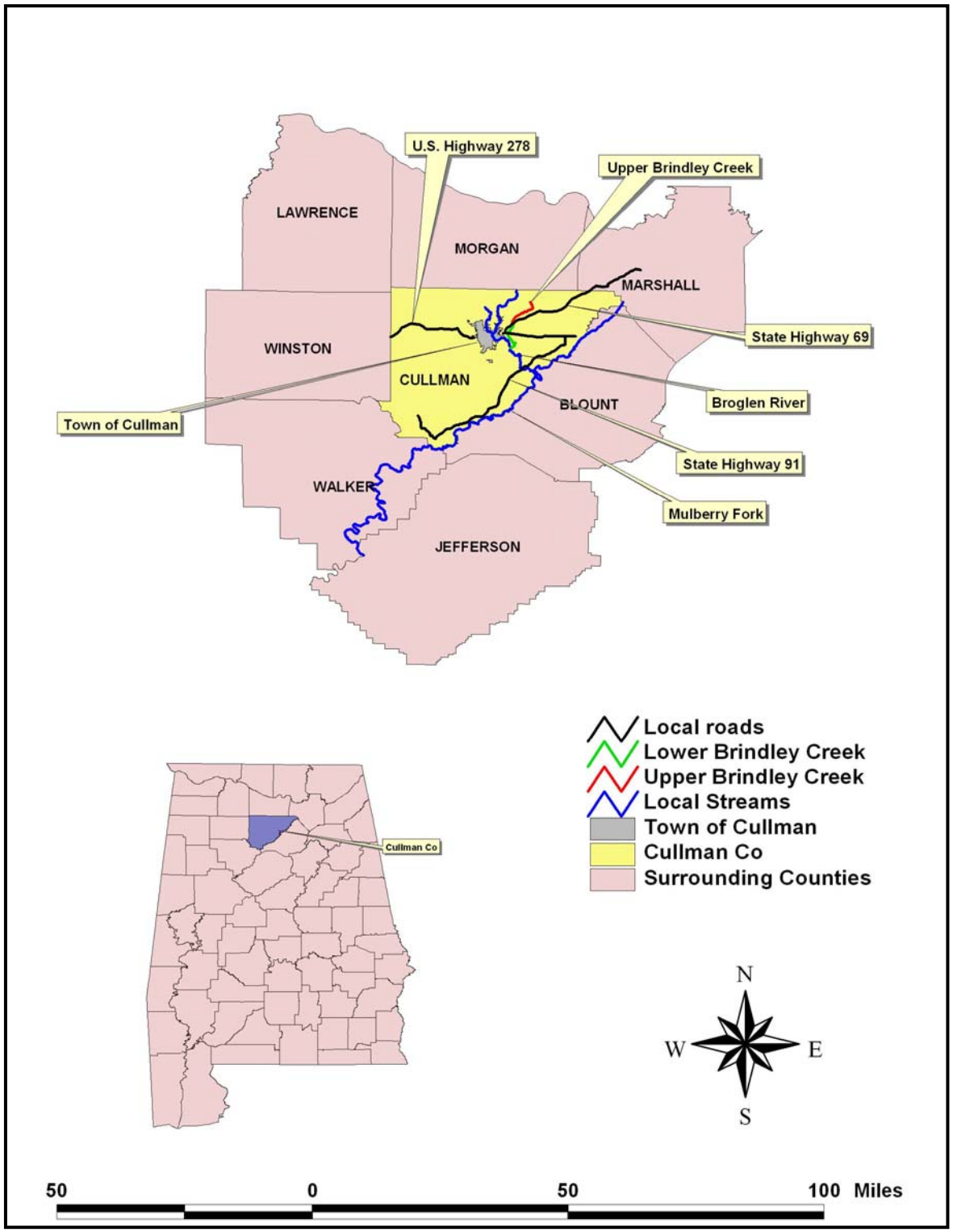
Final

Total Maximum Daily Load for

Upper Brindley Creek
AL/03160109-030_01
Pathogens (fecal coliform)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
December 2005

Figure 1: Brindley Creek Watershed Map



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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 use 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).

