Final

Total Maximum Daily Load (TMDL)
For
Indian Creek

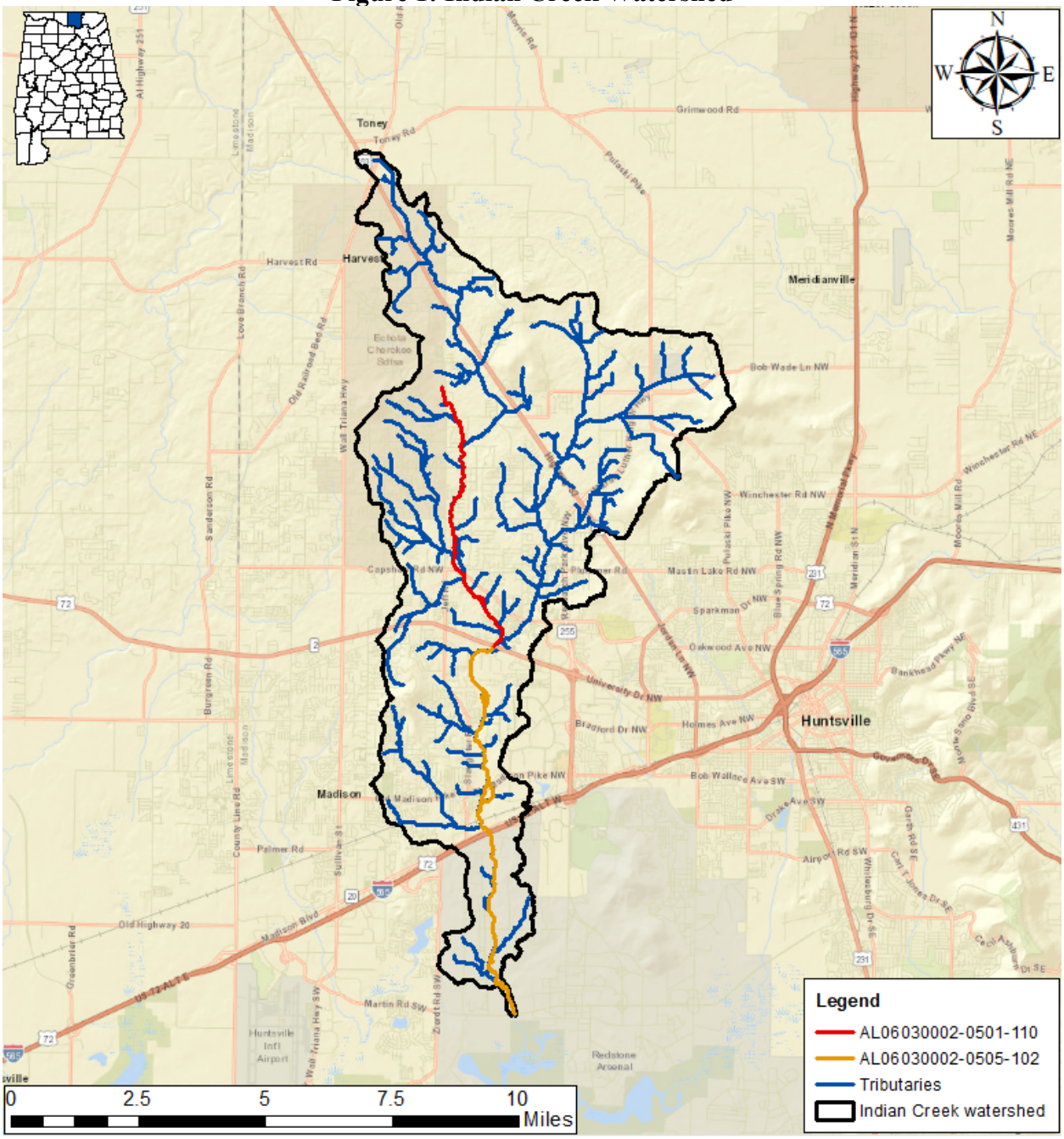
Assessment Unit ID Numbers:
AL06030002-0501-110
AL06030002-0505-102

Madison County

Pathogens (*E. coli*)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
August 2022

Figure 1: Indian Creek 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).

Indian Creek is currently included on Alabama's §303(d) list as impaired for pathogens from Martin Road near Redstone Arsenal (Huntsville, AL) to its source. The Indian Creek headwaters forms in Madison County, and it flows for approximately 24.5 miles before it merges with the Tennessee River (Wheeler Lake). There are two segments listed as impaired for pathogens; AL06030002-0501-110 and AL0603002-0505-102 are both classified as Fish & Wildlife (F&W). The Indian Creek embayment (AL06030002-0505-111) is classified as Public Water Supply (PWS)/Fish & Wildlife (F&W) and is impaired for nutrients. This TMDL addresses only the two segments that are impaired for pathogens.

Indian Creek was originally included on the §303(d) list for pathogens (*E. coli*) in 2018. Indian Creek was sampled from 2013-2016 and was found to exceed bacteriological standards at two stations. Due to these exceedances, follow up sampling was conducted at both stations to verify the impairment and provide data for TMDL development.

During 2017-2021, sampling studies were performed by ADEM on Indian Creek to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2017-2021 data will be used because it is the most current data and provides the best picture of the current water quality conditions of the stream. The 2022 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 of the recent bacteriological data is listed in the Appendix for reference. ADEM collected 42 samples from Indian Creek during 2017-2021. According to the data, Indian Creek was not meeting the pathogen criteria applicable to its use classification of Fish & Wildlife (F&W). Therefore, this TMDL has been developed for pathogens (*E. coli*) for both of the impaired segments of Indian Creek.

A mass balance approach was used for calculating the pathogen TMDL for Indian 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 that 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 268.2 colonies/100 ml (298 colonies/100 ml – 10% Margin of Safety) and geometric mean *E. coli* target of 113.4 colonies/100 ml (126 colonies/100 ml – 10% Margin of Safety).

Tables 1 and 2 list the TMDL for each segment, defined as the maximum allowable *E. coli* loading under critical conditions for Indian Creek.

Table 1: *E. coli* TMDL for Indian Creek (AL06030002-0501-110)

TMDL[a]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[b]			Load Allocation (LA)	
		WWTPs[c]	MS4s[d]	Leaking Collection Systems[e]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
1.82E+11	1.82E+10	8.7E+9	85%	0	1.55E+11	85%

a. TMDL was established using the single sample criterion of 298 colonies/100ml.
b. Future CAFOs in the watershed will be assigned a waste load allocation (WLA) of zero.
c. WLA for WWTPs is expressed as a daily maximum. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
d. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
e. 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*.

