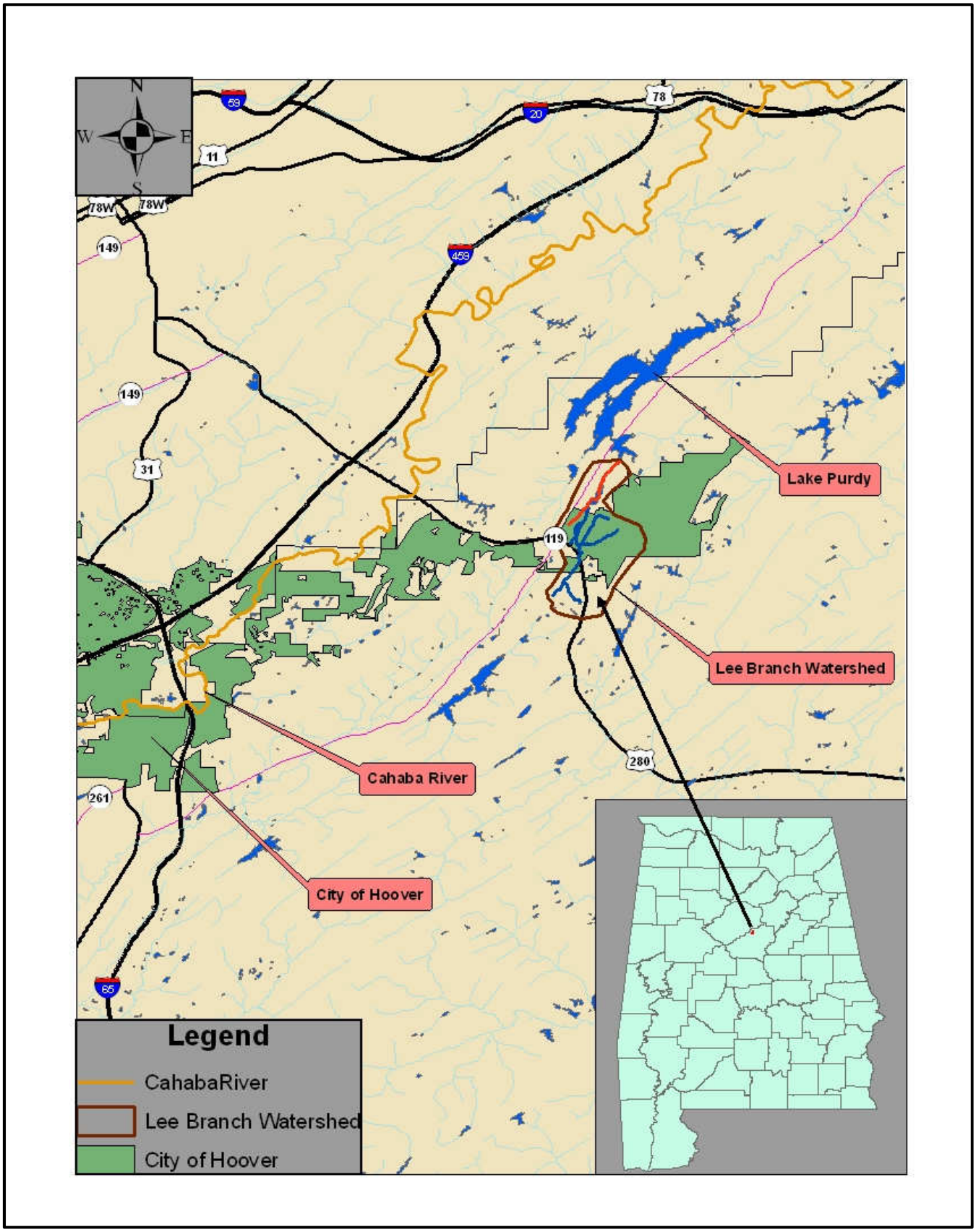
Final

Total Maximum Daily Load (TMDL)
for
Lee Branch
Assessment Unit ID # AL03150202-0103-300
Pathogens (E. coli)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
September 2011

Figure I. Site Map of the Lee Branch Watershed



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1.0 Executive Summary

Section (§) 303(d) of the Clean Water Act (CWA) and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for waterbodies that are not meeting designated uses under technology-based pollution controls. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting water quality standards for the pollutant of concern. All TMDLs include a wasteload allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES) regulated discharges, a load allocation (LA) for all nonpoint sources, and an explicit and/or implicit margin of safety (MOS).

Lee Branch is a small waterbody that feeds into Lake Purdy in northern Shelby County. Lake Purdy is a part of the upper Little Cahaba River Basin (there is also a lower Little Cahaba River Basin in Bibb County) and provides drinking water for the greater Birmingham area. Lee Branch has a length of 2.87 miles and a drainage area of 3.06 square miles. It has a use classification of Fish & Wildlife (F&W). The watershed is a part of two Phase I municipal separate storm sewer systems (MS4s), namely Jefferson (Birmingham) and Shelby County.

Lee Branch was first placed on the State's §303(d) list for pathogens in 2000 as a result of fecal coliform data collected by the United States Geological Survey (USGS) from 1996 through 1999. Subsequent data collected by ADEM in 2009 has confirmed the impairment.

Pathogen loadings are calculated as the product of concentration times flow times an appropriate conversion factor. The highest load reduction to the watershed is employed for the TMDL, the rationale being that if the watershed can meet pathogen criteria under the highest load conditions, it should be able to meet the criteria under any other conditions. The highest E. coli value measured from field data was the single sample value of 1203 colonies/100 mL at station LEBS-2 on September 28, 2009. Measured flow (i.e., the critical flow) on the same day was 8.42 cubic feet per second (cfs). The allowable concentration is equal to the water quality criterion minus a 10% MOS. The E. coli single sample summer water quality criterion is 487 colonies/100 mL for waterbodies classified as F&W. Incorporating a 10% MOS results in an allowable pathogen concentration of 438 colonies/100 mL. Shown in Table 1-1 below are the existing conditions and required load reduction for E. coli within the Lee Branch watershed.

For comparison purposes, the highest load reduction employing the geometric mean criterion was also calculated. That value was 59% as measured at station LEBS-4 for the time frame from September 1 through September 28, 2009 (see Table 7-6 in Appendix 7.2).

Table 1-1. 2009 E. coli Loads and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction (%)
NPS load	2.48×10^{11}	9.03×10^{10}	1.58×10^{11}	64
Point Source	0	0	0	0

Shown in Table 1-2 below are the required TMDL pathogen loads under critical conditions for Lee Branch.

