Alabama Department of Environmental Management

FINAL

Total Maximum Daily Load (TMDL)
for
Indian Camp Creek

Assessment Unit ID # AL03140201-1001-700 (2008 ID)
Assessment Unit ID # AL03140201-0901-200 (2010 ID)

Pathogens (E. coli)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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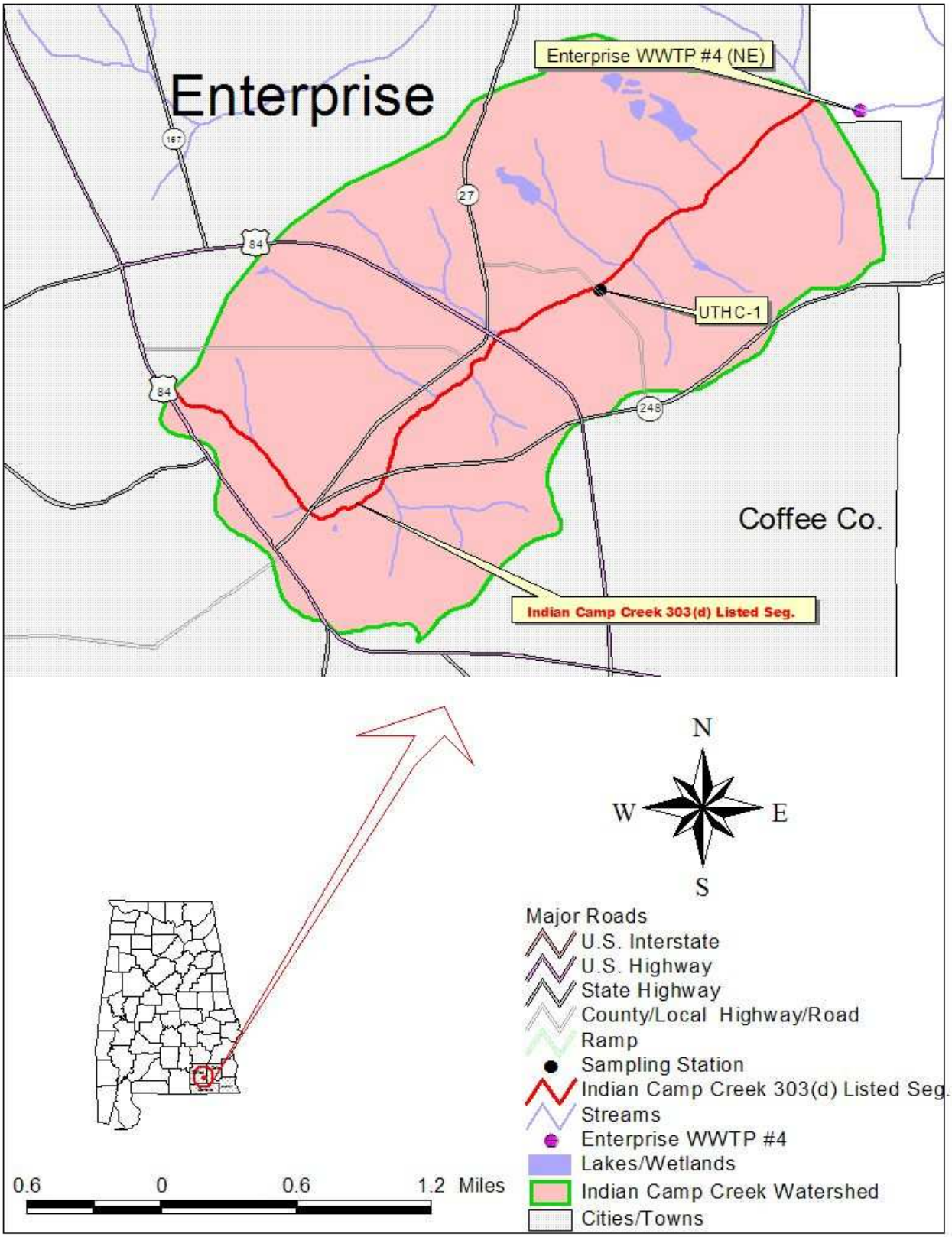
Figure I: Indian Camp Creek Watershed



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

Indian Camp Creek is on the §303(d) list for pathogens from its source to Harrand Creek. Indian Camp Creek forms in Coffee County within the town of Enterprise, in the Choctawhatchee River Basin. It flows through Enterprise and into Harrand Creek on the northeast side of town. The total length of Indian Camp Creek is 3.98 miles, of which all is on the §303(d) list. The total drainage area of the Indian Camp Creek watershed is 4.92 square miles, of which all drains to the impaired segment. Indian Camp Creek has a use classification of Fish & Wildlife (F&W). During the 1998 through 2008 listing cycles, Indian Camp Creek's Assessment Unit ID was AL03140201-1001-700. During development of the 2010 Integrated Report its Assessment Unit ID was revised to AL03140201-0901-200. For purposes of this report and future tracking the new Assessment Unit ID will be used.