Table 2: *E. coli* TMDL for Indian Creek (AL06030002-0505-102)

TMDL[a]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[b]			Load Allocation (LA)	
		WWTPs[c]	MS4s[d]	Leaking Collection Systems[e]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
2.54E+12	2.54E+11	8.7E+9	89%	0	2.27E+12	89%

a. TMDL was established using the single sample criterion of 298 colonies/100ml.
b. Future CAFOs in the watershed will be assigned a waste load allocation (WLA) of zero.
c. WLA for WWTPs is expressed as a daily maximum. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
d. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
e. 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*.

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 Indian 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 two segments of Indian Creek, totaling 16.86 miles, as impaired for pathogens (*E. coli*). The §303(d) listing was originally reported on Alabama's 2018 List of Impaired Waters based on data collected from 2013-2016, and was included on all subsequent lists. The sources of the impairment on the 2020 §303(d) list are collection system failures, pasture grazing, and urban runoff/storm sewers.

2.2 Problem Definition

Waterbody Impaired:	Indian Creek - From Martin Road (Redstone Arsenal) to its source
Impaired Reach Length:	16.86 miles
Impaired Drainage Area:	52.4 square miles
Water Quality Standard Violation:	Pathogens (Single Sample Maximum, Geometric Mean)
Pollutant of Concern:	Pathogens (*E. coli*)
Water Use Classification:	Fish and Wildlife

Usage Related to Classification:
The pathogen-impaired segments are classified as Fish and Wildlife. 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 Fish and Wildlife 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:

Two segments of Indian Creek were placed on the 2018 §303(d) list for pathogens (*E. coli*). These two segments are AL06030002-0505-102 (lower segment) and AL06030002-0501-110 (upper segment). Data at INDM-249 from 2013-2016 was used to list the lower segment. There were five exceedances out of 22 samples at this station. Data at INDM-250 from 2015 was used to list the upper segment. At this station, there were two violations out of eight samples. Both segments are classified as Fish and Wildlife; therefore, the criteria for this use classification were applied to evaluate the waterbody. The complete dataset can be found in Appendix 7.2

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

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 of 298 colonies/100 ml 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

3.2.1 Point Sources in the Indian 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.

Continuous Point Sources

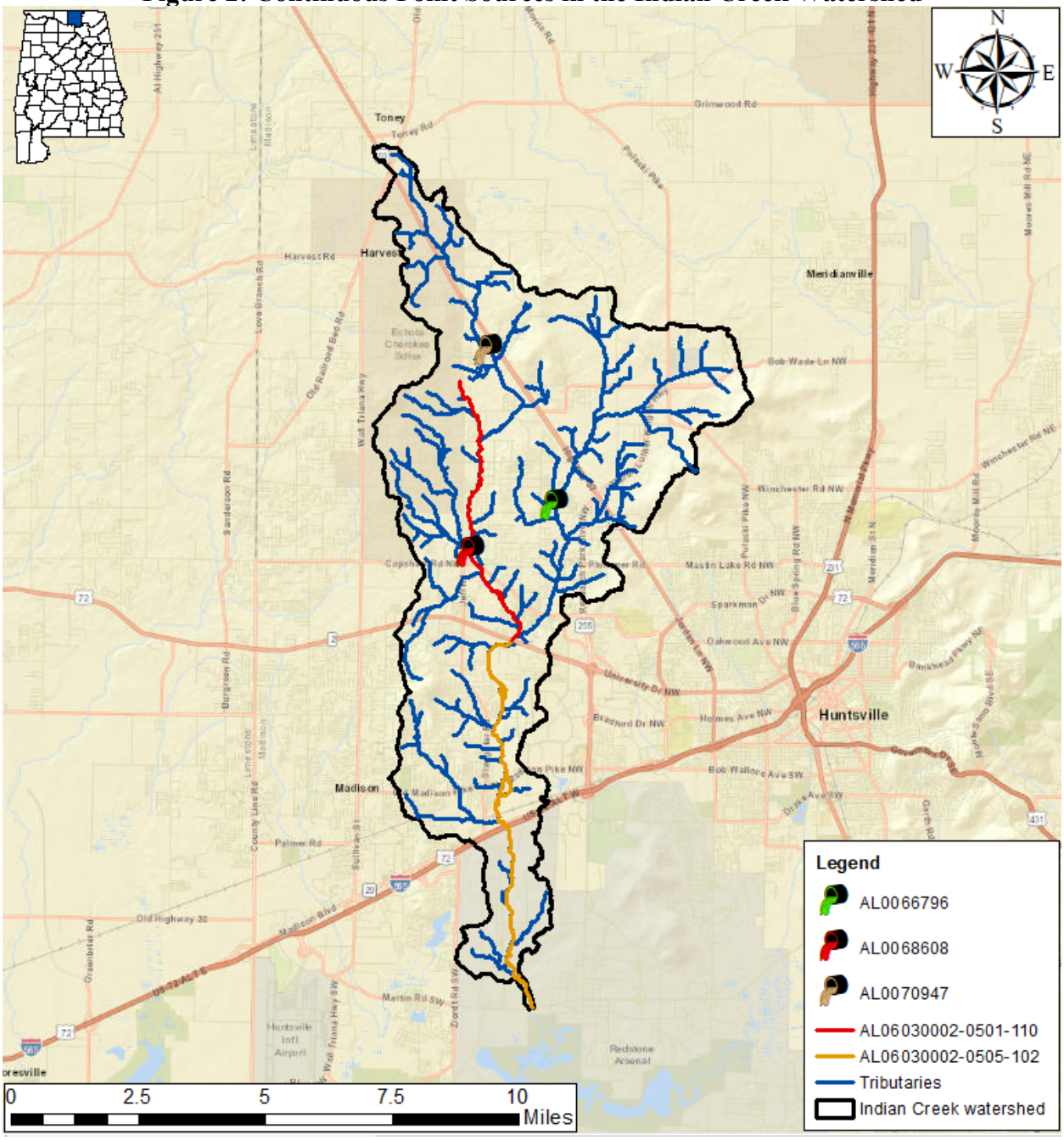
There are three continuous NPDES-permitted facilities in the Indian Creek watershed. These facilities are minor (<1 MGD) wastewater treatment plants. All three of these facilities discharge in the upper portion of the watershed, draining to or discharging directly to the top impaired segment of Indian Creek (AL0603002-0501-110). All of the permitted facilities have 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: Permitted NPDES continuous dischargers in the Indian Creek Watershed

Type	Permit Number	Facility Name	Receiving Stream	Flow (MGD)
Municipal	AL0066796	Stoney Creek WWTP	Dry Creek	0.02
Municipal	AL0068608	Jeff Road WWTP	Indian Creek	0.5
Municipal	AL0070947	Burwell Road WWTP	Dry Creek	0.25

Figure 2: Continuous Point Sources in the Indian Creek Watershed



Any future NPDES-regulated continuous 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.

