Draft

Total Maximum Daily Load (TMDL)

For

Panther Creek

Assessment Unit ID# AL03140201-0203-200

Pathogens (*E. coli*)

Dale and Henry Counties

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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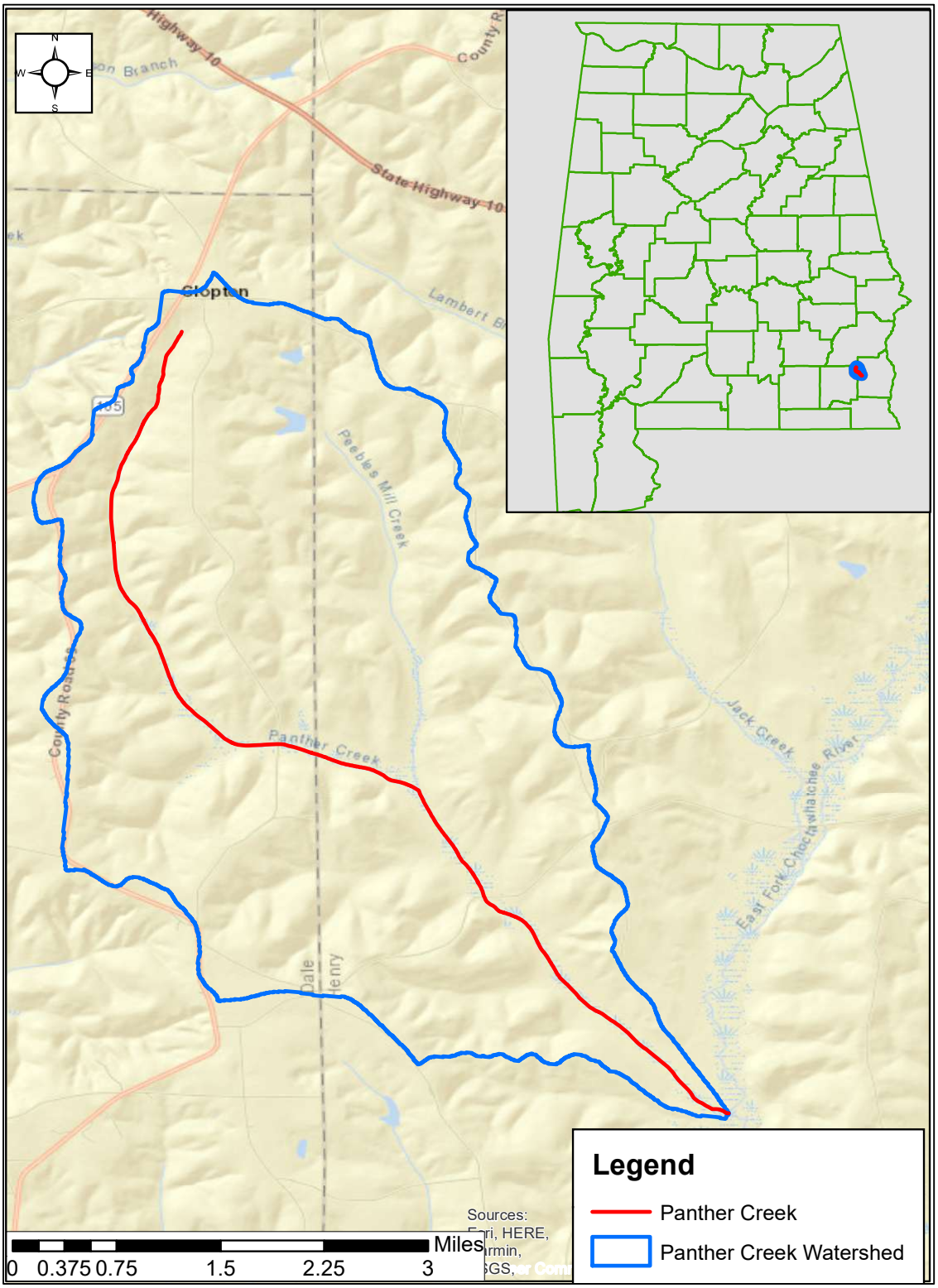
Figure 1: Panther Creek Watershed



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1.0 Executive Summary

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

Panther Creek, part of the Choctawhatchee River basin, begins south of Clopton, Alabama and flows southeast into East Fork Choctawhatchee River. Panther Creek is currently included on Alabama's §303(d) list as impaired for pathogens (*E. coli*) from its source to East Fork Choctawhatchee River. Panther Creek has a designated use classification of Fish and Wildlife (F&W). The total drainage area for the Panther Creek watershed is approximately 13.98 square miles.