Table 1-2. E. coli TMDL for Lee Branch

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation(LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(cols/day)	(cols/day)	(cols/day)	(% reduction)	(cols/day)	(cols/day)	(% reduction)
$1.00x10^{11}$	$1.00x10^{10}$	NA	64	0	$9.03x10^{10}$	64

Note: NA = Not applicable. Cols=colonies.

a. There are no CAFOs in the Lee Branch watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs expressed as E. coli loads (colonies/day). Future WWTPs must meet instream water quality criteria at the point of discharge as specified in their NPDES permits**.**
c. Applies to all regulated MS4s located in the Lee Branch watershed, both current and future.
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 487 colonies/100ml.

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 are eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria with a commitment to targeting the necessary load reductions to improve water quality in the Lee Branch watershed. As additional data and/or information becomes 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 (CWA) as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)] require states to identify waterbodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters 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 from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified Lee Branch as being impaired by pathogens (E. coli). The §303(d) listing was originally reported on Alabama's 2000 List of Impaired Waters. The sources of the impairment are listed as urban runoff and storm sewers.

2.2 Problem Definition

Waterbody Impaired:	Lee Branch from Lake Purdy to its source
Waterbody Length:	2.87 miles
Waterbody Drainage Area:	3.06 square miles
Water Quality Standard Violation:	E. coli (single sample) E. coli (geometric mean)
Pollutant of Concern:	Pathogens (E. coli)
Water Use Classification:	Fish and Wildlife

Usage Related to Classification:
The impaired segment of Lee Branch is 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, 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 Criteria:
Criteria for acceptable bacteria levels for the Fish and Wildlife use classification are described in ADEM Admin. Code R. 335-6-10-.09(5)(e)7(i) and (ii) as follows:

7. Bacteria:

(i) In non-coastal waters, bacteria of the E. coli group shall not exceed a geometric mean of 548 colonies/100 ml; nor exceed a maximum of 2,507 colonies/100 ml in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours.

(ii) For incidental water contact and 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 periodat 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:
Water quality data collected by the USGS from 1996 through 1999 was used for listing Lee Branch on Alabama's 2000 §303(d) list. At the time of the listing, fecal coliform was the accepted pathogen indicator. Waters in which less than or equal to 10% of the samples collected over a five year period exceeded the single-sample maximum of 2000 colonies/100 mL were

considered to comply with Alabama's water quality standard for fecal coliform bacteria. Geometric mean samples comprised of at least 5 samples collected over a thirty day period that were reported less than or equal to 200 colonies/100 mL (June-September) or 1000 colonies/100 mL (October-May) were considered to comply with Alabama's water quality standard for fecal coliform bacteria. Waters in which greater than 10% of the samples exceeded the single-sample maximum criterion of 2000 colonies/100 mL or any geometric mean sample that exceeded the geometric mean criterion of 200 colonies/100 mL (June-September) or 1000 colonies/100 mL (October-May) were considered impaired and subsequently listed for pathogens (fecal coliform) on Alabama's §303(d) list. It should be noted that the Environmental Management Commission (EMC) of ADEM adopted E. coli as the new pathogen water quality criterion for freshwater in Alabama on December 11, 2009.

The USGS fecal data was collected on Lee Branch near Cahaba Heights (#0242340575). Of 13 samples collected, four exceeded the single sample maximum fecal criterion of 2,000 colonies/100 mL.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

For the purpose of this TMDL, a single sample E. coli target of 438 colonies/100 mL will be used. This target was derived by using a 10% explicit margin of safety for the single sample summer criterion of 487 colonies/100 mL.

3.2 Source Assessment

3.2.1 Point Sources in the Lee Branch Watershed

Continuous Point Sources

There are no continuous NPDES discharges located in the Lee Branch watershed. However, 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

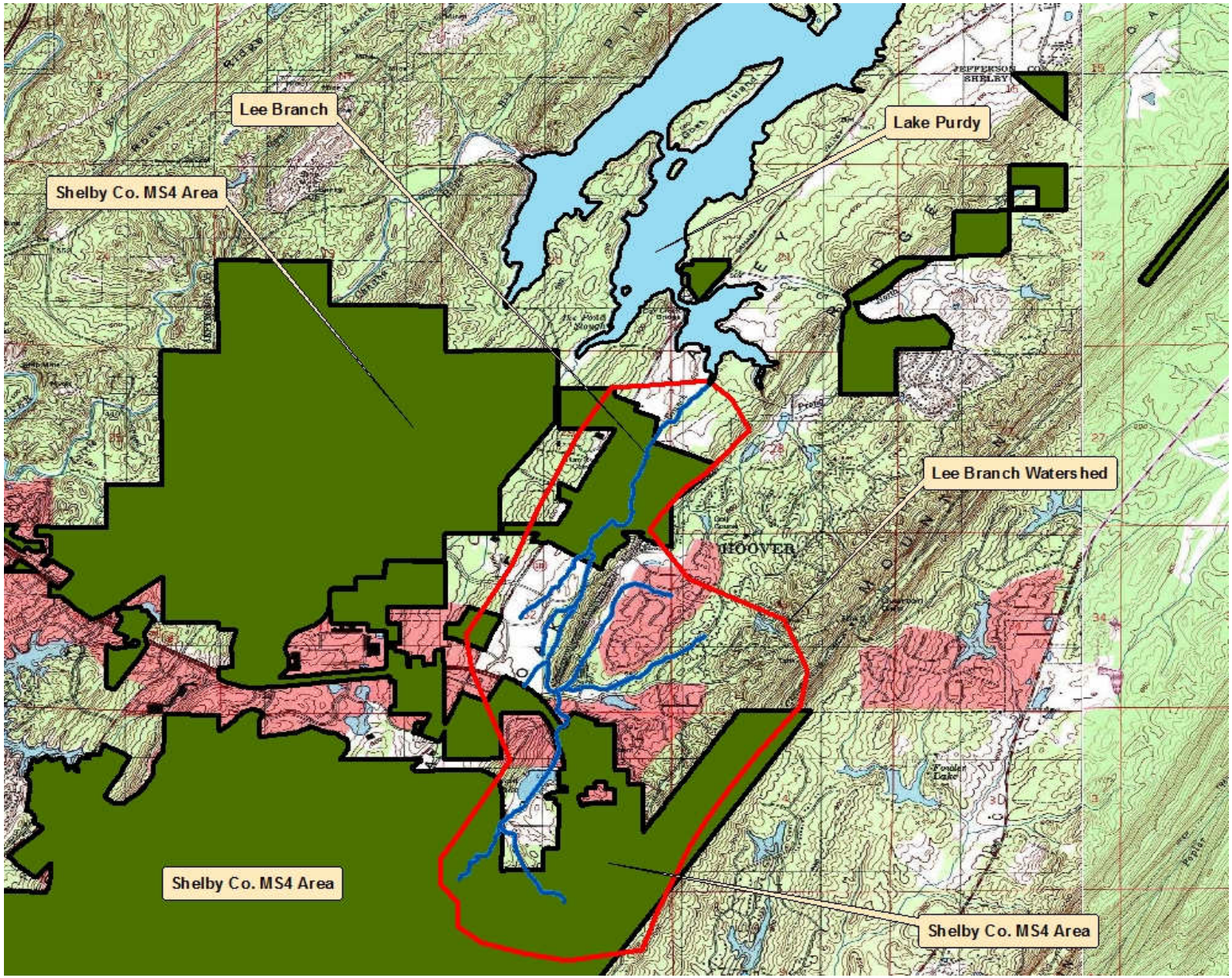
The Lee Branch watershed lies within two permitted MS4 areas. The first area belongs to Jefferson County which includes Hoover and Birmingham as well as numerous other co-permittees. Its NPDES number is ALS000001. The second area belongs to Shelby County along with seven co-permittees. The permit number is ALS000003. MS4 areas are addressed in the TMDL as part of the WLA component. Figure 3-1 shows the Lee Branch watershed within the two MS4 areas. The dark green, black-outlined polygons in the watershed represents Shelby County's MS4 coverage. The rest of the watershed is a part of Jefferson County's MS4 area which includes the cities of Hoover and Birmingham.