Indian Camp Creek was first listed on the §303(d) list in 2006 based on data collected in 1999 and 2004 by the Alabama Department of Environmental Management (ADEM) which indicated the stream was impaired for fecal coliform. The data was collected from station UTHC-1 and can be found in Appendix 7.2, Table 7-1. Indian Camp Creek has subsequently been listed on the 2008 and 2010 §303(d) lists of impaired waterbodies.

In 2008, §303(d) sampling studies were performed by ADEM on Indian Camp Creek to further assess the water quality of the impaired stream. For purposes of this TMDL, the 2008 data will be used to assess the water quality of Indian Camp Creek because it was collected less than six years ago and provides the best picture of the current water quality of the stream. The January 2010 edition of ***Alabama's Water Quality Assessment and Listing Methodology*** section 4.8.2, prepared by ADEM, provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody when that data indicates a change in water quality has occurred. Also, as a result of the Alabama Environmental Management Commission's (EMC) adoption of the Escherichia coli (E. coli) criteria as the new bacterial indicator, this TMDL will be developed from E. coli data collected at station UTHC-1 in 2008; even though the 1999 and 2004 data that prompted the listing of Indian Camp Creek was based on the fecal coliform criteria. The 2008 bacterial data is listed in Appendix 7.2, Table 7-2 for reference. ADEM collected 11 samples from Indian Camp Creek in 2008. According to the data collected in 2008, Indian Camp Creek was not meeting the pathogen criterion applicable to its use classification of Fish and Wildlife. Therefore, a TMDL will be developed for pathogens (E. coli) on the listed reach.

A mass balance approach was used for calculating the pathogen TMDL for Indian Camp Creek. The mass balance approach utilizes the conservation of mass principle. Loads were calculated by multiplying the E. coli concentrations times respective instream flows and a conversion factor.

The mass loading was calculated using the geometric mean sample exceedance with the highest percent reduction (Appendix 7.2, Table 7-2). In the same manner, an allowable load was calculated for the geometric mean E. coli criterion of 126 colonies/100 mL. The TMDL was based on this violation and resulted in a percent reduction of E. coli loading necessary to achieve applicable water quality for the geometric mean criterion.

The existing pathogen loading for this TMDL was calculated using the geometric mean exceedance concentration of 2,087.2 colonies/100 mL from 8/12/2008 through 8/19/2008 times the average flow of the five samples (6.64 cfs) and a conversion factor. The allowable loading, defined by the geometric mean criterion including a margin of safety, was calculated using the same average flow value times the E. coli geometric mean target of 113.4 colonies/100 mL (126 colonies/100 mL – 10% Margin of Safety). The reduction required to meet the allowable loading was then calculated by subtracting the allowable loading from the existing loading.

Table 1-1 is a summary of the estimated existing load, allowable load, and percent reduction for the geometric mean criterion. Table 1-2 provides the details of the TMDL along with the corresponding reductions for Indian Camp Creek which are protective of E. coli water quality standards year round.

Table 1-1. 2008 E. coli Loads and Required Reductions

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
NPS load	3.39E+11	1.84E+10	3.21E+11	95%

Table 1-2. E. coli TMDL for Indian Camp Creek

TMDL	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)
2.05E+10	2.05E+09	NA	NA	0	1.84E+10	95%

a. There are no CAFOs in the Indian Camp Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum; NA = not applicable, no point sources. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. NA = not applicable, no regulated MS4 areas. 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.

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 towards targeting the load reductions to improve water quality in the Indian Camp 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 instream water quality conditions, so that states can establish water-quality based controls to reduce pollution and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified the 3.98 miles of Indian Camp Creek as impaired for pathogens. The §303(d) listing was originally reported on Alabama's 2006 List of Impaired Waters based on ADEM data collected in 1999 and 2004 and subsequently included on the 2008 and 2010 lists. The source of the impairment is listed on the 2010 §303(d) list as urban runoff/storm sewers.

2.2 Problem Definition

Waterbody Impaired:	Indian Camp Creek – From Harrand Creek to its source
Impaired Reach Length:	3.98 miles
Impaired Drainage Area:	4.72 square miles
Water Quality Standard Violation:	Pathogens (geometric mean)
Pollutant of Concern:	Pathogens
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, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food-processing purposes.