Panther Creek was first included on the §303(d) list as impaired for pathogens in 2018 based on data collected by the Alabama Department of Environmental Management (ADEM) in 2014. The exceedances were found at station PRCH-1. This data, which can be found in Appendix 7.2, indicated that Panther Creek was impaired for pathogens (*E. coli*).

In 2024, sampling studies were performed by ADEM on Panther Creek to further assess the water quality of the impaired stream. ADEM collected 11 samples at station PRCH-1 in 2024. A geometric mean study was also conducted at this station. For the purposes of this TMDL, the 2024 data will be used to assess the water quality of Panther Creek because it is the most current data and provides the best picture of the current water quality conditions of the stream. The 2024 edition of *Alabama's Water Quality Assessment and Listing Methodology*, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody. All the available and recent bacterial data is listed in the Appendix for reference. According to the 2024 data, Panther Creek was still not meeting the pathogen criteria applicable to its use classification of F&W. Therefore, this TMDL has been developed for pathogens (*E. coli*) for Panther Creek.

A mass balance approach was used for calculating the pathogen TMDL for Panther Creek. The mass balance approach utilizes the conservation of mass principle. The TMDL was calculated using the single sample or geometric mean sample exceedance event which resulted in the highest percent reduction. Existing loads were calculated by multiplying the *E. coli* concentrations times the respective in-stream flows and a conversion factor. In the same manner as existing loads were calculated, allowable loads were calculated for the single sample *E. coli* target of 268.2 colonies/100 mL (298 colonies/100mL-10% Margin of Safety) and geometric mean *E. coli* target of 113.4 colonies/100 ml (126 colonies/100 ml – 10% Margin of Safety). In this case, it was determined that the highest percent reduction was

calculated from a single sample *E. coli* violation of 1145 colonies/100 mL measured on May 24, 2024, at station PRCH-1. This violation calls for a reduction of 77%.

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

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

Source	Existing Load (col/day)	Allowable Load (col/day)	Required Reduction (col/day)	% Reduction
Single Sample	1.19E+11	2.79E+10	9.11E+10	77%
Geometric Mean	4.59E+10	1.19E+10	3.4E+10	74%

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

TMDL[e]	**Margin of Safety (MOS)**	**Wasteload Allocation (WLA)[a]**			**Load Allocation (LA)**	
		WWTPs[b]	**Stormwater (MS4s and other NPDES sources)[c]**	**Leaking Collection Systems[d]**		
(col/day)	**(col/day)**	**(col/day)**	**% reduction**	**(col/day)**	**(col/day)**	**% reduction**
3.10E+10	3.10E+9	N/A	N/A	0	2.79E+10	77%

Note: N/A = not applicable
a. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas and other NPDES stormwater sources will be required to demonstrate consistency with the assumptions and requirements of this TMDL through implementation and maintenance of BMPs on a case-by-case basis.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for *E. coli*.
e. TMDL was established using the single sample criterion of 235 colonies/100 ml.

Compliance with the terms and conditions of future National Pollutant Discharge Elimination System (NPDES) permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required 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 Panther 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 TMDL for pollutants causing use impairment. The TMDL process establishes the allowable loading of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified the 7.63 miles of Panther Creek from its source to East Fork Choctawhatchee River as impaired for pathogens. Panther Creek was originally listed on Alabama's 2018 List of Impaired Waters for pathogens based on data collected in 2014. The potential sources of the pathogens impairment are listed as animal feeding operations and pasture grazing on the 2024 §303(d) List.

2.2 Problem Definition

Waterbody Impaired:	Panther Creek – from its source to East Fork Choctawhatchee River
Impaired Reach Length:	7.63 miles
Impaired Drainage Area:	13.98 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 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:

Panther Creek was first included on Alabama's §303(d) list for pathogens (*E. coli*) in 2018 based on data collected by ADEM in 2014 at station PRCH-1. Monthly sample results taken from station PRCH-1 for *E. coli* showed four out of eight samples exceeding the applicable single sample criterion. The listing data can be found in Appendix 7.2.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

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

3.2 Source Assessment

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

There are currently no NPDES-regulated point sources in the Panther Creek watershed. In addition, the Panther Creek watershed does not presently qualify as a municipal separate storm sewer system (MS4) area. There are also currently no voluntary Animal Feeding Operation/Concentrated Animal Feeding Operation (AFO/CAFO) facilities located within the Panther Creek watershed. The ADEM AFO/CAFO rules prohibit discharges of pollutants from the facilities and their associated waste land application activities. As a result, future AFOs/CAFOs will receive a waste load allocation of zero.