Non-Continuous Point Sources

There are currently 17 NPDES storm water discharge permits within the Indian Creek watershed. These facilities are not considered to be a source of pathogens due to the nature of their processes. No *E. coli* loading to the Indian Creek watershed will be attributed to these facilities, and they will not receive an allocation in this TMDL.

Table 4: Permitted NPDES non-continuous dischargers in the Indian Creek Watershed

Permit Number	Name
AL0000019	Redstone Arsenal/US Army Garrison
AL0000221	Nasa Marshall Flight Center
ALG110381	Ikard Septic Manufacturing and Sales
ALG110414	Ready Mix USA, LLC
ALG110524	Bama Concrete Birmingham, Inc.
ALG120322	ATI Huntsville Operations
ALG120481	Toyota Motor Manufacturing Alabama, Inc
ALG120676	Kennametal, Inc
ALG140581	Waste Away Group, Inc.
ALG140968	Reed Contracting Services Inc
ALG141104	JHCC Holdings LLC
ALG180881	Barry Isaac dba Bahab's Repair Shop
ALG340590	Hudson Alpha Institue for Biotechnology
ALG640028	Burwell Water Treatment Plant
ALG640036	Mt. Zion Road Water Treatment Plant
ALG850044	Fitcheard Farms, LLC
ALG850135	Reed Contracting Services, Inc

The Indian Creek watershed currently contains zero Voluntary Animal Feeding Operations (AFOs)/Concentrated Animal Feeding Operations (CAFOs). Currently 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.

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.

A portion of the Indian Creek watershed is classified as an MS4 area and therefore must be addressed in the TMDL as part of the WLA. The Indian Creek watershed overlaps the city limits and urbanized regions of the Huntsville-Madison area. As a result, the Indian Creek watershed contains areas included in Phase I and Phase II permits. Contributions from the Phase I and Phase II MS4 areas drain to the pathogen impaired segments of the Indian Creek watershed and will be allocated as MS4 WLAs in the TMDL. The table below lists the three MS4 permits within the Indian Creek watershed.

Table 5: Phase I and Phase II MS4 Permits in the Indian Creek Watershed

Permit Number	Name	Phase
ALS000005	City of Huntsville	I
ALS000014	City of Madison	II
ALR040014	Madison County	II

Future NPDES-regulated storm water discharges 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 four facilities reported 26 SSOs from 2017 to July 2021 within the Indian Creek watershed. The numerous SSOs are considered a source of pathogens to Indian Creek. The reported SSOs are listed in Appendix 7.4.

3.2.2 Nonpoint Sources in the Indian 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. 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, 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 Indian Creek watershed was determined using ArcMap with land use datasets derived from the 2019 National Land Cover Dataset (NLCD). Table 6 depicts the primary land uses in the Indian Creek watershed. Figure 3 displays the land use areas within the watershed.

Developed land, which includes both commercial and residential land uses, is 40.29% of the watershed. Agricultural land uses, which can contribute to pathogen run-off into streams if not managed properly, make up 32.22% of the watershed area. Naturally occurring forested areas are 27.34% of the watershed, with deciduous forest (14.08%) being the most dominant sub-category. The remaining 0.14% of the land area consists of open water.

Table 6: Land use (2019) in the Indian Creek watershed

Land Use	Miles^2	Acres	Percent
Open Water	0.08	48.48	0.14%
Developed, Open Space	7.37	4717.22	14.06%
Developed, Low Intensity	8.41	5382.18	16.04%
Developed, Medium Intensity	4.27	2734.34	8.15%
Developed, High Intensity	0.94	601.8	1.79%
Barren Land	0.13	81.4	0.24%
Deciduous Forest	7.38	4722.33	14.08%
Evergreen Forest	1.82	1166.02	3.48%
Mixed Forest	1.46	937.17	2.79%
Shrub/Scrub	0.33	213.5	0.64%
Herbaceous	0.47	303.12	0.90%
Hay/Pasture	10.03	6421.87	19.14%
Cultivated Crops	6.86	4388.29	13.08%
Woody Wetlands	2.58	1654.17	4.93%
Emergent Herbaceous Wetlands	0.27	174.80	0.52%
Totals→	**52.42**	**33546.70**	**100.00%**
Class Description	**Miles^2**	**Acres**	**Percent**
Open Water	0.08	48.48	0.14%
Agricultural Lands	16.89	10810.17	32.22%
Forested/Natural	14.33	9171.12	27.34%
Developed Land (Grouped)	21.12	13516.93	40.29%
Totals→	**52.42**	**33546.70**	**100.00%**