(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 and recreation during June through September, 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 places and will be considered satisfactory for swimming and other whole body water-contact sports.

E. coli Criterion:

Criterion for acceptable bacteria levels for the F&W use classification is 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 recreation during June through September, 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 487 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:
Fecal coliform data collected by ADEM Field Operations in 1999 and 2004 was used for listing Indian Camp Creek on Alabama's 2006 §303(d) list. At the time of the listing, the binomial distribution function was employed to calculate the number of exceedances in each range of sample sizes collected over a six year period that exceed the single-sample maximum of 2000 colonies/100 mL. This number is the number of exceedances of the single-sample maximum criterion of 2000 colonies/100 mL for pathogens needed to say with 90% confidence that the criterion is exceeded in more than 10% of the population represented by the available samples. Waters in which samples collected over a six year period exceeding the single-sample maximum of 2000 colonies/100 mL is less than or equal to the allowable exceedances for that sample size or a geometric mean less than or equal to 200 colonies/100 mL (June-September) or 1000 colonies/100 mL (October-May) in at least five samples collected in a thirty day period were considered to comply with Alabama's water quality standard for pathogens. Waters in which the samples collected over a six year period exceeding the single-sample maximum of 2000 colonies/100 mL is greater than the allowable exceedances for that sample size or a geometric mean greater than 200 colonies/100 mL (June-September) or 1000 colonies/100 mL (October-May) in at least five samples collected in a thirty day period were considered impaired and listed for pathogens on Alabama's §303(d) list.

ADEM collected single sample data on Indian Camp Creek at Dixie Road (UTHC-1) in Enterprise, in January 1999 and 2004. According to the 2006 §303(d) list fact sheet, Indian Camp Creek was listed as impaired based on pathogen data collected by ADEM in 1999 and 2004 at station UTHC-1 as part of the §303(d) monitoring program. Of 12 samples collected by ADEM in 1999 and 2004 at station UTHC-1, 4 samples exceeded the 2000 colonies/100 ml single sample criterion for fecal coliform causing the stream to be placed on the list of impaired streams.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

On December 11, 2009, the Alabama 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, the fecal coliform criteria were used by ADEM as the bacterial indicator for freshwater. The E. coli criteria was 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 UTHC-1 in 2008; even though the 1999 and 2004 data that prompted the listing of Indian Camp Creek was based on the fecal coliform criteria.

For the purpose of this TMDL a geometric mean E. coli target of 113.4 colonies/100 mL will be used. 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 (June-September F&W criteria) to be exceeded.

3.2 Source Assessment

3.2.1 Point Sources in the Indian Camp Creek Watershed

A point source can be defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source contributions can typically be attributed to municipal wastewater facilities, illicit discharges, and leaking sewers 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 can typically run parallel to streams in the floodplain. If there is a leaking sewer line, high concentrations of E. coli can flow into the stream or leach into the groundwater. Illicit discharges are found at facilities that are discharging E. coli bacteria when they are not permitted, or they are violating their defined permit limit by exceeding the E. coli concentration.

Continuous Point Sources

There are no point sources in the Indian Camp Creek watershed which would cause or contribute to the E. coli loading. Therefore, the WLA portion of this TMDL is not applicable.

Any future NPDES regulated discharges that are considered by the Department to be a pathogen source will be required to meet the instream water quality criteria for pathogens at the point of discharge.

Non-Continuous Point Sources

Currently there are no Municipal Separate Stormwater Sewer System (MS4) areas located within the Indian Camp Creek watershed.

Also, according to the ADEM database, there have been no reported sanitary sewer overflows (SSOs) that have occurred in the Indian Camp Creek watershed. 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.

Future NPDES regulated stormwater discharges will be required to demonstrate consistency with the assumptions and requirements of this TMDL.

3.2.2 Nonpoint Sources in the Indian Camp Creek Watershed

Nonpoint sources of E. coli bacteria do not have a defined discharge point, but rather, occur over the entire length of a stream or waterbody. On the land surface, E. coli bacteria can accumulate over time in the soil and then are washed off during rain events. As the runoff transports the

sediment over the land surface, more E. coli bacteria are collected and carried to the stream or waterbody. Therefore, there is some net loading of E. coli bacteria into the stream as dictated by the watershed hydrology.

Due to the absence of point sources, nonpoint sources are believed to be the primary source of E. coli bacteria in the Indian Camp Creek watershed. Land use in this watershed is primarily urban, consisting of 60% developed, 24% forested, and 10% agriculture (pasture/hay and row crops).