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

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

Sanitary sewer overflows (SSOs) have the potential to severely impact water quality and can often result in the violation of water quality standards. It is the responsibility of the NPDES wastewater discharger or collection system operator for non-permitted "collection only" systems to ensure that releases do not occur. Unfortunately, releases to surface waters from SSOs are not always preventable or reported. From review of ADEM files, it was found that no facilities reported SSOs within the TMDL watershed in the last several years.

3.2.2 Nonpoint Sources in the Panther Creek Watershed

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

Agricultural land can be a source of *E. coli* bacteria. Stormwater runoff from pastures and animal feeding areas can be a source of *E. coli*. In addition, improper land application of animal wastes and animals with direct access to streams are mechanisms that can contribute bacteria to waterbodies. To account for the potential influence from animals with direct access to stream reaches in the watershed, *E. coli* loads can be calculated as a direct source into the stream.

E. coli bacteria can also originate from forested areas due to the presence of wild animals such as deer, raccoons, turkey, waterfowl, etc. Wildlife will deposit feces onto land surfaces, where it can be transported during rainfall events to nearby streams. Control of these sources is usually limited to land management BMPs and may be impracticable in most cases. As a result, forested areas are not specifically targeted in this TMDL.

E. coli loading from developed areas is potentially attributable to multiple sources including storm water runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. On-site septic systems may be direct or indirect sources of bacterial pollution via ground and surface waters due to system failures and malfunctions.

3.3 Land Use Assessment

Land use for the Panther Creek watershed was determined using ArcMap with land use datasets derived from the 2021 National Land Cover Dataset (NLCD). The total drainage area of the Panther Creek watershed is approximately 13.98 square miles. Figures 2 and 3 and Table 3 depict the primary land uses in the Panther Creek watershed.