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. There has been one reported SSO in the Lee Branch watershed. It was reported by the City of Hoover. It occurred in September 2010 at a pump station at the Lee Branch Shopping Center.

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

Figure 3-1. MS4 Areas in the Lee Branch Watershed



3.2.2 Nonpoint Sources in the Lee Branch 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 dictated by the watershed hydrology.

Agricultural land can be a source of E. coli bacteria. Runoff from pastures, confined animal feeding operations (CAFOs), 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, turkeys, beaver, and waterfowl. 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.

A site visit was made to the Lee Branch watershed on December 3, 2010. Based upon observations during the visit, wildlife (particularly a year-round geese population) appears to be plentiful in the watershed. Appendix 7.3 is a compilation of photographs taken during the visit.

E. coli loading from urban areas is potentially attributable to multiple sources including storm water runoff, illicit discharges of wastewater, runoff from improper disposal of waste materials, failing septic tanks, sewer overflows due to I&I (infiltration and inflow) 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 Landuse Assessment

Lee Branch is a part of the upper Little Cahaba River watershed. The 12-digit hydrologic unit code (HUC) for the upper Little Cahaba River watershed is 031502020103. Table 3-1 provides landuse in the Lee Branch watershed and its respective percentages. Landuse for the Lee Branch watershed was determined using ArcMap 10 with landuse information derived from the 2006 National Land Cover Dataset (NLCD). Figure 3-2 is a map of landuse within the watershed.

As can be seen from the landuse table, most of the land in the watershed consists of forest and developed land. Developed land includes both commercial and residential tracts. The NLCD is based upon 2006 data. There has been considerable growth in the area since 2006. Based upon site visit observations, it is probably not unreasonable to estimate developed land in the watershed to be currently on the order of two-thirds of the total area – i.e., approximately 67% of the watershed. This is further substantiated by the following quote taken from Shelby County's

web site concerning county demographics: "Over the last decade Shelby County's population has increased by more than 4,000 people every year, making it Alabama's fastest growing county and among the fastest growing in the United States. With a 2007 population estimate of 182,113, Shelby County's population has increased 83% since 1990." A population density map of the watershed, based upon 2000 U.S. Census data, is shown in Figure 3-3. A link to Shelby County's web site for demographics is provided in Appendix 7-1. An aerial map of the watershed is shown in Figure 3-4. The aerial map reflects imagery data from ESRI's ArcGIS web site. Data from this site was last modified May 21, 2010. A link to ESRI's web site is also provided in Appendix 7-1. ESRI is an acronym for Environmental Systems Research Institute.

Table 3-1. 2006 Landuse in the Lee Branch Watershed

Class Description	Count (30m)	mi²	Acres	Percent
Emergent Herbaceuous Wetlands		0.00	0.00	0.00%
Open Water	65	0.02	14.46	0.74%
Barren Land	84	0.03	18.68	0.95%
Woody Wetlands	26	0.01	5.78	0.30%
Herbaceuous	153	0.05	34.03	1.74%
Hay/Pasture	266	0.09	59.16	3.02%
Developed, High Intensity	233	0.08	51.82	2.65%
Evergreen Forest	462	0.16	102.75	5.24%
Shrub/Scrub	75	0.03	16.68	0.85%
Cultivated Crops	63	0.02	14.01	0.72%
Mixed Forest	70	0.02	15.57	0.79%
Deciduous Forest	1815	0.63	403.65	20.60%
Developed, Medium Intensity	944	0.33	209.94	10.72%
Developed, Low Intensity	2475	0.86	550.43	28.10%
Developed, Open Space	2078	0.72	462.14	23.59%
TOTALS →	**8809**	**3.06**	**1959.08**	**100.00%**
Aggregate Landuse				
Class Description	**Count (30m)**	**Mi²**	**Acres**	**Percent**
Open Water	65	0.02	14.46	0.74%
Agricultural Lands	329	0.11	73.17	3.73%
Forested / Natural	2685	0.93	597.13	30.48%
Developed Land (Grouped)	5730	1.99	1274.32	65.05%
TOTALS →	**8809**	**3.06**	**1959.08**	**100.00%**