Agricultural land can be a source of E. coli bacteria. Runoff from pastures, animal feeding areas, improper land application of animal wastes, and animals with direct access to streams are all mechanisms that can contribute E. coli bacteria to waterbodies. To account for the potential influence from animals with direct access to stream reaches in the watershed, E. coli 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 deposit feces onto land surfaces where it can be transported during rainfall events to nearby streams. Control of these sources is usually limited to land management BMPs and may be impracticable in most cases. As a result, forested areas are not specifically targeted in this TMDL.

E. coli loading from urban areas is potentially attributable to multiple sources including storm water runoff, unpermitted discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, and domestic animals. 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. Onsite septic systems have the potential to deliver E. coli bacteria to surface waters due to system failure and malfunction.

3.3 Land Use Assessment

Land use for the Indian Camp Creek watershed was determined using ArcView with land use datasets derived from the 2001 National Land Cover Dataset (NLCD). Figure 3-1 and Table 3-1 display the land use areas for the Indian Camp Creek watershed. Figure 3-2 is a graph depicting the primary land uses in the Indian Camp Creek watershed.

The majority of the Indian Camp Creek watershed is clearly developed accounting for approximately 60% of the watershed. Developed land includes both commercial and residential land uses. Other major land uses include forest which accounts for approximately 24% of the watershed, agriculture which accounts for approximately 10% of the watershed, and shrub/scrub which accounts for approximately 4% of the watershed. If not managed properly, agriculture can have significant nonpoint source impacts. Also, septic systems can be a main source of bacteria if not properly installed and maintained.