Figure 2. Land Use in the Panther Creek Watershed

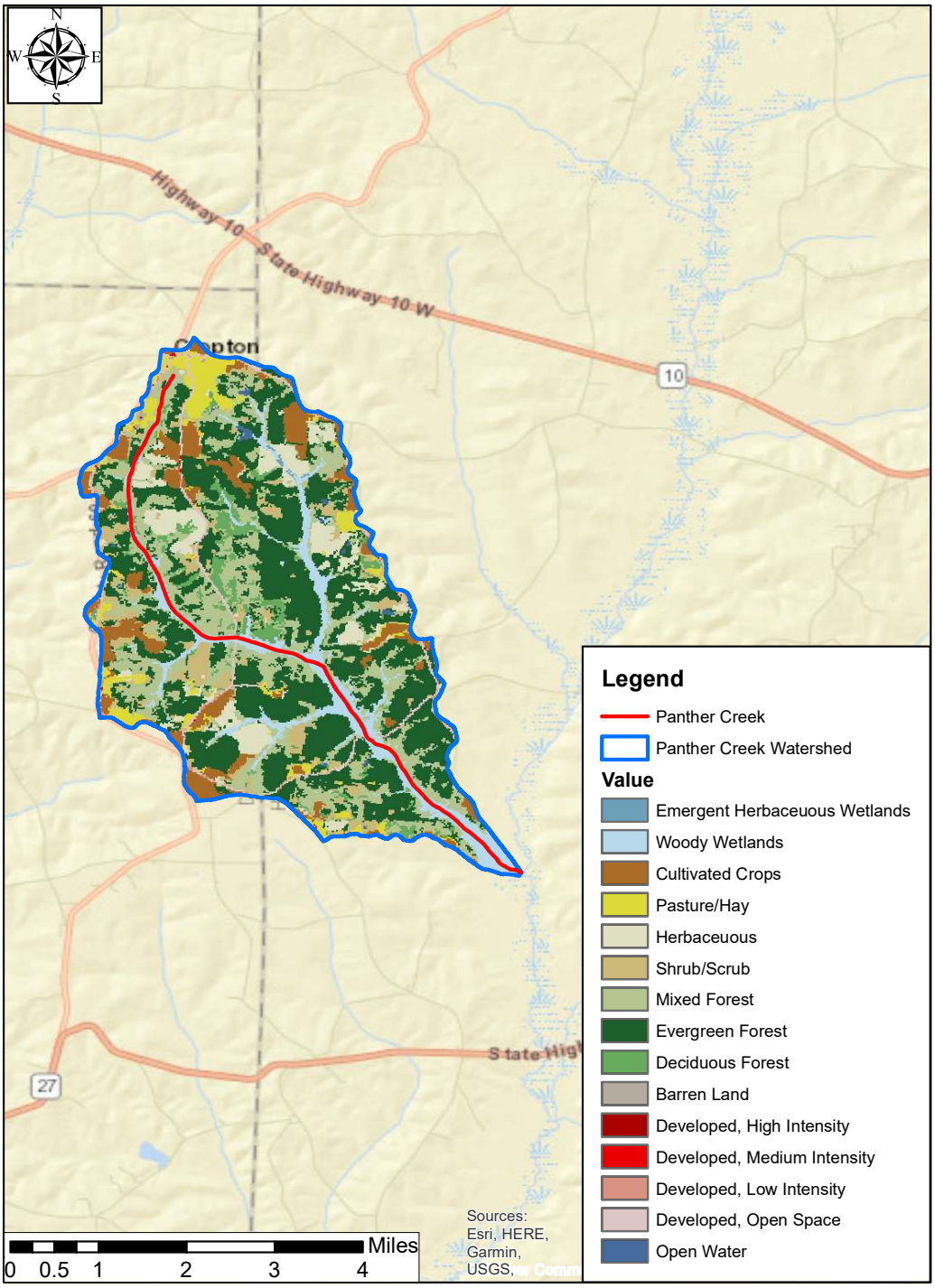
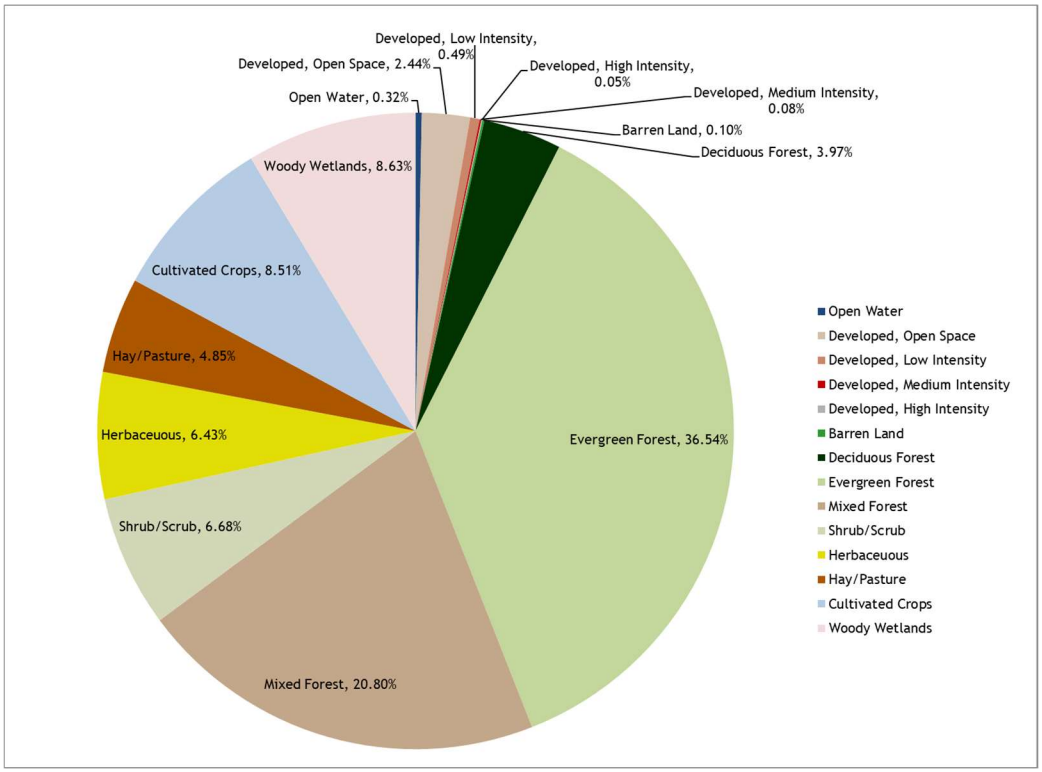