Figure 3-2. Landuse Map of the Lee Branch Watershed

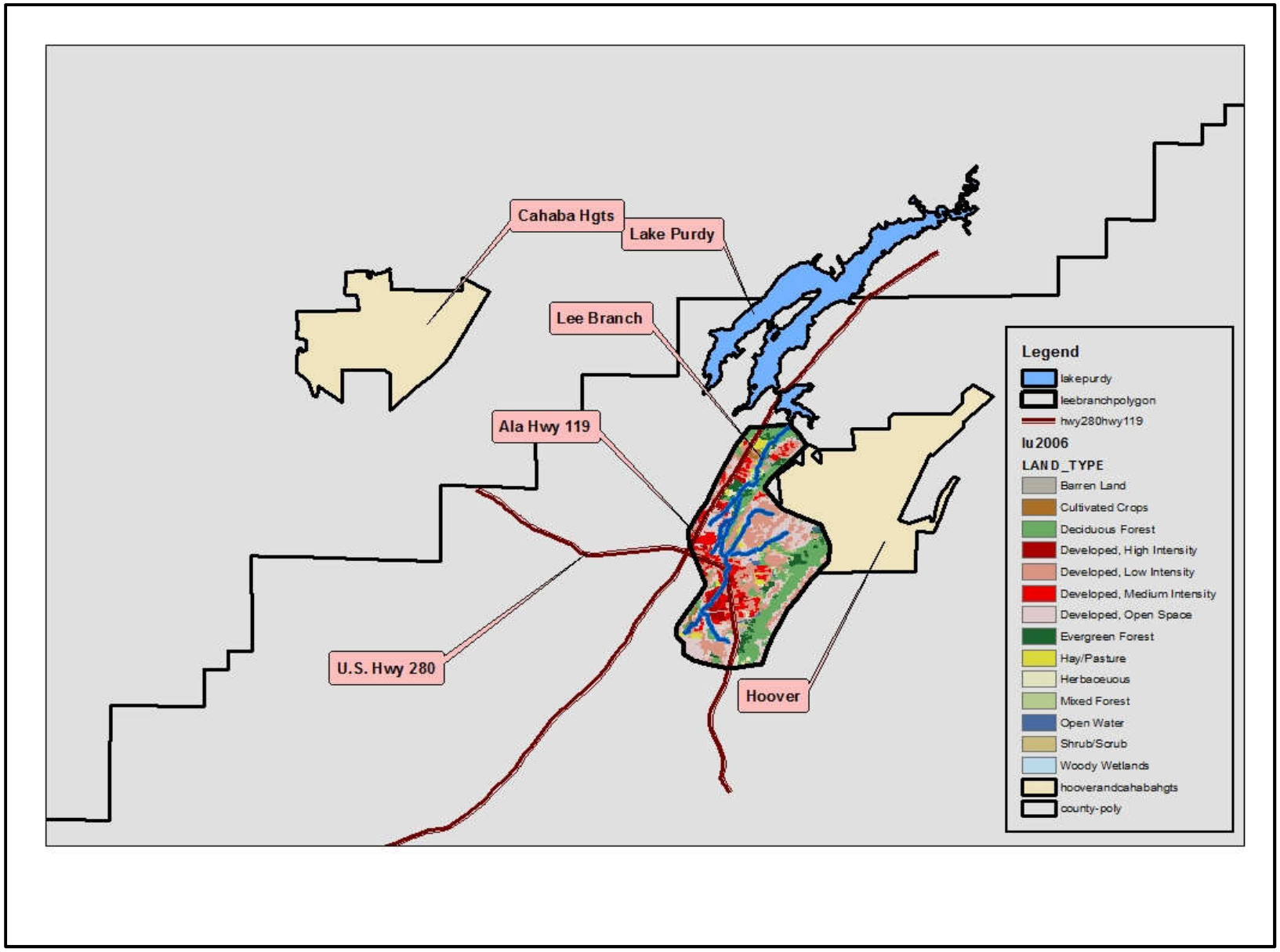


Figure 3-3. 