Figure 3-1. Land Use Map for the Indian Camp Creek Watershed

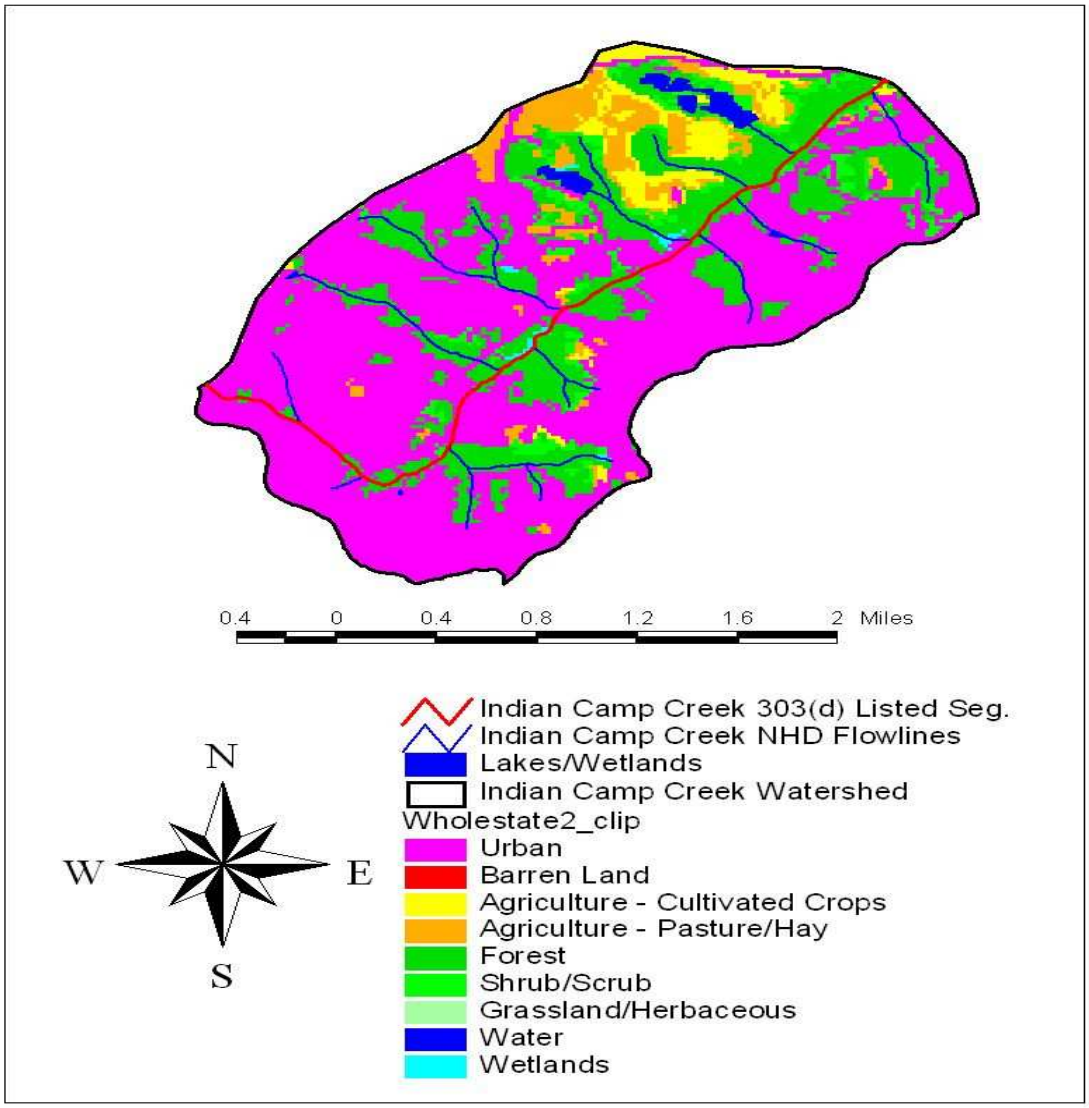
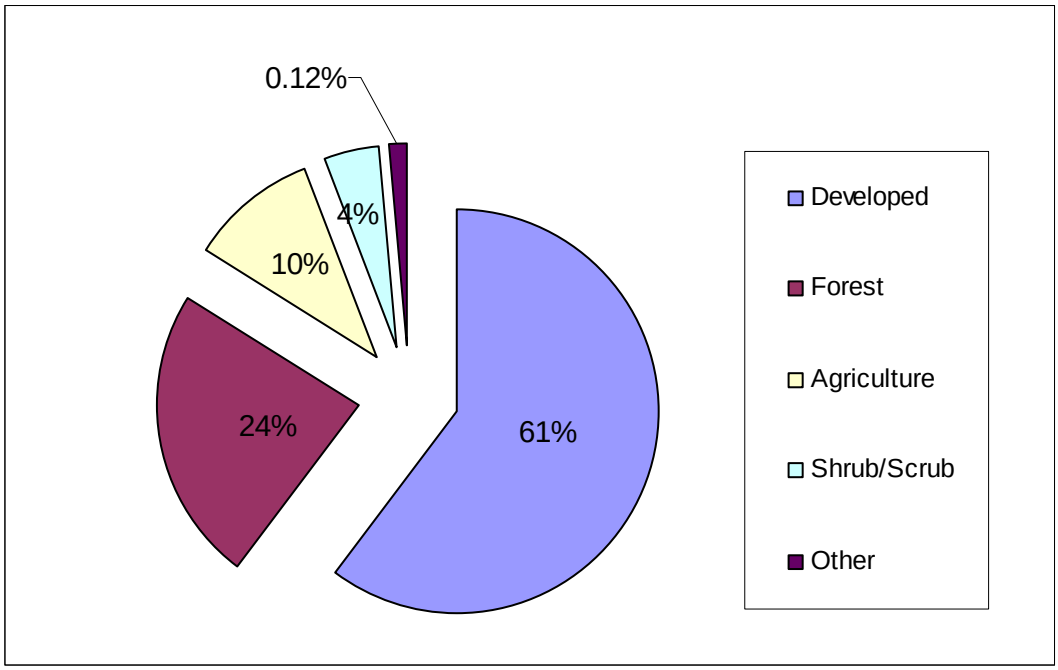


Table 3-1. Land Use Areas for the Indian Camp Creek Watershed

Land Use	Sq. Meters	Acres	Sq. Miles	%
Developed	7,357,500	1,818.08	2.84	60.20%
Forest	2,900,700	716.78	1.12	23.74%
Agriculture	1,260,900	311.58	0.49	10.32%
Shrub/Scrub	533700	131.88	0.21	4.37%
Other	168,300	41.59	0.06	1.38%
Total	**12,221,100**	**3,019.90**	**4.72**	**100.00%**

Figure 3-2. Graph of Primary Landuses in the Indian Camp Creek Watershed



3.4 Linkage Between Numeric Targets and Sources

The Indian Camp Creek watershed has three main landuses, namely developed, forest, and agriculture. 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 Indian Camp Creek are from the agricultural land uses, urban run-off from rain events, unpermitted discharges of wastewater, and failing septic systems. 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

ADEM collected monthly water quality data for Indian Camp Creek at Station UTHC-1 at Dixie Drive. Of the 12 monthly samples that were collected in 1999 and 2004, 4 samples exceeded the 2000 colonies/100 mL single sample criterion for fecal coliform bacteria. Because the F&W fecal coliform single sample criterion was exceeded, Indian Camp Creek was initially placed on the 2006 §303(d) list and subsequently listed on the 2008 and 2010 lists. This data can be viewed in Appendix 7.2, Table 7-1.