Figure 3: Land Use in the Indian Creek Watershed

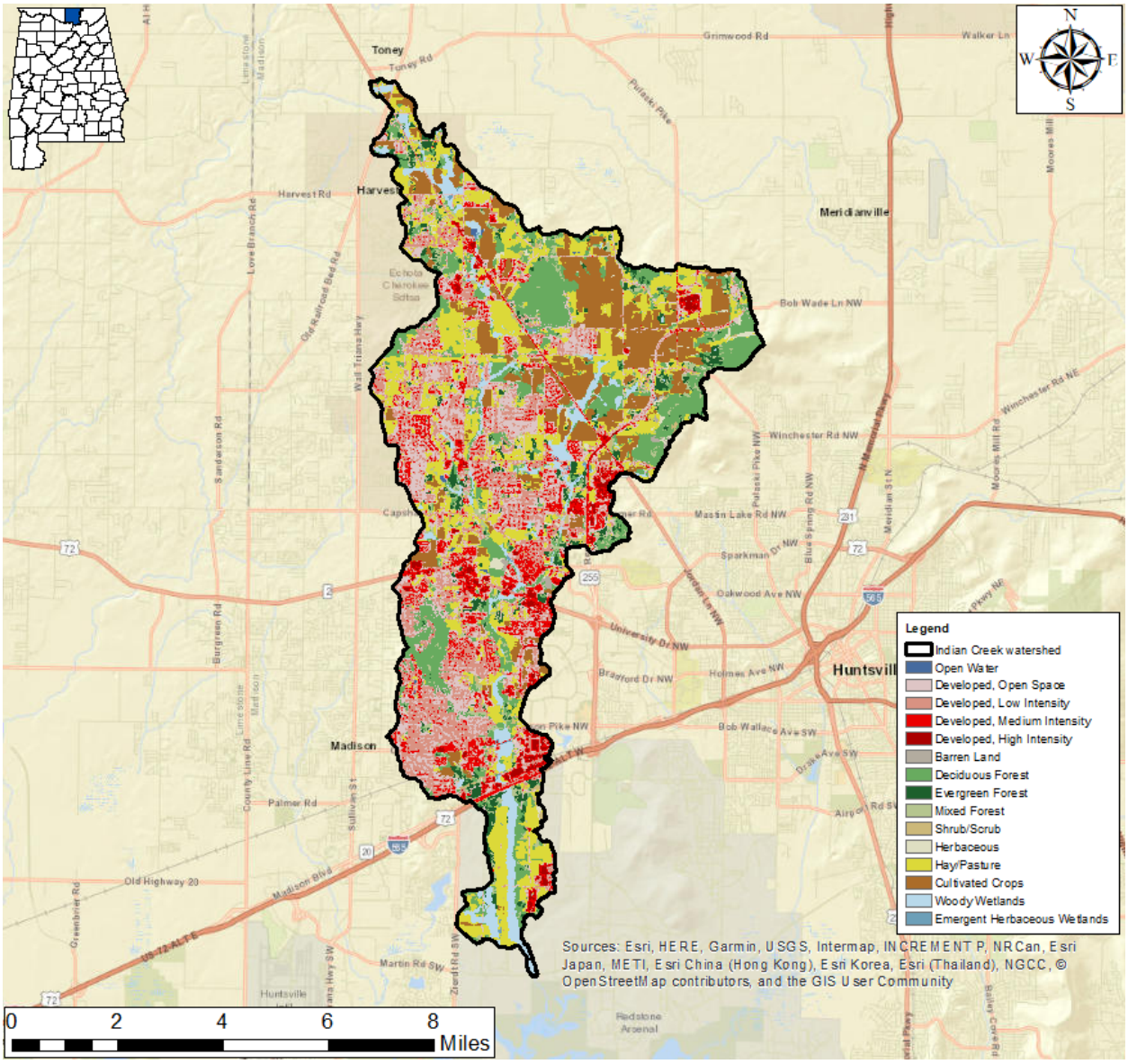
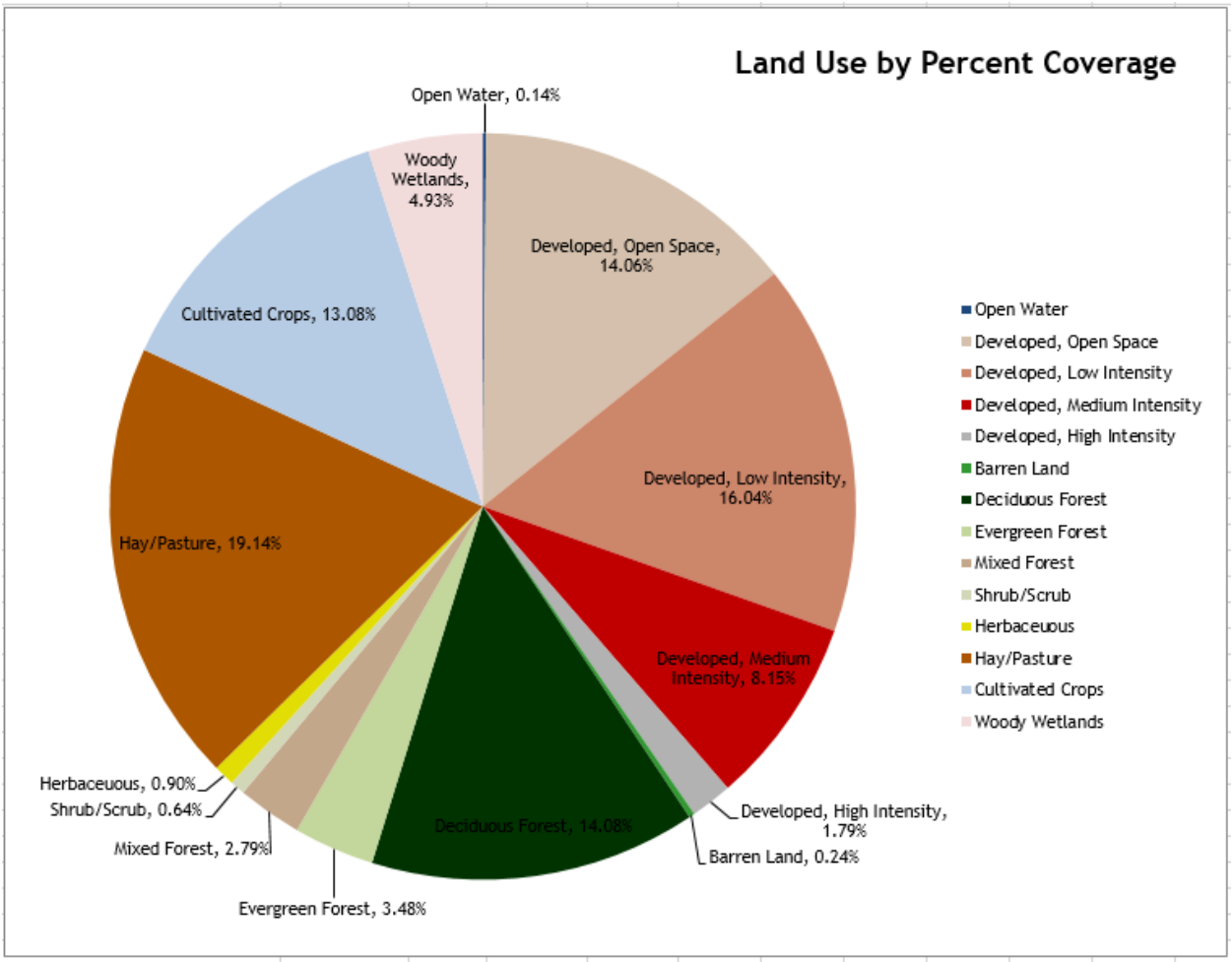


Figure 4: Pie graph of land use in the Indian Creek Watershed



3.4 Linkage between Numeric Targets and Sources

The major land usages in the Indian Creek watershed are developed, agricultural, and forested/natural lands. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most probable sources of pathogen loadings within the watershed are agricultural land applications (pasture grazing), sanitary sewer system failures, and urban runoff. 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.