Brindley Creek is a part of the upper Black Warrior River basin. It combines with Eightmile Creek east of the town of Cullman to form the Broglen River. The Broglen River drains into Mulberry Fork. The USGS hydrologic unit code (HUC) for Mulberry Fork is 03160109. Mulberry, Sipsey and Locust Forks together comprise the upper Black Warrior River basin. Brindley Creek, Eightmile Creek and the Broglen River all constitute individual subwatersheds in the Mulberry Fork HUC. Their individual Soil Conservation Service (SCS) subwatershed numbers are 030, 040, and 050, respectively. Hence, a complete HUC code numeric ID for Brindley Creek is 03160109-030. The "_01" suffix listed on the cover page (and headers) represents a numeric assignment from the Water Quality Branch. It signifies the first impaired segment within that subwatershed (in the event that there is more than one).

The total drainage area of Brindley Creek is 24.9 square miles. The drainage area of the impaired segment of Brindley Creek (upper portion) is 14.7 square miles. It has a use classification of Public Water Supply (PWS). Most of the watershed consists of forests and agriculture. It has one water supply reservoir, Lake Ingram, for a local poultry processor, Golden Rod Broilers. Lake Ingram is located in the lower part of the watershed.

Brindley Creek was first placed on the state's §303(d) list in 1998 for ammonia, nutrients, OE/DO (organic enrichment/low dissolved oxygen), and pathogens (fecal coliform bacteria). This was a result of data acquired from ADEM's 1997 NPS Screening Assessment of the Black Warrior River basin. There was one Brindley Creek station during that study. Its station ID was BRIC-72a. Data from that station can be found in Appendix B.

From 1999 through 2002, additional water quality data was acquired on Brindley Creek to assess its ability to support a PWS use classification. The data indicates that the lower portion of the creek, from its mouth to Alabama Highway 69, now fully supports its use classification with respect to pathogens. This portion is being delisted in a separate document. The upper portion has been assessed with a partial support status. The upper portion begins at Alabama Highway 69 and extends to its source. It is the upper portion of Brindley Creek for which this TMDL was developed.

A loading curve analysis was considered for this evaluation but was rejected because it was felt that there wasn't a sufficient amount of field data. A mass balance approach was also rejected because there was no measured flow for the highest exceedance sampling

event. Most TMDLs are evaluated in terms of loading, expressed as a mass per unit time of pollutant (e.g., pounds per day of BOD) or a count per unit time (e.g., col per day of fecal coliform organisms). It should be noted, however, that the Clean Water Act allows a certain amount of flexibility in allowable TMDL parameters (as expressed in Code of Federal Regulations (CFR) 40 CFR 130.2(i)). Other allowed parameters include toxicity and concentration, depending on the circumstances for a specific situation. The upper Brindley Creek pathogen TMDL is one that is better suited to using concentration as the TMDL parameter of choice. This is because the highest exceedance event had no associated measured flow. The measured value for that event was 7300 cols/100 mLs. This value was chosen to represent the existing (or critical) condition event. The single sample fecal criterion for upper Brindley Creek is 2000 col/100 mLs. The single sample fecal target was taken to be 90% of the fecal criterion (i.e., 1800 col/100 mLs). The margin of safety (MOS) was selected to be 10% of the criterion (i.e., 200 cols/100 mLs). A percent reduction required to meet the allowable concentration target was then calculated. Table 1.1 is a summary of existing and reduction concentrations needed to meet the applicable water quality fecal coliform single sample criterion for Brindley Creek. Table 1.2 lists the TMDL pathogen concentrations required to support existing uses for the waterbody.

Table 1.1 – Current Concentrations and Required Reductions

Source	Current Conc (col/100 mLs)	Allowable Conc with MOS (col/100 mLs)	MOS (col/100 mLs)	Percent Reduction (%)
NPS	7300	1800	200	75
Point Source	0	0	0	0
Total	7300	1800	200	75

Table 1.2 - TMDL for Upper Brindley Creek

TMDL = WLA + LA + MOS			
TMDL	WLA	LA	MOS
(col/100 mLs)	(col/100 mLs)	(col/100 mLs)	(col/100 mLs)
2000	0	1800	200

It should be noted that that there are also seasonal fecal geometric mean (geomean) criteria for upper Brindley Creek. They are 1000 col/100 mLs for the eight month period from October through May, and 200 col/100 mLs for June through September. There were no exceedances of the geomean criteria.

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).