In 2008, ADEM again collected water quality data on Indian Camp Creek as part of Alabama's §303(d) Monitoring Program at Station UTHC-1 at Dixie Drive. As previously mentioned, the 2008 data will only be used for this assessment because it is less than 6 years old. The January 2010 edition of ***Alabama's Water Quality Assessment and Listing Methodology*** section 4.8.2 prepared by ADEM provides the rationale for the Department to use the most recent data to prepare a TMDL for an impaired waterbody when that data indicates a change in water quality has occurred. Figure 3-3 and Table 3-2 display location and description for the ADEM sampling station. UTHC-1 is the only ADEM sampling station on Indian Camp Creek and is located off Dixie Drive in the upper portion of the watershed. Of the E. coli samples collected at UTHC-1 in 2008, 11 of them violated the single sample F&W maximum criterion of 487 col/100 mL. Of the samples that qualified for a geometric mean calculation in 2008, two months (8/12/2008 through 8/19/2008 and 6/11/2008 through 6/19/2008) exceeded the E. coli geometric mean criterion of 126 col/100 mL. Flow data was available for both geometric mean sampling events during this time period and averaged to obtain a flow. The geometric mean which gave the highest percent reduction was used in calculating the E. coli loading to Indian Camp Creek (refer to Appendix 7.2, Table 7-2).

Figure 3-3. Map of ADEM Sampling Station on Indian Camp Creek

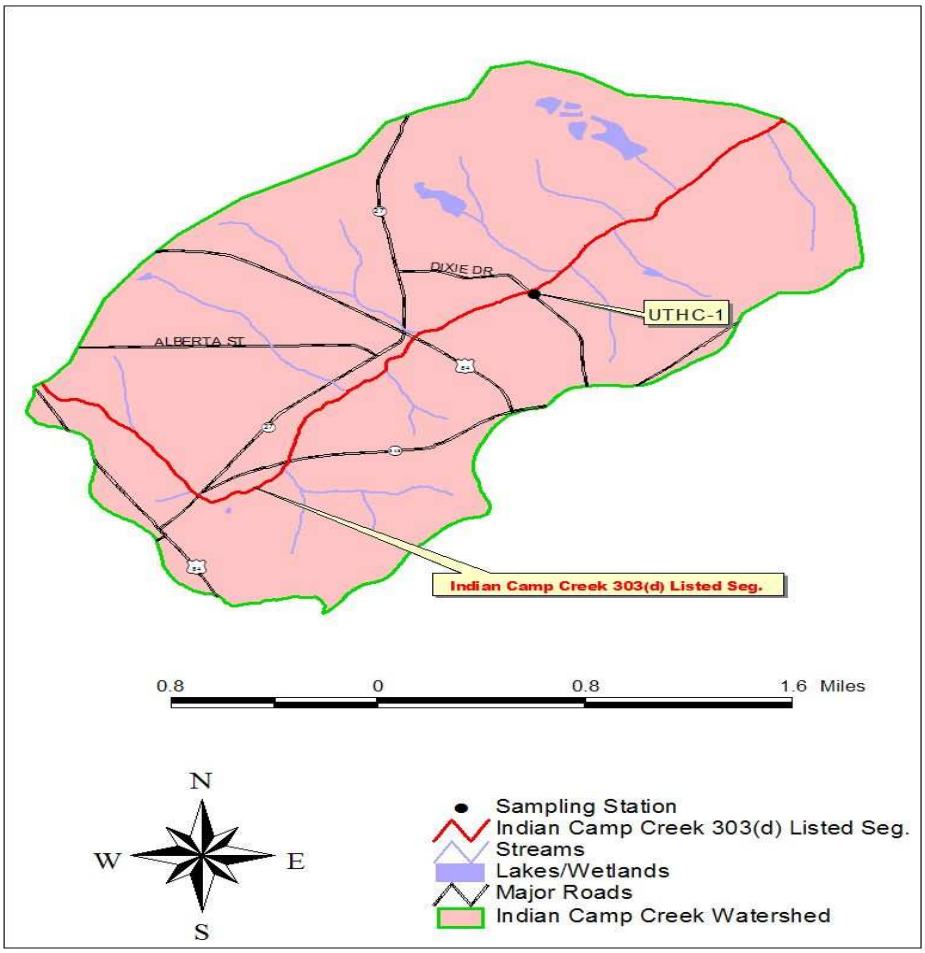


Table 3-2. Indian Camp Creek Sampling Station Description

Years	Station ID	Data Source	Station Location	Latitude	Longitude
1999, 2004, & 2008	UTHC-1	ADEM	Indian Camp Creek @ Dixie Drive approx. 1.3 mi upstream of confluence with Harrand Creek	31.3315	-85.8298

3.6 Critical Conditions

Summer months (June-September) are generally considered critical conditions. 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 E. coli bacteria into streams, resulting in spikes of E. coli bacteria counts. In winter, frequent low intensity rain events are more typical and do not allow for the build-up of E. coli bacteria on the land surface, resulting in a more uniform loading rate.

