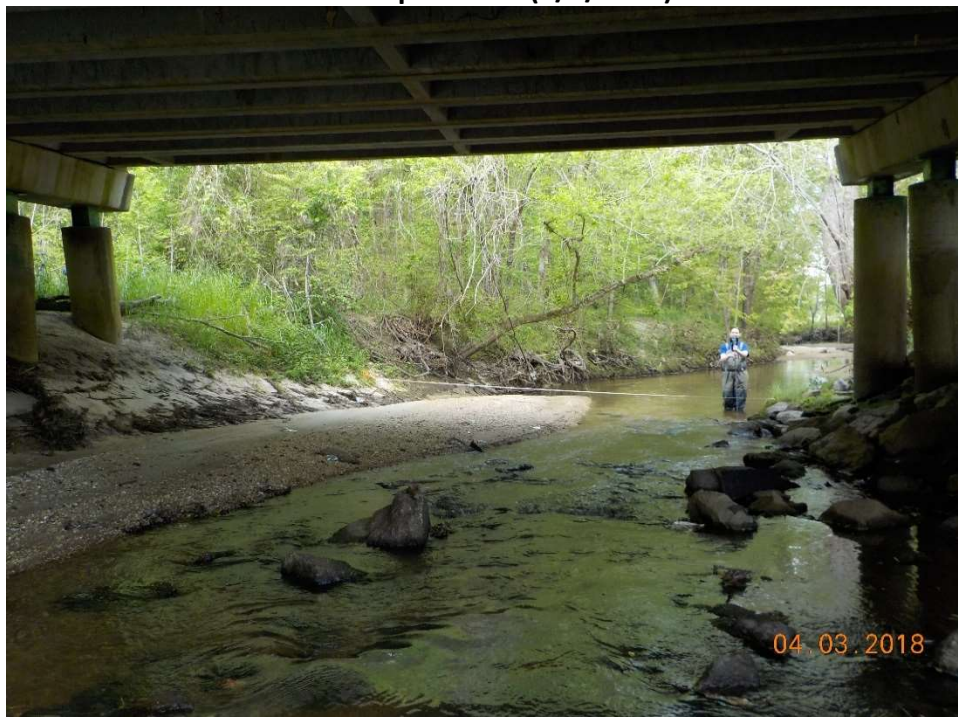


Figure 7.2.5: At Station TMBM-1: Upstream View of Three Mile Branch @ Lower Wetumpka Road (9/11/2018)



Figure 7.2.6: At Station TMBM-1: Downstream View of Three Mile Branch @ Lower Wetumpka Road (9/11/2018)