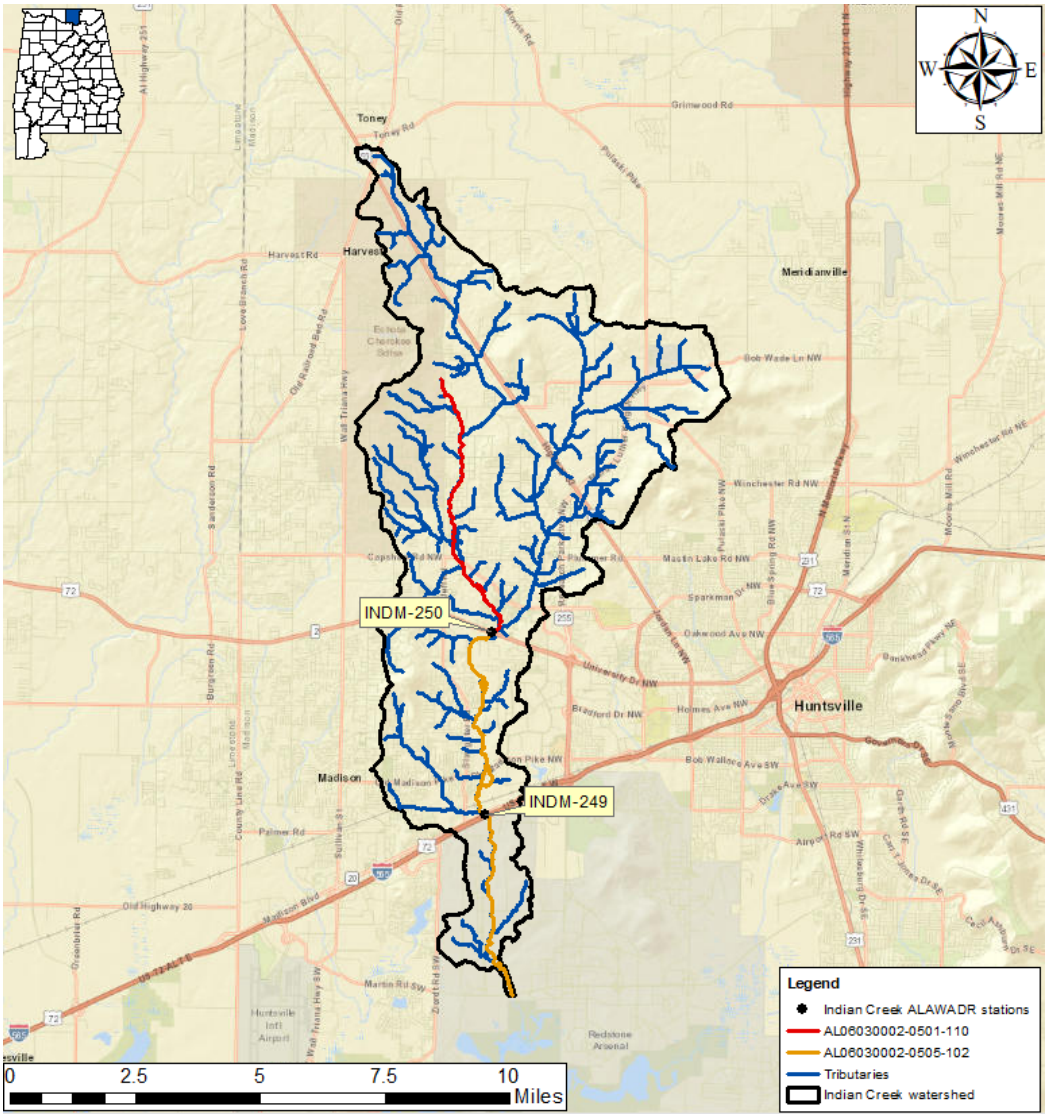
3.5 Data Availability and Analysis

During 2017-2021, ADEM collected data from two stations on the pathogen impaired segments of Indian Creek (INDM-249 and INDM-250). Table 7 and Figure 5 show the locations of these ADEM stations. Forty-two *E. coli* samples were collected during this period, and both stations exhibited single sample and geometric mean *E. coli* exceedances. The 2021 data can be seen below. The complete dataset, including the original impairment data, can be seen in Appendix 7.2.

Table 7: ADEM Sampling Stations in the Indian Creek Watershed

Station	Name	Latitude	Longitude
INDM-249	Indian Creek	34.69731°	-86.7°
INDM-250	Indian Creek	34.7502°	-86.6976°

Figure 5: ADEM sampling stations in the Indian Creek Watershed



INDM-249 (2017-2021): INDM-249 was sampled during the years of 2017-2019 and 2021. During 2017, single sample exceedances occurred on August 7 and October 10. Only one single sample exceedance occurred during 2018; this violation was on August 1. Four single sample exceedances occurred in 2021; these dates were May 5, June 2, July 8, and July 26. The July 2021 and September 2021 geometric mean values both exceeded the geometric mean criteria (126 colonies/100 mL) for Indian Creek. Older data for this station can be seen in Appendix 7.2.

Table 8: *E. coli* data on INDM-249 (AL0603002-0505-102)

INDM-249				
Visit Date	**Single Sample (col/100 mL)**	**Qualifier Code***	**Geometric Mean (col/100 mL)**	**Flow (cfs)**
6/14/2017	186	H		24.6
8/7/2017	**1986.3**	H		45.4
10/10/2017	**2419.6**	GH		348
6/5/2018	186	H		25.2
8/1/2018	**2419.6**	H		21
10/2/2018	185			9.5
4/10/2019	146.7			129.2
6/4/2019	98.8			16.2
8/6/2019	172.2	H		19.8
10/1/2019	55.6	H		1.7
3/8/2021	33.6	-		70.1
4/6/2021	68.3	-		106.6
5/5/2021	**2419.6**	G		-
6/2/2021	**579.4**	H		29.4
7/8/2021	**1119.9**	-		-
7/14/2021	161.6	-		35.6
7/22/2021	201.4	-	**401.20**	42.4
7/26/2021	**980.4**	-		46.7
7/28/2021	290.9	-		30.2
8/3/2021	178.5	H		19.7
9/7/2021	214.2	-		-
9/8/2021	156.5	-		34.3
9/13/2021	113.7	-	**155.84**	16.6
9/24/2021	155.3	-		67.5
9/27/2021	155.3	-		41.8
10/5/2021	86.5	H		27.5

*G = The amount of analyte is above an acceptable level for quantitation and is likely higher than the reported value.
*H = The analytical holding times for analysis are exceeded.

INDM-250 (2021): INDM-250 was sampled from March to October 2021. There were multiple single sample exceedances; the dates of these exceedances were July 8, July 21, July 26, July 28, and August 11. Two geometric mean sampling events took place during the months of July and September. Both of the geometric mean values exceeded the geometric mean criteria (126 colonies/100 mL). Older data for this station can be seen in Appendix 7.2.