The impaired portion of the Indian Camp Creek watershed generally follows the trends described above for the summer months of June through September. The critical condition for this pathogen TMDL was taken to be the one with the highest E. coli geometric mean exceedance value. That value was 2087.2 colonies/100 mL and occurred in August of 2008 at station UTHC-1. An average flow measurement of 6.64 cfs was obtained during these five (5) sampling events.

3.7 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: 1) implicitly incorporate 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 was incorporated into this TMDL. The MOS accounts for the uncertainty associated with the limited availability of E. coli data used in this analysis. An explicit MOS was applied to the TMDL by reducing the E. coli target geometric mean criterion concentration by ten percent and calculating a mass loading target with measured flow data. The geometric mean criterion was reduced by ten percent to achieve a target concentration of 113.4 colonies/100 mL. An implicit MOS was 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 wasteload allocations for point sources (WLAs), 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 pathogen TMDL for Indian Camp 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 instream flow times and a conversion factor. The existing load was calculated for the violation in 2008 that gave the highest percent reduction. This violation was a geometric mean exceedance. In the same manner, the allowable load was calculated for the geometric mean criterion of 126 colonies/100 mL. Although there were multiple single-sample and geometric mean violations in 2008, the TMDL was based on the highest calculated E. coli load percent reduction to achieve applicable water quality criteria.

Existing Conditions

The **geometric mean** mass loading was calculated by multiplying the geometric mean exceedance concentration of 2087.2 colonies/100 ml times the average flow of the five samples. This concentration was calculated based on measurements at UTHC-1 between August 12 and August 19, 2008, and can be found in Table 7-2, Appendix 7.2. The average stream flow was determined to be 6.64 cfs. The product of these two values times the conversion factor gives the total mass loading (colonies per day) of E. coli to Indian Camp Creek under the geometric mean exceedance condition.

$$\frac{6.64\,\text{ft}^3}{\text{s}} \times \frac{2087.2\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\ \ 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.39 \times 10^{11}\ \text{colonies}}{\text{day}}$$

Allowable Conditions

The **allowable load** to the watershed was calculated under the same physical conditions as discussed above for the geometric mean criterion. This is done by taking the product of the average flow used for the violation event times the conversion factor times the allowable concentration.

For the **geometric mean** E. coli concentration of 113.4 colonies/100 mL. The allowable E. coli loading is:

$$\frac{6.64\ \text{ft}^3}{\text{s}} \times \frac{113.4\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{1.84 \times 10^{10}\ \text{colonies}}{\text{day}}$$

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

$$\frac{6.64\,\text{ft}^3}{\text{s}} \times \frac{12.6\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{2.05 \times 10^{9}\ \text{colonies}}{\text{day}}$$

The difference in the pathogen loading between the existing condition (violation event) and the allowable condition converted to a percent reduction represents the total load reduction needed to achieve the E. coli water quality criterion. The TMDL was calculated as the total daily E. coli load to Indian Camp Creek as evaluated at station UTHC-1. Table 4-1 shows the result of the E. coli TMDL and percent reduction for the geometric mean criterion.

Table 4-1. 2008 E. coli Load and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
NPS load	3.39E+11	1.84E+10	3.21E+11	95%

From Table 4-1, compliance with the geometric mean criterion of 126 colonies/100 mL requires a reduction in the E. coli load of 95%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable E. coli criterion are provided in Table 4-2 below.

Table 4-2. E. coli TMDL for Indian Camp Creek

TMDL	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)
2.05E+10	2.05E+09	NA	NA	0	1.84E+10	95%

a. There are no CAFOs in the Indian Camp Creek watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs are expressed as a daily maximum; NA = not applicable, no point sources. Future WWTPs must meet the applicable instream water quality criteria for pathogens at the point of discharge.
c. NA = not applicable, no regulated MS4 areas. 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.