As mentioned previously in the Executive Summary, Brindley Creek was placed on Alabama's §303(d) list in 1998 for four pollutants as a result of data acquired in 1997 by the Alabama Department of Environmental Department (ADEM). This TMDL addresses pathogens for the upper portion of the watershed. The remaining pollutants, OE/DO, ammonia and nutrients, will be addressed at a later date.

2.2 Problem Definition

Waterbody Impaired:	Upper Brindley Creek from Alabama Highway 69 to its source.
Waterbody length:	9.87 miles
Waterbody drainage area:	14.66 square miles
Water Quality Criterion Violation:	Fecal Coliform (single sample)
Pollutant of Concern:	Pathogens (Fecal Coliform)
Water Use Classification:	Public Water Supply (PWS)

Usage related to classification:
The impaired stream segment, Brindley Creek, is classified as PWS. Usage of waters in this classification are described in ADEM Admin. Code R. 335-6-10-.09(2)(a), (b), (c), and (d) as follows:

(a) Best usage of waters: source of water supply for drinking or food-processing purposes.*

(b) Conditions related to best usage: the waters, if subjected to treatment approved by the Department equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to remove naturally present impurities, and which meet the requirements of the Department, will be considered safe for drinking or food-processing purposes.

(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.

Fecal Coliform Criteria:
Criteria for acceptable bacteria levels for the PWS use classification are described in ADEM Admin. Code R. 335-6-10-.09(2)(e)7.(i) and (ii) as follows:

7. Bacteria:

(i) Bacteria of the fecal coliform group shall not exceed a geometric mean of 1000 cols/100 ml; nor exceed a maximum of 2000 cols/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. The membrane filter counting procedure will be preferred, but the multiple tube technique (five-tube) is acceptable.

(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 fecal coliform organism density does not exceed 100 cols/100 ml in coastal waters and 200 cols/100 ml in other waters. 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 mean fecal 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

* **NOTE:** In determining the safety or suitability of waters for use as sources of water supply for drinking or food-processing purposes after approved treatment, the Commission will be guided by the physical and chemical standards specified by the Department.

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:

There have been three sampling events from 1999 through 2002 in the Brindley Creek watershed where the single sample criterion of 2000 col/100 mls has been exceeded. Only one of these events had a flow measurement performed. The other two had no associated flow measurements. The event with the highest fecal exceedance was employed to perform the reduction analysis. This event is one of the two with no associated flow measurements.

3.0 TMDL Technical Basis

3.1 Water Quality Target Identification

A fecal coliform single sample target level of 1800 colonies/100 ml will be used in this TMDL. This target was derived by using a 10% margin of safety from ADEM's single sample PWS criterion of 2000 colonies/100 ml. As mentioned previously, the geometric mean fecal coliform criterion was not employed as a TMDL target because none of the geomean sampling events for fecal coliform violated the 200 col/100 ml criterion.

3.2 Source Assessment

Point Sources in the upper Brindley Creek Watershed:

There are no point sources in the upper Brindley Creek watershed. This includes concentrated animal feeding operations (CAFOs). Hence, the WLA portion of the TMDL will be zero.

Nonpoint Sources in the upper Brindley Creek Watershed:

Landuses in the Brindley Creek watershed are predominantly agriculture and forest. Based on site visits to the watershed, there is a considerable amount of poultry and cattle farming in this area of the state. The following are examples of how different landuses can contribute to fecal coliform bacterial loading:

- Agricultural land can be a source of fecal coliform bacteria. Runoff from pastures, animal operations, improper land application of animal wastes, and animals with access to streams are all mechanisms that can contribute fecal coliform bacteria to waterbodies.
- Fecal coliform bacteria can also originate from forested areas due to the presence of wild animals such as deer, raccoons, turkeys, waterfowl, etc. Control of these sources is usually limited to land management BMPs and may be impracticable in most cases.
- Leaking septic systems can be another source of fecal coliform bacteria.

The nature and extent of fecal coliform bacterial sources in the watershed will be better identified during the implementation phase of the TMDL.

3.3 Landuse

Table 3.1 on the next page provides the various landuses (and their associated percentages) for the upper Brindley Creek watershed. Figure 3.1 is a landuse map of the upper Brindley Creek watershed. The detailed landuse for this watershed was derived from EPA's Watershed Characterization System (WCS). The WCS system is a software tool that provides a means to organize Geographical Information System (GIS) data on a spatial scale for a defined watershed. Landuse information for this assessment was derived from USGS's 1990 Multiple Resolution Land Coverage (MRLC) theme.