Table 9: *E. coli* data on INDM-250 (AL06030002-0501-110)

INDM-250				
Visit Date	**Single Sample (col/100 mL)**	**Qualifier Code**	**Geometric Mean (col/100 mL)**	**Flow (cfs)**
3/10/2021	49.6	-		58.5
4/14/2021	99	-		84.4
5/19/2021	116	-		31.5
6/15/2021	240	-		22.5
7/8/2021	**1732.9**	-		25
7/21/2021	**461.1**	-		40.9
7/22/2021	159.7	-	**474.55**	26.6
7/26/2021	**579.4**	-		30.2
7/28/2021	**325.5**	-		21.7
8/11/2021	**307.6**	-		8.5
9/7/2021	290.9	-		-
9/13/2021	217.8	-		13.8
9/15/2021	272.3	-	**217.19**	14.2
9/24/2021	172.5	-		53.7
9/27/2021	162.4	-		37.7
10/13/2021	161.6	-		29.4

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.

Indian 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. For AL06030002-0505-102, that value was 2419.6 colonies/100ml and occurred on October 10, 2017 at INDM-249. For AL06030002-0501-110, that value was 1732.9 colonies/100ml and occurred on July 8, 2021 at INDM-250. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in Indian 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 *E. coli* maximum criterion 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.

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 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 *E. coli* TMDL for Indian 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 geometric mean exceedance and the highest single sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion and the geometric mean criterion. There were both single sample and geometric mean violations; the TMDL was based on the violation that produced the highest calculated percent reduction to achieve applicable water quality criteria. INDM-249 was chosen as the station representing the lower segment (AL0603002-0505-102), while INDM-250 was the representative station for the upper segment (AL0603002-0501-110).

Existing Conditions

The **single sample** mass loading for each station was calculated by multiplying the highest *E. coli* single sample exceedance concentration by the flow on the day of the exceedance. The highest exceedances were on October 10, 2017, and July 8, 2021, for INDM-249 and INDM-250, respectively. (At INDM-249, there were two other dates with the same *E. coli* value as that recorded on October 10, 2017. This particular violation day was chosen since it had the highest flow.) The product of the concentration times the flow times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Indian Creek under the single sample exceedance condition. Below are the calculations for INDM-249 and INDM-250.

INDM-249:

$$\frac{348\ ft^3}{s} \times \frac{2419.6\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{2.06 \times 10^{13}\ colonies}{day}$$

INDM-250:

$$\frac{25\ ft^3}{s} \times \frac{1732.9\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{1.06 \times 10^{12}\ colonies}{day}$$

The **geometric mean** mass loading at each station was calculated by multiplying the highest geometric mean exceedance concentration times the average flow of the samples over the geometric mean sampling period. The geometric mean concentrations for both INDM-249 and

INDM-250 were calculated based on measurements between July 8, 2021, and July 28, 2021. Calculations for both stations can be seen below. It should be noted that the average flow used at INDM-249 for the geometric mean calculation did not include a flow from July 8, 2021 because no flow was taken on this day. Therefore, only four flows were used (July 14, 2021-July 28, 2021) to determine the average flow.

INDM-249:

$$\frac{38.725\ ft^3}{s} \times \frac{401.2\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{3.8 \times 10^{11}\ colonies}{day}$$

INDM-250:

$$\frac{28.88\ ft^3}{s} \times \frac{474.55\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{3.35 \times 10^{11} colonies}{day}$$

The **continuous point sources** mass loading was calculated by taking the average discharge flow from the month of October 2017 (since this is when the highest exceedance occurred) and multiplying that by the reported maximum daily *E. coli* value for the same month for each facility. These numbers were found in the October 2017 Discharge Monitoring Reports (DMRs) submitted by the facilities. Burwell Road WWTP was not monitoring for *E. coli* during October 2017, so their fecal coliform data was used for their existing loading calculation.

Stoney Creek WWTP (AL0066796):

$$0.0156\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{7\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{4.14 \times 10^6 colonies}{day}$$

Jeff Road WWTP (AL0068608):

$$0.1628\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{3\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{1.85 \times 10^7 colonies}{day}$$

Burwell Road WWTP (AL0070947):

$$0.1509\ MGD \times \frac{1.55\ ft^3}{s * MGD} \times \frac{2\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{1.14 \times 10^7 colonies}{day}$$

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 flow and the allowable concentration. This value was then multiplied by the conversion factor to calculate the allowable load. This was done for both sampling stations and for

the three point sources that were referenced in the existing conditions calculations. These calculations can be seen below.

INDM-249:
For the **single sample** *E. coli* target concentration of 268.2 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{348\ \text{ft}^3}{\text{s}} \times \frac{268.2\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.28 \times 10^{12}\text{colonies}}{\text{day}}$$

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

$$\frac{348\ ft^3}{s} \times \frac{29.8\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{2.54 \times 10^{11} colonies}{day}$$

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

$$\frac{38.725\ ft^3}{s} \times \frac{113.4\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100 mL * s}{ft^3 * day} = \frac{1.07 \times 10^{11} colonies}{day}$$

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

$$\frac{38.725\ ft^3}{s} \times \frac{12.6\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{1.19 \times 10^{10} colonies}{day}$$

INDM-250:
For the **single sample** *E. coli* target concentration of 268.2 colonies/100 ml, the allowable *E. coli* loading is:

$$\frac{25\ \text{ft}^3}{\text{s}} \times \frac{268.2\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.64 \times 10^{11}\text{colonies}}{\text{day}}$$

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

$$\frac{25\ ft^3}{s} \times \frac{29.8\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{1.82 \times 10^{10} colonies}{day}$$

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

$$\frac{28.88\ ft^3}{s} \times \frac{113.4\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100 mL * s}{ft^3 * day} = \frac{8.01 \times 10^{10} colonies}{day}$$

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

$$\frac{28.88\ ft^3}{s} \times \frac{12.6\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{8.9 \times 10^9 colonies}{day}$$

The WLA for the continuous point sources was calculated by multiplying the design flow of each facility by the applicable in-stream single sample *E. coli* criterion. This value was then multiplied by a conversion factor to come up with the appropriate loading. As noted above, Burwell Road WWTP had fecal coliform limitations in 2017; however, the current permit for Burwell Road WWTP has *E. coli* limitations. Therefore, the allowable conditions for all facilities are based on the applicable *E. coli* limitations.