2000 Population Density Map of the Lee Branch Watershed

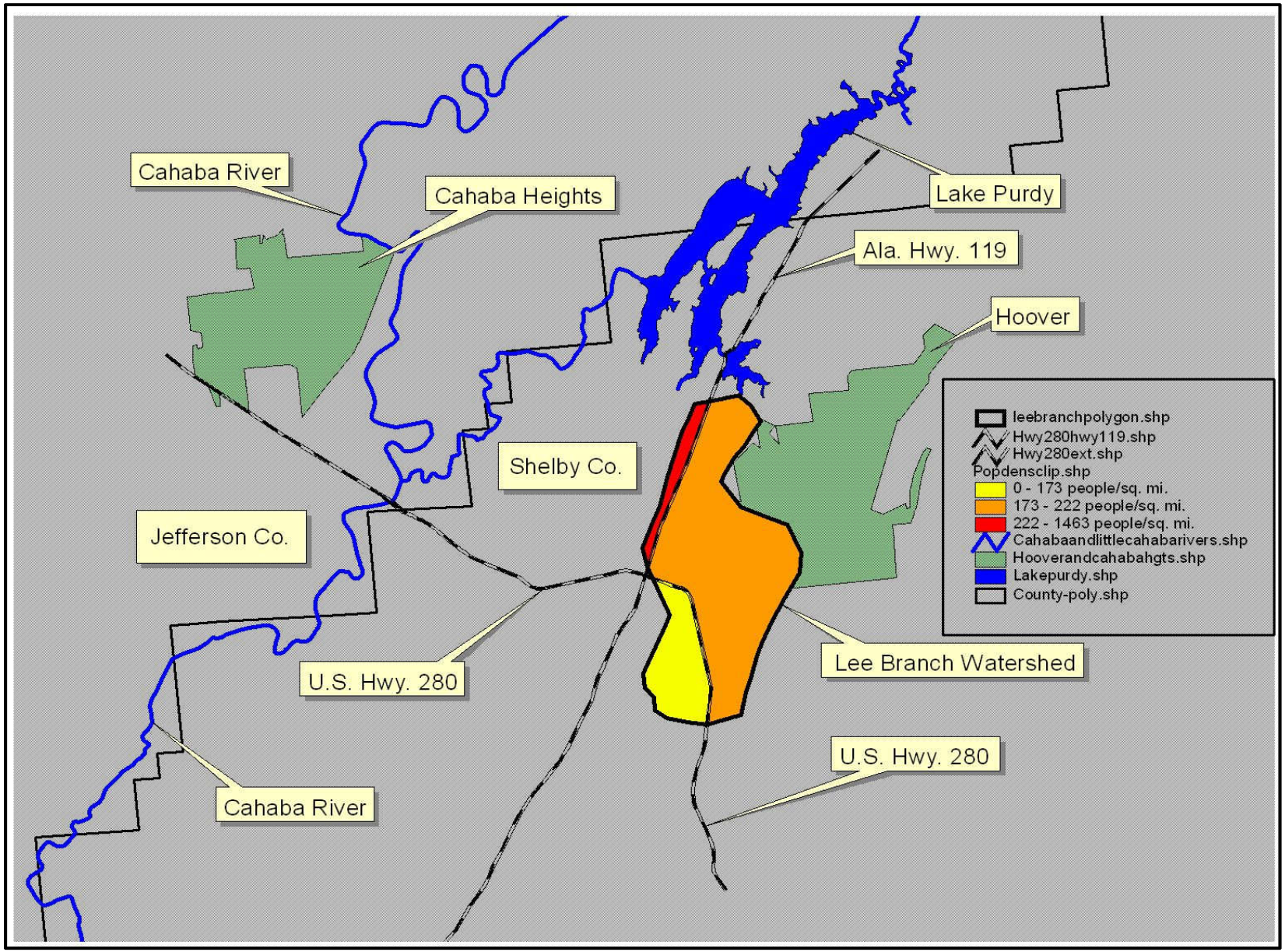
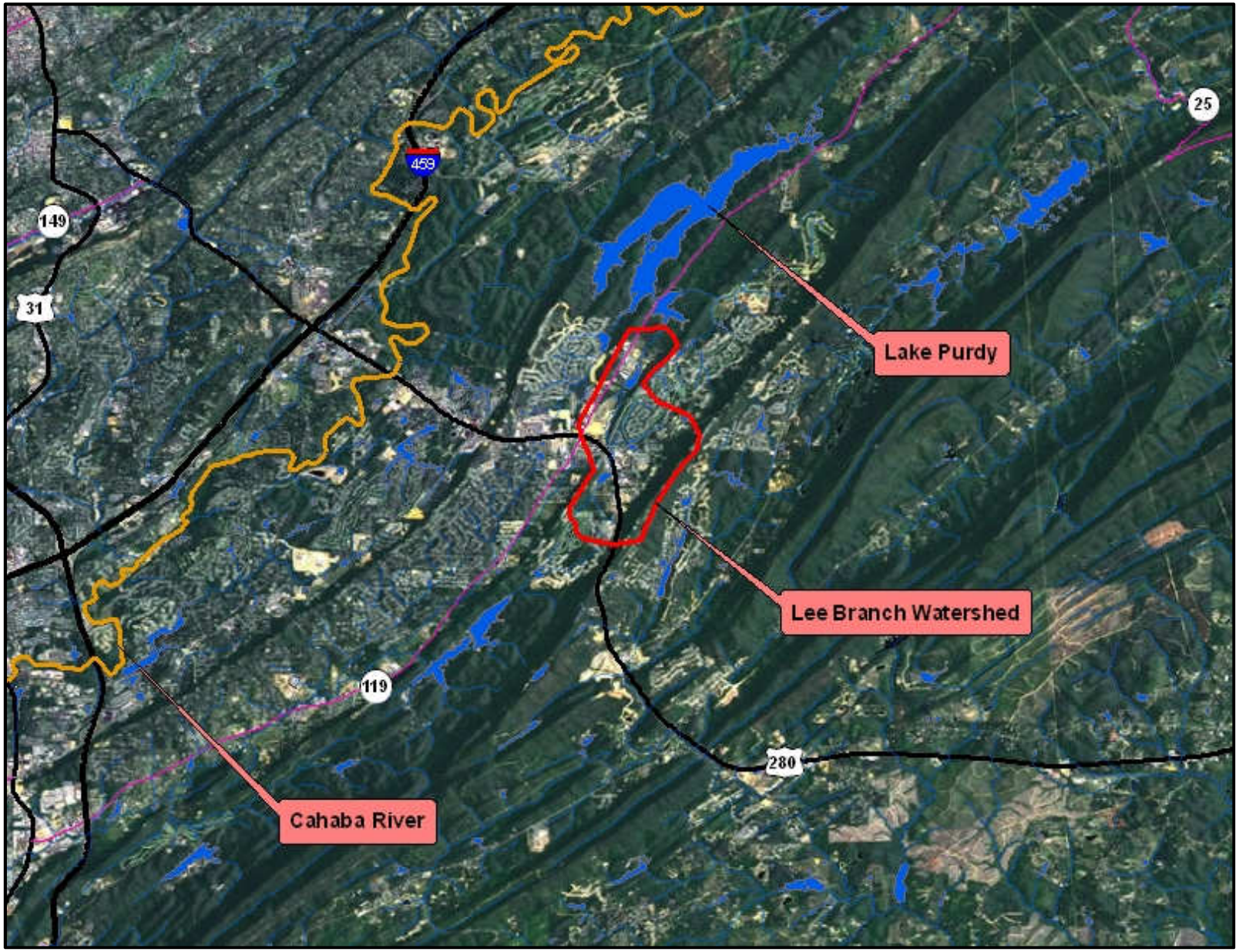