Table 3.1 Landuse in the upper Brindley Creek Watershed

Landuse	Acres	Sq. Miles	Percentage
Deciduous Forest	1499	2.34	16.0
Evergreen Forest	631	0.99	6.7
High Intensity Commercial/Industrial/Transportation	21	0.03	0.2
Low Intensity Residential	13	0.02	0.1
High Intensity Residential	2	0.00	0.0
Mixed Forest	1371	2.14	14.6
Open Water	32	0.05	0.3
Other Grasses (Urban/recreational; e.g. parks, lawns, etc)	28	0.04	0.3
Pasture/Hay	3671	5.74	39.1
Row Crops	2004	3.13	21.4
Transitional	21	0.03	0.2
Woody Wetlands	90	0.14	1.0
Total	**9383**	**14.66**	**100.0**

Grouped Landuses	Acres	Sq. Miles	Percentage
Agricultural	5675	8.87	60.5
Forest	3501	5.47	37.3
Other	207	0.32	2.2
Total	**9383**	**14.66**	**100.0**

3.4 Linkage between Numeric Targets and Sources

As can be seen from an inspection of the above table, upper Brindley Creek has two major landuses – forest and agriculture. Pollutant loadings from forested areas tend to be low due to their filtering capabilities. The most likely sources of pathogen loadings in upper Brindley Creek are from the agricultural landuses and failing septic systems. Because this watershed has a small drainage area (less than 15 square miles), it was not considered practicable to calculate individual components for nonpoint source (NPS) loadings. Hence, there will not be individual loads or reductions calculated from different sources such as forest, agriculture, and septic systems. The loadings and reductions will only be calculated as a single total NPS load. It is envisioned that the pathogen sources can be better defined during the implementation process.

3.5 Data Availability and Analysis

There are four studies that can be employed as data sources for the Brindley Creek watershed. The first study is ADEM's 1997 NPS Screening Assessment of the Black Warrior River basin. There was one station from that study, identified as BRIC-72a. Data from BRIC-72a placed the creek on the 1998 §303(d) list. Data consisted of chemical parameters, biological parameters, and a habitat assessment.

The second study is derived from a cooperative agreement between ADEM, Conservation and Natural Resources, U.S. Fish and Wildlife, and the Geological Survey of Alabama (GSA). The purpose of the agreement was to perform biomonitoring in the Black Warrior basin from 1999 through 2001. The study was performed by GSA. There was one station in the Brindley Creek watershed, identified as GSA station 40. Data included field parameters, fish IBI scores, and habitat scores.

Finally, more recent data obtained in the watershed comes from monthly 303(d) sampling (study #3) and intensive fecal surveys (study #4) by the Department in 2001 and 2002. Monthly 303(d) stations are identified as BINC-190 through 193; intensive fecal survey stations as BDC-1 through 3. The intensive fecal surveys were employed to obtain enough data to perform geometric mean estimates. There were no violations of the PWS summer geometric mean criterion of 200 col/100 mls. The monthly 303(d) data was employed to compare with the single sample year-round criterion of 2000 col/100 mls. It is this data which resulted in the assessment that the lower part of the watershed was supporting its PWS use classification while the upper part was only partially supporting with respect to pathogens. All data for the aforementioned stations can be found in Appendix B. Sample locations are shown in Figure 3.2. Location descriptions for all stations can be found in Table 3.2. Please note that some stations have more than one ID, depending on which study is under consideration.

Table 3.2 Sampling Station Location Descriptions

Station ID	Latitude	Longitude	Location Description
BINC-190/BDC-1	34.14528	-86.76806	Brindley Creek just US of mouth
BINC-191	34.15111	-86.76028	Brindley Creek at dam forebay
BINC-192/BDC-3	34.20944	-86.76667	Brindley Creek at Ala Hwy 69
BINC-193	34.24889	-86.72389	Brindley Creek at county road approx 2 miles west of Fairview
BDC-2	34.1824	-86.7736	Brindley Creek at U.S. Hwy 278
BRIC-72a/GSA Station 40	34.23028	-86.75734	Brindley Creek at county road approx 1 mile NW of Simcoe