4.3 TMDL Summary

Indian Camp Creek was placed on Alabama's §303(d) list in 2006 based on data collected by ADEM in 1999 and 2004. In 2008, ADEM collected additional water quality data 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 Indian Camp Creek. 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 towards targeting the load reductions to improve water quality in the Indian Camp 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 management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, ADEM's water quality resources are concentrated in one of the five basin groups. One goal is to continue to monitor §303(d) listed waters. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed. This monitoring will occur in each basin according the schedule shown.

Table 5-1. 303(d) Follow Up Monitoring Schedule

River Basin Group	Year to be Monitored
Alabama / Coosa / Tallapoosa	2010
Escatawpa / Mobile / Lower Tombigbee / Upper Tombigbee	2011
Black Warrior/Cahaba	2012
Chattahoochee / Chipola / Choctawhatchee / Perdido-Escambia	2013
Tennessee	2014

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 was made available on ADEM's Website: www.adem.state.al.us. The public can also request paper or electronic copies of the TMDL by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. 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 finalization of this TMDL and subsequent submission to EPA Region 4 for final review and approval.

7.0 Appendices

Appendix 7.1
References

ADEM Administrative Code, 2010. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2010. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

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Alabama Department of Environmental Management (ADEM) Laboratory QA Manual, Chapter 5, Table 5-2: ADEM Laboratory Qualifier Codes and, June 13, 2005.

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

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Appendix 7.2
Water Quality Data

Table 7-1. ADEM Pathogen Data Collected on Indian Camp Creek (1999, 2004)

Station ID	Date	Stream Flow (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor	Single Sample Exceedance
UTHC-1	10/19/2004		3700	GH	3700
UTHC-1	9/13/2004		1800	H	
UTHC-1	8/31/2004	1.5	2300		2300
UTHC-1	7/7/2004	2.2	2700	G	2700
UTHC-1	6/3/2004		13500	G	13500
UTHC-1	5/12/2004	2.5	1500		
UTHC-1	4/14/2004		170		
UTHC-1	3/23/2004	2.2	420	H	
UTHC-1	8/5/1999	1.7	600	G	
UTHC-1	7/22/1999		600	G	
UTHC-1	6/9/1999	0.2	240		
UTHC-1	6/1/1999	2.1			
UTHC-1	5/20/1999	2.2	600	G	

G = The analyte is present, but the amount of the analyte is determined to be above an acceptable level for quantitation. QC measurements indicate a low bias for the sample result reported or an accurate result cannot be calculated, but is determined to be greater than the value given (Micro: The actual number was greater than the number reported)

H = The analytical holding times for analysis are exceeded.

Table 7-2. 2008 ADEM Pathogen Data with Percent Reductions Collected from Indian Camp Creek

Station ID	Date	Stream Flow (cfs)	Fecal Coliform (col/100ml)	Fecal Coliform oor	E coli (col/100ml)	E coli oor	Geometric Mean Exceedance	Single Sample Exceedance	Geomean Percent Reduction	Single Sample Percent Reduction
UTHC-1	11/12/2008	1.22								
UTHC-1	10/9/2008	3.17								
UTHC-1	9/10/2008	1.22	100	JH	770.1	H		770.1		43%
UTHC-1	8/19/2008	1.70	1800		1553.1		2087.2	1553.1	95%	72%
UTHC-1	8/18/2008	2.00	5200		>2419.6	G		2419.6		82%
UTHC-1	8/14/2008	2.40	7600		2419.6			2419.6		82%
UTHC-1	8/13/2008	24.70	20000	G	>2419.6	G		2419.6		82%
UTHC-1	8/12/2008	2.40	5100		2419.6			2419.6		82%
UTHC-1	7/8/2008		410	H	387.3	H				
UTHC-1	7/7/2008	1.10								
UTHC-1	6/19/2008	1.10	230		579.4		808.3	579.4	86%	24%
UTHC-1	6/18/2008	1.30	1100		1203.3			1203.3		64%
UTHC-1	6/17/2008	1.40	1500		816.4			816.4		46%
UTHC-1	6/16/2008	1.50	930		579.4			579.4		24%
UTHC-1	6/11/2008	2.00	1200	G	1046.2			1046.2		58%
UTHC-1	5/7/2008	1.15	320	H	387.3	H				
UTHC-1	4/9/2008	7.90								

G = The analyte is present, but the amount of the analyte is determined to be above an acceptable level for quantitation. QC measurements indicate a low bias for the sample result reported or an accurate result cannot be calculated, but is determined to be greater than the value given (Micro: The actual number was greater than the number reported)

H = The analytical holding times for analysis are exceeded.

JH = The identification of the analyte is acceptable; the reported value is an estimate. J must always be accompanied by at least one other qualifier (e.g. JH).