Figure 3-4. Aerial Map of the Lee Branch Watershed



3.4 Linkage Between Numeric Targets and Sources

The Lee Branch watershed is highly developed. Most of the remaining landuse is forest. E. coli loads from forests and wetlands tend to be low due to their filtering capabilities and are considered as natural or background conditions with respect to pollutant sources. It is believed that the most likely sources of pathogens in Lee Branch are from domestic animals and other wildlife within the watershed.

It is not considered practical to calculate individual components for nonpoint source loadings. Hence, there will not be individual loads or reductions calculated for different nonpoint sources such as commercial and residential land uses. The loadings and reductions will only be calculated as a single total nonpoint source load and reduction.

3.5 Data Availability and Analysis

Water quality data collected by the USGS from 1996 through 1999 was used for listing Lee Branch on Alabama's 2000 §303(d) list of impaired waters. The USGS fecal data was collected on Lee Branch near Cahaba Heights (#0242340575). Of 13 samples collected, four exceeded the single sample maximum fecal criterion of 2,000 colonies/100 mL. The USGS pathogen data used for the original listing can be found in Appendix 7.2.

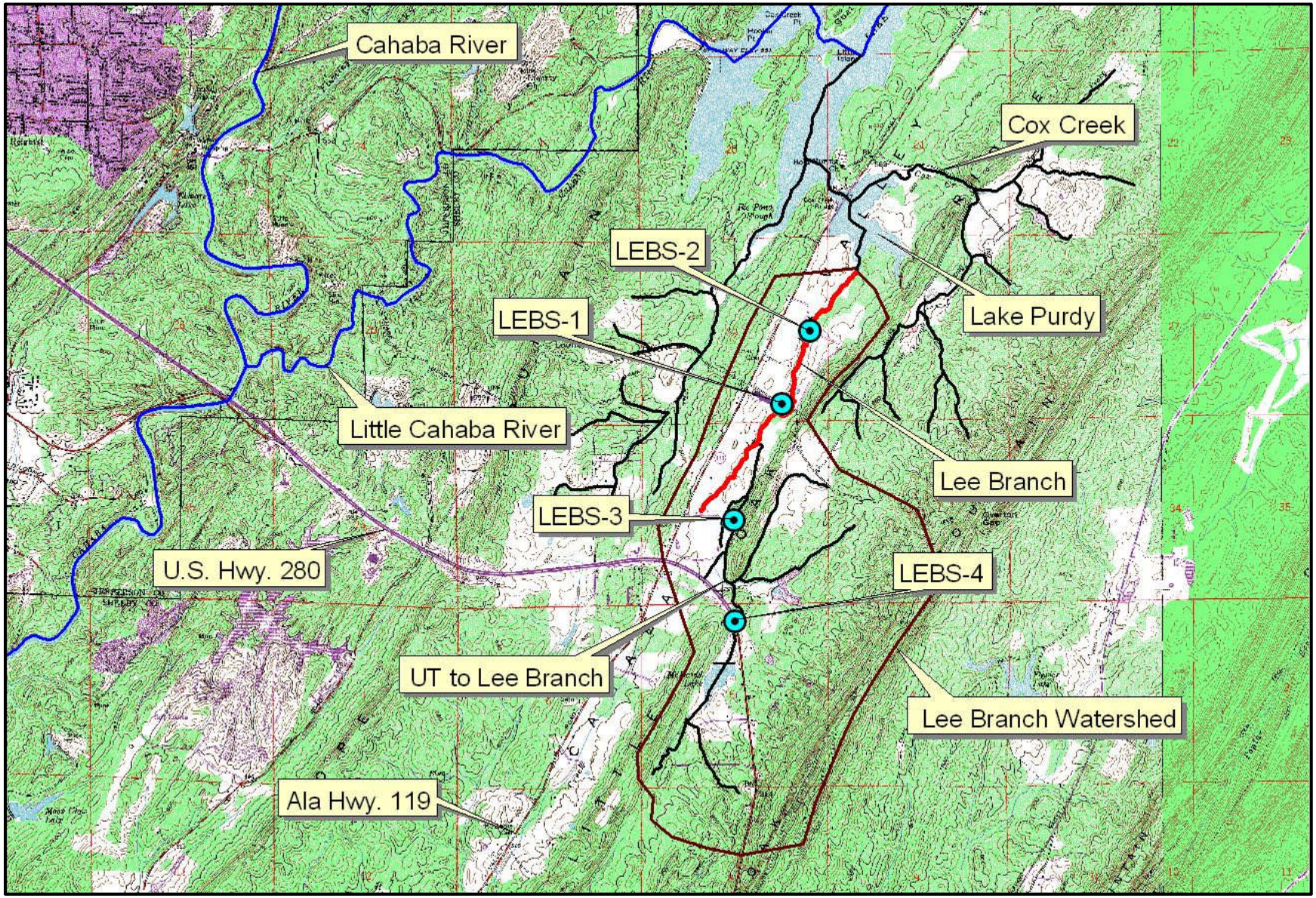
Since the original listing, ADEM has collected E. coli data at four stations in the watershed in 2009. Each station had exceedances of both the geometric mean and the single sample criteria for E. coli. Geometric mean criteria for F&W waterbodies is as follows: 126 colonies/100 mL and 548 colonies/100 mL, respectively, for summer and winter. Single sample criteria for F&W waterbodies are 487 and 2507 colonies/100 mL, respectively, for summer and winter. Summer is defined as the time frame from June through September and winter is defined as October through May. ADEM data can be found in Appendix 7.2. Table 3-2 shows location descriptions for ADEM's 2009 sampling stations. Figure 3-5 is a map of the station locations. It should be noted that USGS station 0242340575 is the same as ADEM station LEBS-1.

ADEM also collected fecal data at station LEBS-1 in 2003 and 2004. However, this data cannot be employed for assessment purposes because fecal coliform is no longer the applicable pathogen indicator. The data can be found in Appendix 7.2.

Table 3-2. ADEM Sampling Stations in the Lee Branch Watershed

Station ID	Location Description	Latitude	Longitude
LEBS-1	Lee Branch approximately 0.1 mile southeast of Ala. Hwy. 119 in SE 1/4, Sec 29, T18S, R1W.	33.43161	-86.66092
LEBS-2	Lee Branch approximately 0.2 mile southeast of Ala. Hwy. 119 in E 1/2, Sec 29, T18S, R1W.	33.4371	-86.65831
LEBS-3	UT to Lee Branch at Greystone Way. NE 1/4, Sec 32, T18S, R1W.	33.42499	-86.66381
LEBS-4	UT to Lee Branch just downstream of U.S. Hwy. 280. N 1/2, Sec 5, T19S, R1W.	33.41573	-86.66582

Figure 3-5. Map of Lee Branch Sampling Station Locations



3.6 Critical Conditions

Critical conditions typically occur during the summer months. This can be explained by the nature of storm events in the summer versus the winter. Periods of dry weather interspersed with thunderstorms allow for the accumulation and washing off of E. coli bacteria into streams, resulting in spikes in 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. Also, the summer E. coli criterion is more stringent than the winter criterion.

The highest load reduction to the watershed is employed for the TMDL, as this can be considered the critical condition. The highest E. coli value measured from field data was 1203 colonies/100 mL at station LEBS-2 on September 28, 2009. The allowable concentration is equal to the water quality criterion minus a 10% MOS. The E. coli single sample summer water quality criterion is 487 colonies/100 mL for F&W waterbodies. Incorporating a 10% MOS results in an allowable pathogen concentration of 438 colonies/100 mL. Calculated load reduction for this event is equal to 64%.

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 single sample criterion concentration by ten percent and calculating a mass loading target with measured flow data. The single sample maximum value of 487 colonies/100 mL was reduced by 10% to 438 colonies/100 mL. An implicit MOS was also incorporated in the TMDL by basing the existing condition on the highest measured E. coli concentration that was collected during critical conditions.

4.0 TMDL Development

4.1 Definition of a TMDL

A total maximum daily load (TMDL) is the sum of individual 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

Existing and Allowable Conditions

As discussed previously, the highest concentration measured from the 2009 field data was 1203 colonies/100 mL at station LEBS-2 on September 28, 2009. This can be referred to as the existing conditions concentration. The allowable conditions concentration would be the criterion minus the 10% MOS, or 438 colonies/100 mL. Measured flow from the exceedance event was 8.42 cfs. Based upon comments from the field crew, this was an above-average flow, and was probably the result of a storm event in the area. Concentration multiplied by the flow gives a loading (i.e., colonies/unit time) for E. coli. Employment of the appropriate conversion factor gives the loading in colonies/day. When the concentration is given in colonies/100 mL and the flow in cubic feet per second (cfs), the appropriate conversion factor is 24465755. Units of the conversion factor are equal to [(100mL)(s)]/[(cubic feet)(day)]. Hence, the existing conditions loading is calculated as follows:

$$\frac{8.42\,\text{ft}^3}{\text{s}} \times \frac{1203\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\,^{*}100\,\text{mL}*\text{s}}{\text{ft}^3*\text{day}} = \frac{2.48\times10^{11}\ \text{colonies}}{\text{day}}$$

The allowable conditions loading is given as follows:

$$\frac{8.42\,\text{ft}^3}{\text{s}} \times \frac{438\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\,^{*}\,100\,\text{mL}*\text{s}}{\text{ft}^3*\text{day}} = \frac{9.03\times10^{10}\ \text{colonies}}{\text{day}}$$

The difference between the two loadings results in the reduction required to bring the waterbody into compliance with F&W criteria for pathogens. The difference divided by the existing conditions loading times 100 gives the load reduction as a percentage. These values are listed in Table 4-1 below.

Table 4-1. 2009 E. Coli Loads and Required Reduction

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	Reduction (%)
NPS load	$2.48x10^{11}$	$9.03x10^{10}$	$1.58x10^{11}$	64
Point Source	0	0	0	0

Shown in Table 4-2 below are the required TMDL pathogen concentrations under critical conditions for Lee Branch.