Stoney Creek WWTP (AL0066796):

$$0.02\ MGD\ \times \frac{1.55\ ft^3}{s * MGD} \times \frac{298\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{2.26 \times 10^8 colonies}{day}$$

Jeff Road WWTP (AL0068608):

$$0.5\ MGD\ \times \frac{1.55\ ft^3}{s * MGD} \times \frac{298\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{5.65 \times 10^9 colonies}{day}$$

Burwell Road WWTP (AL0070947):

$$0.25\ MGD\ \times \frac{1.55\ ft^3}{s * MGD} \times \frac{298\ colonies}{100\ mL} \times \frac{24{,}465{,}755 * 100\ mL * s}{ft^3 * day} = \frac{2.83 \times 10^9 colonies}{day}$$

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 Indian Creek as evaluated at stations INDM-249 and INDM-250. Tables 10 and 11 show the existing and allowable *E. coli* loads and required reductions for each station.

Table 10: *E. coli* Load and Required Reduction for AL06030002-0505-102 at INDM-249*

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	2.06E+13	2.28E+12	1.83E+12	89%
Geometric Mean Load	3.8E+11	1.07E+11	2.73E+11	72%
AL0066796	4.14E+6	2.26E+8	0	0%
AL0068608	1.85E+7	5.65E+9	0	0%
AL0070947**	1.14E+7	2.83E+9	0	0%

*The highest exceedances of the single sample and geometric mean criteria were used in these calculations.
**Existing conditions for Burwell Road WWTP (AL0070947) are in fecal coliform and allowable conditions are in *E. coli*. Based on reported values, no reductions are necessary.

Table 11: *E. coli* Load and Required Reduction for AL06030002-0501-110 at INDM-250*

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Single Sample Load	1.06E+12	1.64E+11	8.96E+11	85%
Geometric Mean Load	3.35E+11	8.01E+10	2.55E+11	76%
AL0066796	4.14E+6	2.26E+8	0	0%
AL0068608	1.85E+7	5.65E+9	0	0%
AL0070947**	1.14E+7	2.83E+9	0	0%

*The highest exceedances of the single sample and geometric mean criteria were used in these calculations.
**Existing conditions for Burwell Road WWTP (AL0070947) are in fecal coliform and allowable conditions are in *E. coli*. Based on reported values, no reductions are necessary.

The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criteria are provided in Tables 12 and 13 below.

Table 12: *E. coli* TMDL for Indian Creek (AL06030002-0501-110)

TMDL[a]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[b]			Load Allocation (LA)	
		WWTPs[c]	MS4s[d]	Leaking Collection Systems[e]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
1.82E+11	1.82E+10	8.7E+9	85%	0	1.55E+11	85%

a. TMDL was established using the single sample criterion of 298 colonies/100ml.
b. Future CAFOs in the watershed will be assigned a waste load allocation (WLA) of zero.
c. WLA for WWTPs is expressed as a daily maximum. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
d. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
e. 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*.

Table 13: *E. coli* TMDL for Indian Creek (AL06030002-0505-102)

TMDL[a]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[b]			Load Allocation (LA)	
		WWTPs[c]	MS4s[d]	Leaking Collection Systems[e]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
2.54E+12	2.54E+11	8.7E+9	89%	0	2.27E+12	89%

a. TMDL was established using the single sample criterion of 298 colonies/100ml.
b. Future CAFOs in the watershed will be assigned a waste load allocation (WLA) of zero.
c. WLA for WWTPs is expressed as a daily maximum. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
d. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
e. 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*.

4.3 TMDL Summary

Indian Creek was placed on Alabama's §303(d) list in 2018 based on data collected from 2013-2016. Additional data collected by ADEM during 2017-2021 confirmed the pathogen impairment.

A mass balance approach was used to calculate the *E. coli* TMDL for Indian Creek. Based on the TMDL analysis, it was determined that *E. coli* reductions of 89% for segment AL06030002-0505-102 and 85% for segment AL06030002-0501-110 were 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 Indian 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 the schedule shown in Table 14.

Table 14: Follow-up Monitoring Schedule

River Basin Group	Years to be Monitored
Coosa, Escatawpa, Tennessee (Guntersville), Tombigbee	2022/2025
Alabama, Cahaba, Mobile, Tallapoosa, Tennessee (Pickwick and Wilson)	2023/2026
Black Warrior, Blackwater, Chattahoochee, Chipola, Choctawhatchee, Escambia, Perdido, Tennessee (Wheeler), Yellow	2024/2027

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 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. 2013-2021. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, 2022.

Alabama's §303(d) List and Fact Sheet. 2018, 2020. ADEM.

Alabama Department of Environmental Management (ADEM) Laboratory QA Manual, Chapter 10, Appendix A: ADEM Laboratory Qualifier Codes and Descriptions, January 24, 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 15: 2013-2016 *E. coli* Data for Station INDM-249

INDM-249			
Visit Date	Single Sample (col/100 mL)	Qualifier Code	Flow (cfs)
3/19/2013	1553.1		
4/2/2013	104.6		117.8
5/8/2013	235.9		
6/11/2013	290.9		21.1
7/17/2013	193.5		65.3
8/6/2013	**2419.6**	G	
9/12/2013	122.3		4.9
10/15/2013	80.9		4.4
6/24/2014	**1203.3**	H	40.6
8/5/2014	201.4	H	17
10/8/2014	**410.6**	H	8.3
3/10/2015	488		539
4/7/2015	649		
5/12/2015	146.7		35.8
6/23/2015	214.3	H	7.7
7/14/2015	185		9.7
8/11/2015	178.9	H	13.2
9/8/2015	185		7.2
10/28/2015	**325.5**	H	9
6/14/2016	165.8	H	6.3
8/9/2016	**1553.1**	H	2.6
10/11/2016	37.3	H	0.4

*G = The amount of analyte is above an acceptable level for quantitation and is likely higher than the reported value.
*H = The analytical holding times for analysis are exceeded.

Table 16: 2015 *E. coli* Data for Station INDM-250

INDM-250			
Visit Date	**Single Sample (col/100 mL)**	**Qualifier Code**	**Flow (cfs)**
3/10/2015	687		
4/7/2015	326		
5/12/2015	160.7		29.2
6/23/2015	228.2	H	6.6
7/14/2015	248.1		9.6
8/11/2015	129.6	H	11.6
9/8/2015	**307.6**		5.8
10/28/2015	**325.5**	H	9.6

*H = The analytical holding times for analysis are exceeded.