Table 3: Land Use (2021) in the Panther Creek Watershed

Class Description	Count (30m)	mi²	Acres	Percent
Open Water	127	0.04	28.24	0.32%
Developed, Open Space	980	0.34	217.95	2.44%
Developed, Low Intensity	196	0.07	43.59	0.49%
Developed, Medium Intensity	33	0.01	7.34	0.08%
Developed, High Intensity	22	0.01	4.89	0.05%
Barren Land	40	0.01	8.90	0.10%
Deciduous Forest	1599	0.56	355.61	3.97%
Evergreen Forest	14702	5.11	3269.65	36.54%
Mixed Forest	8369	2.91	1861.22	20.80%
Shrub/Scrub	2689	0.93	598.02	6.68%
Herbaceuous	2586	0.90	575.11	6.43%
Hay/Pasture	1951	0.68	433.89	4.85%
Cultivated Crops	3425	1.19	761.70	8.51%
Woody Wetlands	3474	1.21	772.60	8.63%
Emergent Herbaceuous Wetlands	39	0.01	8.67	0.10%
TOTALS →	**40232**	**13.98**	**8947.39**	**100.00%**

Class Description	Count (30m)	Mi²	Acres	Percent
Open Water	127	0.04	28.24	0.32%
Agricultural Lands	5376	1.87	1195.59	13.36%
Forested / Natural	33458	11.63	7440.89	83.16%
Developed Land (Grouped)	1271	0.44	282.66	3.16%
TOTALS →	**40232**	**13.98**	**8947.39**	**100.00%**

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



Most of the Panther Creek watershed is comprised of forested and natural land (83.16%) and agricultural land (13.36%). The remaining land use is approximately 3.16% developed land and 0.32% open water. Developed land includes both commercial and residential land uses.

3.4 Linkage between Numeric Targets and Sources

The predominant land usage in the Panther Creek watershed is forested and natural land, followed by agricultural land. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most likely sources of pathogen loadings in Panther Creek are from the agricultural land uses. It is not considered a logical approach to calculate individual components for nonpoint source loadings. Hence, there will not be individual loads or reductions calculated for the various nonpoint sources. The loadings will be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

During 2024, ADEM conducted sampling on Panther Creek to further assess the water quality of the impaired stream. For purposes of this TMDL, the data from 2024 will be used to assess the water quality of Panther Creek because it is the most current data and provides the best picture of the current water quality conditions of the stream. The 2024 edition of *Alabama's Water Quality Assessment and Listing Methodology*, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody.

ADEM collected water quality data for the Panther Creek watershed at station PRCH-1. A description of the station location can be found in Table 4, and a map showing the station location can be found in Figure 4. A total of 11 *E. coli* samples were collected at PRCH-1 during 2024. There were multiple violations of the applicable single sample criterion. In addition, there was a geometric mean exceedance at PRCH-1 in May/June 2024. A complete list of the data used in this report and photographs at the station can be found in Appendices 7.2 and 7.3, respectively.

Table 4: ADEM Sampling Station in the Panther Creek Watershed

Station Name	Agency Name	Latitude	Longitude	Description
PRCH-1	ADEM	31.54617355	-85.39747549	Panther Creek at Co. Rd. 40