Figure 3.1 – Landuse Map of the upper Brindley Creek Watershed

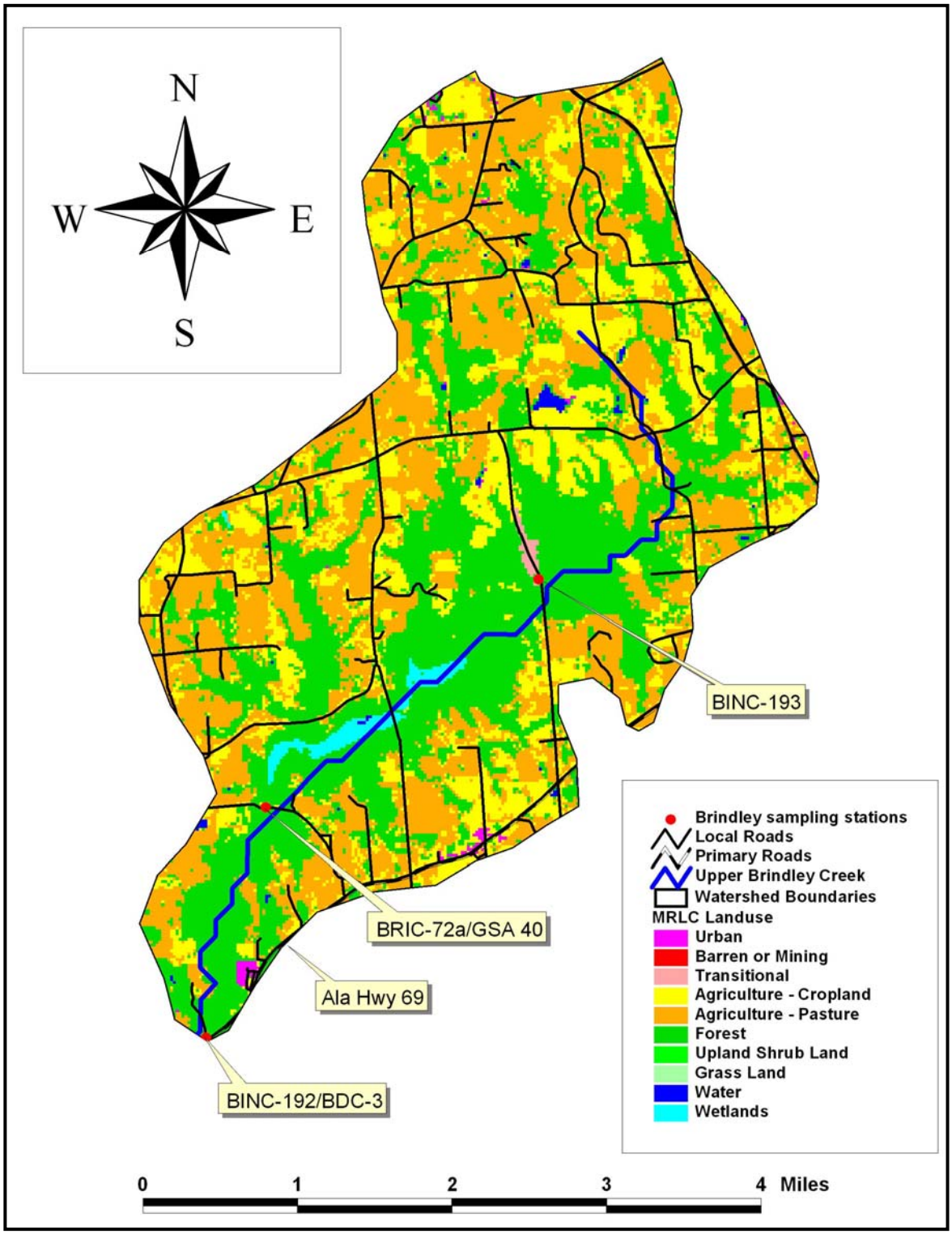
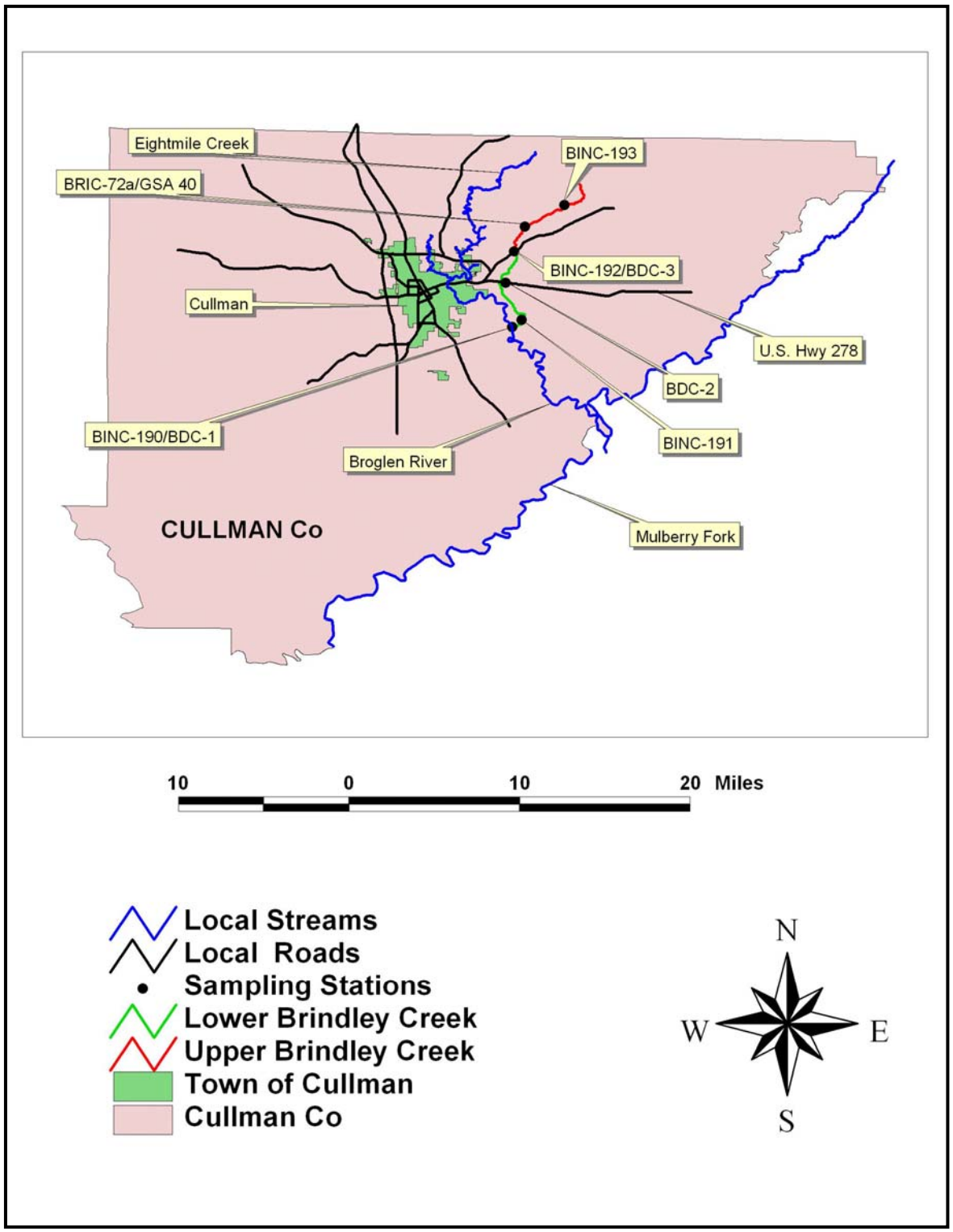