Table 4-2. E. coli TMDL for Lee Branch

TMDL	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation(LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(cols/day)	(cols/day)	(cols/day)	(% reduction)	(cols/day)	(cols/day)	(% reduction)
$1.00x10^{11}$	$1.00x10^{10}$	NA	64	0	$9.03x10^{10}$	64

Note: NA = Not applicable. Cols=colonies.

a. There are no CAFOs in the Lee Branch watershed. Future CAFOs will be assigned a waste load allocation (WLA) of zero.
b. WLAs for WWTPs expressed as E. coli loads (colonies/day). Future WWTPs must meet instream water quality criteria at the point of discharge as specified in their NPDES permits.
c. Applies to all regulated MS4s located in the Lee Branch watershed, both current and future.
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 487 colonies/100ml.

4.3 TMDL Summary

Lee Branch was placed on Alabama's §303(d) list in 2000 based on data collected by USGS from 1996 through 1999. In 2009, ADEM collected additional water quality data which confirmed the pathogen impairment and provided the basis for TMDL development. Based upon the TMDL analysis, it was determined that a 64% 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 are eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria with a commitment to targeting the necessary load reductions to improve water quality in the Lee Branch watershed. As additional data and/or information becomes available, it may be 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, the ADEM 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 in Table 5-1 below.

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

River Basin Group	Year to be Monitored
Escatawpa / Mobile / Lower Tombigbee / Upper Tombigbee	2011
Black Warrior / Cahaba	2012
Chattahoochee / Chipola / Choctawhatchee / Perdido-Escambia	2013
Tennessee	2014
Alabama / Coosa / Tallapoosa	2015

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.

Appendix 7.1

References

ADEM Administrative Code, 2007. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2007. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

Alabama's §303(d) Monitoring Program. 2009. ADEM.

Alabama Department of Environmental Management (ADEM), Alabama's Water Quality Assessment and Listing Methodology, January 2010.

Alabama's 2000 §303(d) List. ADEM.

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 Geological Survey, 2000 Water Resources Data Report for Alabama. Water-Data Report AL-00-1.

U.S. Census Bureau. 2000 Census data.

ESRI Web Site for ArcGIS maps and data: http://www.arcgis.com/home/group.html?q=tags:ArcMap931_Base&t=group&owner=esri&title=ESRI%20Maps%20and%20Data&sortField=title&sortOrder=asc&content=all.

Shelby County web site for demographics: www.shelbycountytourism.org.

Appendix 7.2

Water Quality Data

Table 7-1. Pathogen Data Collected by USGS from 1996 to 1999

Agency	Station ID	Date	Time	Fecal Result	Rev Fecal Result
USGS	242340575	2/6/1996	10:00	96	96
USGS	242340575	4/8/1996	10:00	210	210
USGS	242340575	7/18/1996	9:30	E 540	540
USGS	242340575	11/14/1996	8:30	E 19	19
USGS	242340575	2/3/1997	10:30	E 47	47
USGS	242340575	5/28/1997	9:15	5200	5200
USGS	242340575	7/23/1997	10:00	2500	2500
USGS	242340575	11/19/1997	9:45	110	110
USGS	242340575	2/23/1998	9:45	E 760	760
USGS	242340575	6/2/1998	10:55	2200	2200
USGS	242340575	8/14/1998	9:45	2800	2800
USGS	242340575	3/16/1999	10:00	220	220
USGS	242340575	6/22/1999	13:00	E 20	20

Note: Cells highlighted in red represent exceedances of the single sample fecal water quality criterion of 2,000 cols/100 mLs.

Table 7-2. Pathogen Data Collected by ADEM at Station LEBS-1 in 2003 and 2004

Station_ID	Date	Time (24hr)	Duplicate Sample	Duplicate Time (24hrs)	Fecal Coliform (col/100ml)	Fecal Coliform oor	Fecal Coliform Rev (col/100ml)	Geomean
LEBS-1	6/9/2003	1015	FALSE		480		480	1345
LEBS-1	6/12/2003	1110	FALSE		7300		7300	
LEBS-1	6/16/2003	1220	FALSE		7300		7300	
LEBS-1	6/19/2003	1015	FALSE		1000		1000	
LEBS-1	6/23/2003	945	FALSE		172		172	
LEBS-1	9/15/2003	950	FALSE		110		110	225
LEBS-1	9/18/2003	1200	FALSE		180		180	
LEBS-1	9/22/2003	1000	FALSE		620	G	620	
LEBS-1	9/25/2003	955	FALSE		300		300	
LEBS-1	9/29/2003	920	FALSE		156		156	
LEBS-1	6/15/2004	915	FALSE		1	L	1	45
LEBS-1	6/21/2004	1230	FALSE		176		176	
LEBS-1	6/22/2004	1100	FALSE		61		61	
LEBS-1	6/24/2004	1200	FALSE		124		124	
LEBS-1	6/28/2004	1330	FALSE		10		10	
LEBS-1	6/30/2004	900	FALSE		600	G	600	
LEBS-1	9/8/2004	1300	FALSE		240		240	233
LEBS-1	9/22/2004	1200	FALSE		100		100	
LEBS-1	9/27/2004	1020	FALSE		170		170	
LEBS-1	9/28/2004	855	FALSE		280		280	
LEBS-1	9/29/2004	910	FALSE		600	G	600	

Fecal Criteria		
Parameter	Summer	Winter
Geomean	200	1000
SS	2000	2000

Summer=June-Sept
Winter=Oct-May

Note: Cells highlighted in red present exceedances of the applicable fecal criterion.

Table 7-3. Pathogen Data Collected by ADEM at Station LEBS-1 in 2009

Station ID	Visit Date	Locale Name	Flow Stage	Flow CFS	E Coli	E Coli Dc
LEBS-1	3/19/2009	Lee Br	UNKNOWN	1.5		
LEBS-1	4/21/2009	Lee Br	NORMAL			
LEBS-1	5/13/2009	Lee Br	NORMAL	1.5		
LEBS-1	6/8/2009	Lee Br	NORMAL			
LEBS-1	7/1/2009	Lee Br				
LEBS-1	7/6/2009	Lee Br				
LEBS-1	7/20/2009	Lee Br	LOW			
LEBS-1	7/23/2009	Lee Br	LOW			
LEBS-1	7/28/2009	Lee Br	NORMAL			
LEBS-1	8/6/2009	Lee Br				
LEBS-1	9/1/2009	Lee Br	NORMAL	0.32	178.5	
LEBS-1	9/8/2009	Lee Br	NORMAL	0.19	248.1	
LEBS-1	9/14/2009	Lee Br	NORMAL	0.09	172.5	
LEBS-1	9/17/2009	Lee Br	LOW	0.18	325.5	
LEBS-1	9/28/2009	Lee Br	NORMAL	0.25	517.2	
LEBS-1	10/29/2009	Lee Br	LOW		231	