Figure 4: ADEM Sampling Station in the Panther Creek Watershed

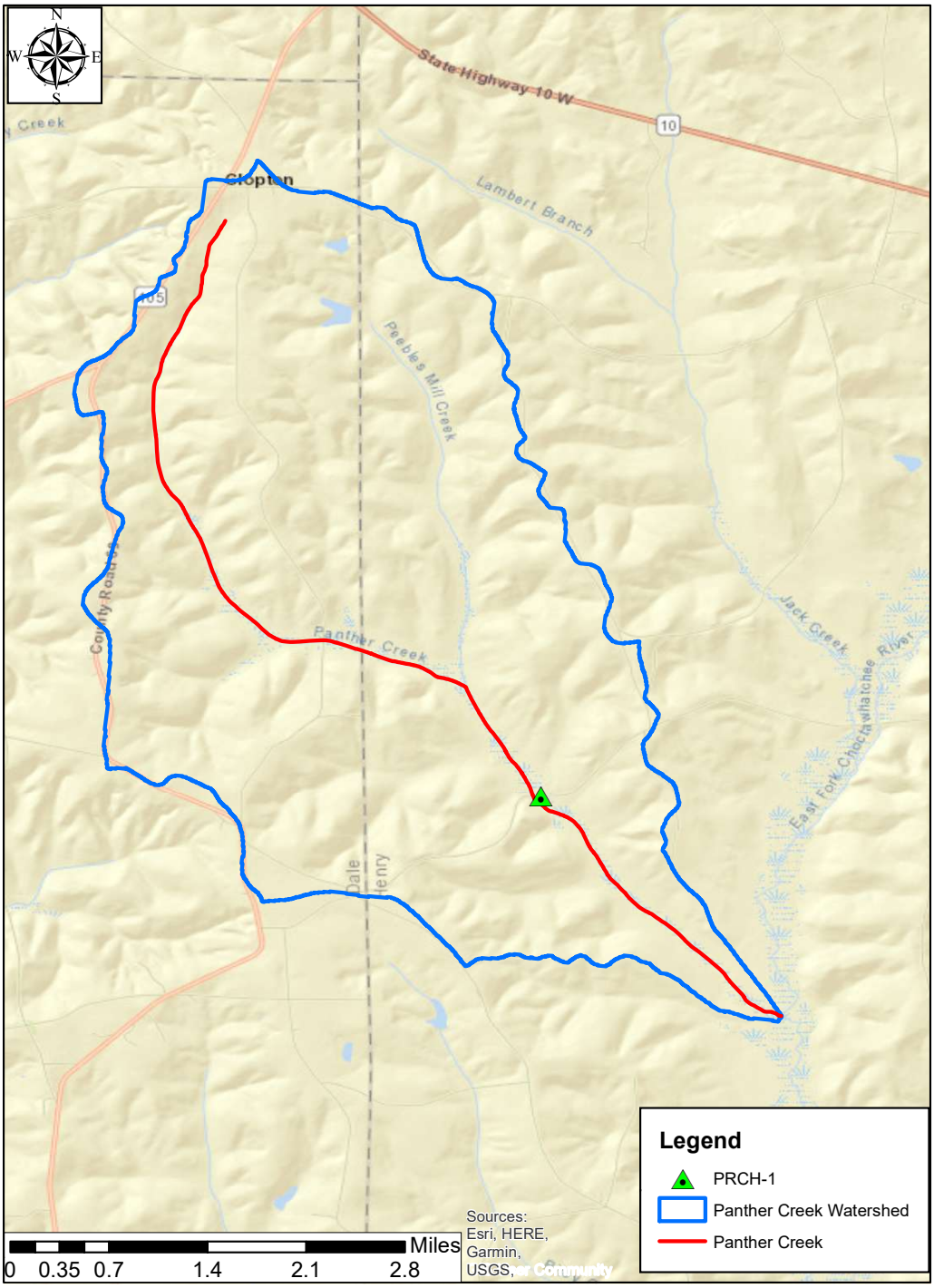


Table 5: 2024 *E. coli* data for Panther Creek

Station ID	Visit Date	*E. coli* (col/100 ml)	*E. coli* dc*	*E. coli* Criterion (col/100 ml)	Geometric Mean (col/100 ml)	Geometric Mean Criterion (col/100 ml)	Flow (cfs)
PRCH-1	3/12/2024	214.2	H	2507			20.03
PRCH-1	4/2/2024	461.1	H	2507			6.946
PRCH-1	5/7/2024	142.4	-	298	436.9	126	3.02
PRCH-1	5/22/2024	663	-	298			6.686
PRCH-1	5/24/2024	**1145**	-	298			4.248
PRCH-1	5/31/2024	176.4	-	298			3.977
PRCH-1	6/5/2024	835	-	298			3.587
PRCH-1	7/10/2024	248.9	H	298			1.835
PRCH-1	8/6/2024	260.3	H	298			-
PRCH-1	9/4/2024	261.3	H	298			-
PRCH-1	10/2/2024	290.9	H	298			9.212

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

3.6 Critical Conditions/Seasonal Variation

Critical conditions typically occur during the summer months (May – October). This can be explained by the nature of storm events in the summer versus the winter. In summer, periods of dry weather interspersed with thunderstorms allow for the accumulation and washing off of bacteria into streams, resulting in spikes of bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up of bacteria on the land surface, resulting in a more uniform loading rate.