Figure 3.2 Sampling Stations in the Brindley Creek Watershed



3.6 Critical Conditions

The critical condition for this pathogen TMDL was taken to be the one with the highest fecal exceedance value. That value was 7300 col/100 mLs and occurred on 1/24/2002 at station BINC-193. No flow measurement was obtained during this particular sampling event.

It should be noted that two other 303(d) sampling events exceeded the single sample criterion of 2000 col/100 mLs. One occurred at BINC-193 on 12/18/2001 with a value of 2120 col/100 mLs. The flow measured during this event was 37 cfs. The other occurred at BINC-192 on 1/24/2002 with a measured concentration of 4400 col/100 mLs. There was no accompanying flow measurement.

3.7 Margin of Safety (MOS)

There are two methods for incorporating a 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.

An explicit MOS was incorporated in this TMDL. The explicit MOS includes the uncertainty of the fecal coliform data (i.e., the limited amount of fecal data) used in this analysis and the uncertainty of selecting an appropriate critical condition from the existing fecal coliform loads. A margin of safety was applied to the TMDL by reducing the target criterion concentration by ten percent. For this TMDL, the single sample year-round criterion was reduced by ten percent to achieve a target concentration of 1800 colonies/100ml, which yields a MOS equal to 200 colonies/100ml.

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:

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

A TMDL is the maximum amount of a given pollutant that can be assimilated by the receiving waterbody without violating water quality standards under critical conditions.

4.2 TMDL Calculations

A target concentration approach was used to calculate the TMDL for upper Brindley Creek. Four concentrations (expressed as col/100 mLs) are needed for the evaluation:

- The exceedance value of 7300;
- The criterion value of 2000;
- The MOS of 200, and;
- The target value of 1800.

The percent reduction is given by the following equation:

Percent Reduction (%) = ((existing conc – target conc)/existing conc) * 100

Where, conc = fecal coliform concentration (cols/100 mLs).

Substituting the above values into the equation gives the following reduction:

Percent Reduction = ((7300 – 1800)/7300) * 100 = 75%.

Table 4.1 on the next page illustrates the fecal reduction calculations.

Since there are no point sources in the upper Brindley watershed, all of the fecal allocation is allotted to the other two TMDL components (i.e., the LA and the MOS). The LA component is equal to 1800 col/100 mLs while the MOS is 200 col/100 mLs. Hence, the TMDL can be written as follows:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$
$$TMDL = 0 + 1800 + 200 = 2000 \text{ col/100 mLs.}$$

Table 4.1 Fecal Reduction Calculations for the Upper Brindley Creek Watershed

Fecal reduction calculations for Upper Brindley Creek

Sample Location: BINC-193
Date of Exceedance Event: 1/24/2002
Fecal concentration on day of exceedance event: 7300 col/100 mL
Allowable Fecal concentration: 1800 col/100mL

Existing Conditions:
Fecal Conc = 7300

Allowable Conditions:
Target Conc = 1800 col/100 mLs

Calculations:
MOS = 200 col/100 MIs
Target Conc = 1800 col/100 mLs
Fecal Criterion = MOS + Target Conc = 2000 col/100 mLs
Percent Reduction (%) = ((existing conc – target conc)/existing conc) * 100

Source	Existing Conc (col/100 mLs)	Allowable Conc (col/100 mLs)	Required Reduction (col/100 mLs)	Reduction (%)
LA	7300	1800	5500	75%
WLA	0	0	0	0%
Total	7300	1800	5500	75%

Percent Reduction to Achieve the Fecal Coliform Standard:
Total reduction: 75%

4.3 Seasonal Variation

Regulations require that a TMDL be established with consideration of seasonal variations. Data from 303(d) sampling was collected over both wet and dry seasons, thereby taking these variations into account. The data was collected monthly over an 8-month period starting in November 2001 and going through June 2002.

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 resources for water quality monitoring are concentrated in one of the 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 to the schedule shown in Table 5.1.

Table 5.1 ADEM's Major River Basin Sampling Schedule

River Basin Group	Schedule
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2006
Cahaba / Black Warrior	2007
Tennessee	2008
Choctawhatchee / Chipola / Perdido-Escambia / Chattahoochee	2009
Tallapoosa / Alabama / Coosa	2010

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 clj@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 A
References

USEPA. 2001. *Protocol for Developing Pathogen TMDLs.* EPA 841-R-00-001. U.S. Environmental Protection Agency, Office of Water, Washington DC.

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

Alabama Department of Environmental Management's 303(d) Monitoring Program. 2001-2002.

ADEM Administrative Code, 2002. Water Quality Program, Chapter 335-6-10, Water Quality Criteria, and Chapter 335-6-11 Use Classifications for Interstate and Intrastate Waters.

Alabama Department of Environmental Management. January 1999. *Surface Water Screening Assessment of the Black Warrior River Basin—1997.* Environmental Indicators Section. Field Operations Division.