Sept geomean=	264	(fail)
# SS Exceedances=	1	
Count=	6	

E. Coli Criteria		
Parameter	Summer	Winter
Geomean	126	548
SS	487	2507

Summer=June-Sept
Winter=Oct-May

Table 7-4. Pathogen Data Collected by ADEM at LEBS-2 in 2009

Station ID	Visit Date	Locale Name	Flow Stage	Flow CFS	E Coli	E Coli Dc
LEBS-2	3/19/2009	Lee Br	UNKNOWN	6.3		
LEBS-2	4/21/2009	Lee Br	NORMAL	6.4		
LEBS-2	5/13/2009	Lee Br	NORMAL	5.7		
LEBS-2	6/8/2009	Lee Br	NORMAL	1.7		
LEBS-2	7/1/2009	Lee Br	NORMAL	0.78		
LEBS-2	7/6/2009	Lee Br	NORMAL	0.62		
LEBS-2	7/20/2009	Lee Br	NORMAL	2.32		
LEBS-2	7/23/2009	Lee Br		1.41		
LEBS-2	7/28/2009	Lee Br	NORMAL	2.15		
LEBS-2	8/6/2009	Lee Br	NORMAL	1.39		
LEBS-2	9/1/2009	Lee Br	ABOVE NORMAL		105	
LEBS-2	9/8/2009	Lee Br	NORMAL	2.07	28.5	
LEBS-2	9/14/2009	Lee Br	NORMAL	1.49	13.4	
LEBS-2	9/17/2009	Lee Br	ABOVE NORMAL	4.52	980.4	
LEBS-2	9/28/2009	Lee Br	ABOVE NORMAL	8.42	1203.3	
LEBS-2	10/29/2009	Lee Br	NORMAL	2.61	153.9	

Sept geomean=	136	(fail)	
# SS Exceedances=	2		
Count=	6		

E. Coli Criteria		
Parameter	Summer	Winter
Geomean	126	548
SS	487	2507

Summer=June-Sept
Winter=Oct-May

Table 7-5. Pathogen Data Collected by ADEM at LEBS-3 in 2009

Station ID	Visit Date	Locale Name	Flow Stage	Flow CFS	E Coli	E Coli Dc
LEBS-3	3/19/2009	Lee Br	UNKNOWN	2.5		
LEBS-3	4/21/2009	Lee Br	NORMAL			
LEBS-3	5/13/2009	Lee Br	ABOVE NORMAL	5.9		
LEBS-3	6/8/2009	Lee Br	NORMAL			
LEBS-3	7/1/2009	Lee Br	LOW			
LEBS-3	7/6/2009	Lee Br				
LEBS-3	7/20/2009	Lee Br	LOW			
LEBS-3	7/23/2009	Lee Br	LOW			
LEBS-3	7/28/2009	Lee Br	NORMAL			
LEBS-3	8/6/2009	Lee Br	NORMAL			
LEBS-3	9/1/2009	Lee Br	ABOVE NORMAL	0.44	98.8	
LEBS-3	9/8/2009	Lee Br	NORMAL	0.18	95.9	
LEBS-3	9/14/2009	Lee Br	LOW		46.4	
LEBS-3	9/17/2009	Lee Br	ABOVE NORMAL	1.56	235.9	
LEBS-3	9/28/2009	Lee Br	ABOVE NORMAL	4.09	770.1	
LEBS-3	10/29/2009	Lee Br	LOW		248.9	

Sept geomean=	152	(fail)	
# SS Exceedances=	1		
Count=	6		

E. Coli Criteria		
Parameter	Summer	Winter
Geomean	126	548
SS	487	2507

Summer=June-Sept
Winter=Oct-May

Table 7-6. Pathogen Data Collected by ADEM at LEBS-4 in 2009

Station ID	Visit Date	Locale Name	Flow Stage	Flow CFS	E Coli	E Coli Dc
LEBS-4	3/19/2009	Lee Br	UNKNOWN	2.2		
LEBS-4	4/21/2009	Lee Br	NORMAL	1.7		
LEBS-4	5/13/2009	Lee Br	NORMAL	3.8		
LEBS-4	6/8/2009	Lee Br	NORMAL			
LEBS-4	7/1/2009	Lee Br				
LEBS-4	7/6/2009	Lee Br	ABOVE NORMAL			
LEBS-4	7/20/2009	Lee Br	NORMAL	0.31		
LEBS-4	7/23/2009	Lee Br	LOW			
LEBS-4	7/28/2009	Lee Br				
LEBS-4	8/6/2009	Lee Br				
LEBS-4	9/1/2009	Lee Br	ABOVE NORMAL	0.35	127.4	
LEBS-4	9/8/2009	Lee Br	NORMAL	0.38	248.1	
LEBS-4	9/14/2009	Lee Br	NORMAL	0.11	307.6	
LEBS-4	9/17/2009	Lee Br	ABOVE NORMAL	0.68	166.4	
LEBS-4	9/28/2009	Lee Br	ABOVE NORMAL	2.2	980.4	
LEBS-4	10/29/2009	Lee Br	LOW	0.299	258.9	

	Sept geomean=	**275**	**(fail)**
	# SS Exceedances=	**1**	
	Count=	**6**	

E. Coli Criteria		
Parameter	Summer	Winter
Geomean	126	548
SS	487	2507

Summer=June-Sept
Winter=Oct-May

Appendix 7.3

Photographs

LEBS-5. CPR & Steve Bearss. 12/3/10.

LEBS-4 looking upstream. CPR & Steve Bearss. 12/3/10.

LEBS-4 looking downstream. CPR & Steve Bearss. 12/3/10.

LEBS-3 looking upstream. CPR & Steve Bearss. 12/3/10.

LEBS-3 looking downstream. CPR & Steve Bearss. 12/3/10.

Stormwater pond near LEBS-3. CPR & Steve Bearss. 12/3/10.

Goose feces near LEBS-3. CPR & Steve Bearss. 12/3/10.

Wetlands at LEBS-1. Note beaver dam in foreground. CPR & Steve Bearss. 12/3/10.

LEBS-1 looking upstream. CPR & Steve Bearss. 12/3/10.

LEBS-1 looking downstream. CPR & Steve Bearss. 12/3/10.

Culvert at LEBS-1. CPR & Steve Bearss. 12/3/10.

LEBS-2 looking upstream. CPR & Steve Bearss. 12/3/10.

LEBS-2 looking downstream. CPR & Steve Bearss. 12/3/10.

Beaver dam at LEBS-2. CPR & Steve Bearss. 12/3/10.