The Panther Creek watershed 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. A single sample maximum concentration of 1145 colonies/100 ml was collected on May 24, 2024, at station PRCH-1. The use of the highest exceedance to calculate the TMDL is expected to be protective of water quality in Panther 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

flow data. The single sample maximum *E. coli* criterion of 298 colonies/100 ml was reduced by 10% to 268.2 colonies/100 ml, while the geometric mean criterion of 126 colonies/100 ml was reduced in the same fashion to 113.4 colonies/100 ml.

4.0 TMDL Development

4.1 Definition of a TMDL

A TMDL is the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS). The margin of safety can be included either explicitly or implicitly and accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. As discussed earlier, MOS is explicit in this TMDL. A TMDL can be denoted by the equation:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). However, for pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i).

4.2 Load Calculations

A mass balance approach was used to calculate the pathogen TMDL for Panther Creek. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the *E. coli* concentration times the in-stream flow times a conversion factor. Existing loads were calculated for the highest single sample exceedance and the highest geometric mean sample exceedance. In the same manner, allowable loads were calculated for both the single sample criterion and geometric mean criterion. The TMDL was based on the violation that produced the highest percent reduction of *E. coli* loads necessary to achieve applicable water quality criteria, whether it was the single sample or geometric mean.

4.2.1 Existing Conditions

The **single sample** mass loading was calculated by multiplying the highest single sample *E. coli* concentration of 1145 colonies/100 ml times the measured flow at the time the sample was taken. This concentration was based on a measurement at station PRCH-1 on May 24, 2024, and can be seen above in Table 5. The product of the concentration, measured flow, and a conversion factor gives the total mass loading (colonies per day) of *E. coli* to Panther Creek under the single sample exceedance condition.

$$\frac{4.248\ \text{ft}^3}{\text{s}} \times \frac{1145\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.19 \times 10^{11}\text{colonies}}{\text{day}}$$

The **geometric mean** mass loading was calculated by multiplying the geometric mean exceedance concentration of 436.9 colonies/100 ml times the average of the measured flows taken during the geometric mean sampling period. This concentration was calculated based on measurements at station PRCH-1 between May 7, 2024, and June 5, 2024, and can be found in Table 5. The average stream flow was determined to be 4.30 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of *E. coli* to Panther Creek under the geometric mean exceedance condition.

$$\frac{4.30\ \text{ft}^3}{\text{s}} \times \frac{436.9\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{4.59 \times 10^{10}\text{colonies}}{\text{day}}$$

4.2.2 Allowable Conditions

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

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

$$\frac{4.248\ \text{ft}^3}{\text{s}} \times \frac{268.2\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.79 \times 10^{10}\text{colonies}}{\text{day}}$$

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

$$\frac{4.248\ \text{ft}^3}{\text{s}} \times \frac{29.8\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.10 \times 10^{9}\text{colonies}}{\text{day}}$$

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

$$\frac{4.30\ \text{ft}^3}{\text{s}} \times \frac{113.4\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.19 \times 10^{10}\text{colonies}}{\text{day}}$$

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

$$\frac{4.30\ \text{ft}^3}{\text{s}} \times \frac{12.6\ \text{colonies}}{100\ \text{ml}} \times \frac{24{,}465{,}755 * 100\ \text{ml} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.33 \times 10^{9}\text{colonies}}{\text{day}}$$

The difference between the existing conditions (violation event) and the allowable conditions converted to a percent reduction represents the total load reduction needed to achieve the *E. coli* water quality criteria. The TMDL was calculated as the total daily *E. coli*

load to Panther Creek. Table 6 shows the existing and allowable *E. coli* loads and required reductions for the Panther Creek watershed.

Table 6: *E. coli* Loads and Required Reductions

Source	Existing Load (col/day)	Allowable Load (col/day)	Required Reduction (col/day)	% Reduction
Single Sample	1.19E+11	2.79E+10	9.11E+10	77%
Geometric Mean	4.59E+10	1.19E+10	3.4E+10	74%

From Table 6, compliance with the single sample criterion of 298 colonies/100 ml requires a reduction of 77% in the *E. coli* load. The TMDL, WLA, LA, and MOS values necessary to achieve the applicable *E. coli* criteria are provided below in Table 7.