7.3 Continuous Point Source Effluent Data

Table 17: Stoney Creek WWTP (AL0066796) *E. coli* Data

Monitoring Period End Date	Monthly Average Concentration (col/100 mL)	Maximum Daily Concentration (col/100 mL)
01/31/17	75	140
02/28/17	6	10
03/31/17	19	32
04/30/17	10	13
05/31/17	0	0
06/30/17	1	1
07/31/17	0	0
08/31/17	1	1
09/30/17	3	6
10/31/17	7	10
11/30/17	0	0
12/31/17	0	0
01/31/18	0	0
02/28/18	13	24
03/31/18	1	1
04/30/18	2	3
05/31/18	0	0
06/30/18	0	0
07/31/18	5	10
08/31/18	1	2
09/30/18	11	14
10/31/18	100	200
11/30/18	245	480
12/31/18	301	600

Monitoring Period End Date	Monthly Average Concentration (col/100 mL)	Maximum Daily Concentration (col/100 mL)
01/31/19	24	33
02/28/19	3	4
03/31/19	10	13
04/30/19	0	0
05/31/19	2	2
06/30/19	0	0
07/31/19	1	1
08/31/19	0	0
09/30/19	45	60
10/31/19	5	8
11/30/19	2	4
12/31/19	2	4
01/31/20	3	5
02/29/20	35	70
03/31/20	15	20
04/30/20	10	10
05/31/20	0	0
06/30/20	0	0
07/31/20	0	0
08/31/20	0	0
09/30/20	0	0
10/31/20	0	0
11/30/20	0	0
12/31/20	0	0
01/31/21	0	0
02/28/21	0	0
03/31/21	0	0
04/30/21	5	10
05/31/21	0	0
06/30/21	0	0
07/31/21	0	0
08/31/21	0	0
09/30/21	0	0
10/31/21	5	10

Table 18: Jeff Road WWTP (AL0068608) *E. coli* Data

Monitoring Period End Date	Monthly Average Concentration (col/100 mL)	Maximum Daily Concentration (col/100 mL)
01/31/17	1	6
02/28/17	0	1
03/31/17	0	0
04/30/17	0	0
05/31/17	0	1
06/30/17	2	17
07/31/17	2	10
08/31/17	0	4
09/30/17	0	0
10/31/17	3	11
11/30/17	1	3
12/31/17	0	1
01/31/18	1	2
02/28/18	1	6
03/31/18	1	5
04/30/18	6	49
05/31/18	1	6
06/30/18	1	3
07/31/18	5	22
08/31/18	7	24
09/30/18	4	12
10/31/18	90	**1200**
11/30/18	28	150
12/31/18	10	45

Monitoring Period End Date	Monthly Average Concentration (col/100 mL)	Maximum Daily Concentration (col/100 mL)
01/31/19	10	70
02/28/19	26	200
03/31/19	15	40
04/30/19	93	380
05/31/19	45	150
06/30/19	10	60
07/31/19	40	5
08/31/19	8	50
09/30/19	30	120
10/31/19	16	100
11/30/19	10	4
12/31/19	2	12
01/31/20	1	3
02/29/20	0	0
03/31/20	3	20
04/30/20	21	170
05/31/20	90	22
06/30/20	7	30
07/31/20	21	100
08/31/20	1	10
09/30/20	7	40
10/31/20	10	40
11/30/20	26	80
12/31/20	7	31
01/31/21	36	210
02/28/21	23	102
03/31/21	11	31
04/30/21	47	301
05/31/21	10	31
06/30/21	11	31
07/31/21	6	20
08/31/21	24	171
09/30/21	16	52
10/31/21	10	41

Table 19: Burwell Road WWTP (AL0070947) Fecal Coliform Data

Monitoring Period End Date	Monthly Average Concentration (col/100 mL)	Maximum Daily Concentration (col/100 mL)
2/28/2017	0	0
3/31/2017	0	0
4/30/2017	1	10
5/31/2017	1	20
6/30/2017	2	20
7/31/2017	1	10
8/31/2017	5	30
9/30/2017	10	120
10/31/2017	2	20
11/30/2017	1	10
12/31/2017	3	40
01/31/18	6	80
02/28/18	1	10
03/31/18	1	10
04/30/18	3	10
05/31/18	10	50
06/30/18	14	60
07/31/18	3	20
08/31/18	3	20
09/30/18	12	60
10/31/18	6	80
11/30/18	0	0
12/31/18	0	0
01/31/19	1	10
02/28/19	6	30
03/31/19	20	200
04/30/19	2	20
05/31/19	7	30
06/30/19	15	120
07/31/19	21	100
08/31/19	48	120
09/30/19	**639**	**6000**
10/31/19	18	120
11/30/19	0	0

Table 20: Burwell Road WWTP (AL0070947) *E. coli* Data

Monitoring Period End Date	Monthly Average Concentration (col/100 mL)	Maximum Daily Concentration (col/100 mL)
01/31/20	4	30
02/29/20	3	10
03/31/20	7	20
04/30/20	19	200
05/31/20	21	60
06/30/20	45	170
07/31/20	28	140
08/31/20	6	27
09/30/20	21	80
10/31/20	6	40
11/30/20	17	90
12/31/20	5	24
01/31/21	28	210
02/28/21	30	200
03/31/21	51	210
04/30/21	92	305
05/31/21	87	259
06/30/21	88	216
07/31/21	49	209
08/31/21	66	243
09/30/21	34	279
10/31/21	30	134

7.4 Sanitary Sewer Overflow (SSO) Data in Indian Creek Watershed

Table 21: SSOs from Stoney Creek WWTP (Permit No. AL0066796)

SSO Began	Estimated Release Volume (gallons)	Duration (hours)
8/6/2018	1,000-10,000	12
9/19/2021	10,000-25,000	17

Table 22: SSOs from Jeff Road WWTP (Permit No. AL0068608)

SSO Began	Estimated Release Volume (gallons)	Duration (hours)
2/22/2019	146,983	46
12/23/2019	7,455	1
2/19/2021	1,000-10,000	17
5/22/2021	3,375	2
9/19/2021	25,000-50,000	18

Table 23: SSOs from Burwell Road WWTP (Permit No. AL0070947)

SSO Began	Estimated Release Volume (gallons)	Duration (hours)
8/10/2017	6,000	3
2/16/2018	<=1,000	1
12/8/2018	1,000-10,000	0
12/28/2018	4,000	1
2/22/2019	187,000	70
2/6/2020	7,620	4
7/12/2020	1,000-10,000	0
9/19/2021	81,000	16
9/19/2021	81,000	16

Table 24: SSOs from Madison WWTP (Permit No. AL0071897)

SSO Began	Estimated Release Volume (gallons)	Duration (hours)
5/8/2019	1,000-10,000	0

7.5 Indian Creek Watershed Photos

At station INDM-249, looking upstream (10/05/2021)

At station INDM-249, looking downstream (10/05/2021)

At station INDM-250, looking upstream (09/27/2021)

At station INDM-250, looking downstream (09/27/2021)