Table 7: *E. coli* TMDL for Panther Creek

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	Stormwater (MS4s and other NPDES sources)[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	% reduction	(col/day)	(col/day)	% reduction
3.10E+10	3.10E+9	N/A	N/A	0	2.79E+10	77%

Note: N/A = not applicable
a. Future AFOs/CAFOs will be assigned a waste load allocation (WLA) of zero.
b. Future WWTPs must meet the applicable in-stream water quality criteria for pathogens at the point of discharge.
c. Future MS4 areas and other NPDES stormwater sources will be required to demonstrate consistency with the assumptions and requirements of this TMDL through implementation and maintenance of BMPs on a case-by-case basis.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria for *E. coli*.
e. TMDL was established using the single sample criterion of 298 colonies/100 ml.

4.3 TMDL Summary

Panther Creek was placed on Alabama's §303(d) list for pathogens in 2018 based on data collected in 2014. Additional water quality data was collected by ADEM during 2024, which confirmed the pathogen impairment and provided the basis for TMDL development.

A mass balance approach was used to calculate the *E. coli* TMDL for Panther Creek. Based on the TMDL analysis, it was determined that a 77% reduction in *E. coli* loading was necessary to achieve compliance with applicable water quality standards.

Compliance with the terms and conditions of 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 Panther Creek watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

5.0 Follow-up Monitoring

ADEM has adopted a basin approach to water quality monitoring, an approach that divides Alabama's sixteen major river basins into three groups. Each year, ADEM's water quality resources are concentrated in one of the three basin groups and are divided among multiple priorities including §303(d) listed waterbodies, waterbodies with active TMDLs, and other waterbodies as determined by the Department. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices and load reductions in the watershed. This monitoring will occur in each basin according to the schedule shown in Table 8.

Table 8: Follow-up Monitoring Schedule

River Basin Group	Years to be Monitored
Alabama, Cahaba, Mobile, Tallapoosa, Tennessee (Pickwick and Wilson)	2026/2029
Black Warrior, Blackwater, Chattahoochee, Chipola, Choctawhatchee, Escambia, Perdido, Tennessee (Wheeler), Yellow	2027/2030
Coosa, Escatawpa, Tennessee (Guntersville), Tombigbee	2028/2031

6.0 Public Participation

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

7.0 Appendices

7.1 References

ADEM Administrative Code, 2025. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2025. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's Monitoring Program. 2014, 2024. ADEM.

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

Alabama's §303(d) List and Fact Sheet. 2018, 2020, 2022, 2024. ADEM.

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

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

United States Environmental Protection Agency, 1986. *Quality Criteria for Water*. Office of Water. EPA 440/4-91-001.

7.2 Water Quality Data

Table 9. 2024 *E. coli* Data for Station PRCH-1

Station ID	Visit Date	*E. coli* (col/100 ml)	*E. coli* dc*	*E. coli* Criterion (col/100 ml)	Geometric Mean (col/100 ml)	Geometric Mean Criterion (col/100 ml)	Flow (cfs)
PRCH-1	3/12/2024	214.2	H	2507			20.03
PRCH-1	4/2/2024	461.1	H	2507			6.946
PRCH-1	5/7/2024	142.4	-	298	436.9	126	3.02
PRCH-1	5/22/2024	663	-	298			6.686
PRCH-1	5/24/2024	**1145**	-	298			4.248
PRCH-1	5/31/2024	176.4	-	298			3.977
PRCH-1	6/5/2024	835	-	298			3.587
PRCH-1	7/10/2024	248.9	H	298			1.835
PRCH-1	8/6/2024	260.3	H	298			-
PRCH-1	9/4/2024	261.3	H	298			-
PRCH-1	10/2/2024	290.9	H	298			9.212

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

Table 10. Station PRCH-1 *E. coli* Listing Data (2014)

Station ID	Visit Date	*E. coli* (col/100 ml)	*E.coli* dc*	*E. coli* Criterion (col/100 ml)	Flow (cfs)
PRCH-1	3/27/2014	224.7	-	2507	10.0026
PRCH-1	4/17/2014	167	-	2507	19.5912
PRCH-1	5/14/2014	290.9	-	298	15.2788
PRCH-1	6/12/2014	2827.2	-	298	-
PRCH-1	7/17/2014	372	-	298	7.9425
PRCH-1	8/14/2014	344.6	-	298	4.4145
PRCH-1	9/18/2014	238.2	-	298	3.4148
PRCH-1	10/16/2014	866.4	-	298	10.9257

7.3 Panther Creek Photographs

Figure 5. At Station PRCH-1: Upstream View of Panther Creek (10/16/2014)

Figure 6. At Station PRCH-1: Downstream View of Panther Creek (10/16/2014)