Appendix B
Water Quality Data
ADEM Intensive Survey and 303(d) Data

Monthly 303(d) Sampling				
Station_ID	Date	Time (24hr)	Flow (cfs)	Fecal Coliform col/100 ml
BINC-190	011119	1230	2.40	5
BINC-190	011211	950		13
BINC-190	011212	945	21.20	15
BINC-190	011217	1215		1140
BINC-190	011218	1040		860
BINC-190	020124	920		720
BINC-190	020227	1115	17.90	2
BINC-190	020314	910		13
BINC-190	020411	930		22
BINC-190	020516	1055	17.90	18
BINC-190	020529	1420	8.30	30
BINC-190	020530	945	9.50	58
BINC-190	020613	1020	2.10	240
BINC-190	020620	1140		32
BINC-191	011119	1130		2
BINC-191	011211	815		10
BINC-191	011212	845		10
BINC-191	011217	1148		1260
BINC-191	011218	930		1260
BINC-191	020124	845		470
BINC-191	020227	940		8
BINC-191	020314	840		6
BINC-191	020411	850		7
BINC-191	020516	1020		2
BINC-191	020529	1345		1
BINC-191	020530	910		1
BINC-191	020613	925		7
BINC-191	020620	1115		11
BINC-192	011119	1409	1.00	20
BINC-192	011211	1035		340
BINC-192	011212	1055	10.90	224
BINC-192	011217	1255		1100
BINC-192	011218	1110		1500
BINC-192	020124	950		4400
BINC-192	020227	1225	8.60	8
BINC-192	020314	945		620
BINC-192	020411	1015	16.10	120
BINC-192	020516	1150	8.40	40
BINC-192	020529	1555		100
BINC-192	020530	1130	3.30	176
BINC-192	020613	1140		74
BINC-192	020620	1258		120
BINC-193	011119	1438		68
BINC-193	011211	1050		620
BINC-193	011212	1145	4.40	1240
BINC-193	011217	1310		1200
BINC-193	011218	1155	37.00	2120

ADEM Intensive Survey and 303(d) Data

BINC-193	020124	1005		7300
BINC-193	020227	1310	3.00	70
BINC-193	020314	1020	5.10	620
BINC-193	020411	1100	6.10	540
BINC-193	020411	0		580
BINC-193	020516	1235	3.30	40
BINC-193	020529	1520		340
BINC-193	020530	1055	1.30	300
BINC-193	020613	1110		240
BINC-193	020620	1240		490
Statistical Summary				
Station	# Samples	# Violations	% Violations	Use Support
BINC-190	14	0	0	Full
BINC-191	14	0	0	Full
BINC-192	14	1	7.1%	Full
BINC-193	15	2	13.3%	Partial
Station Locations:				
Station	Location Description			
BINC-190	Brindley Creek @ Co. Rd. prior to confluence with Eightmile Creek			
BINC-191	Brindley Creek @ the reservoir dam, forebay			
BINC-192	Brindley Creek @ State Hwy 69			
BINC-193	Brindley Creek @ Co. Rd. in the SE 1/4 of Sect 15, R2S, T9S			

ADEM Intensive Survey and 303(d) Data

Station Number	Date (YYMMDD)	Time (24hr)	Fecal Coliform (col/100ml)		
BRIC-72a	970521	0700	70		
BRIC-72a	971001	1500	202		
Use Support=Full					
Station Locations:					
Station	Location Description				
BRIC-72a	Brindley Creek @ Cullman Co Rd 1476				
Intensive Fecal Study					
Station	Date	Time	Stream Flow cfs	Fecal Coliform org/100mL	Geo Mean
BDC-1	7/18/2001	1348	3.2	24	
	7/19/2001	1402	2.4	21	
	7/24/2001	1057	1.7	30	23
	7/25/2001	1057	1.5	29	
	7/26/2001	1057	0.9	14	
BDC-2	7/18/2001	1135	0.5	18	
	7/19/2001	1152	2.5	26	
	7/24/2001	1035	1.7	85	49
	7/25/2001	1035	1.5	61	
	7/26/2001	1035	0.3	120	
BDC-3	7/18/2001	1200	1.3	35	
	7/19/2001	1215	1.2	39	
	7/24/2001	0910	1.1	55	69
	7/25/2001	0910	1	220	
	7/26/2001	0910	0.8	92	
BDC-1 Use support=Full					
BDC-2 Use support=Full					
BDC-3 Use support=Full					
Station Locations:					
Station	Location Description				
BDC-1	Brindley Creek upstrm of mouth. (T10S, R2W, S29, NE1/4)				
BDC-2	Brindley Creek @ US Hwy 278. (T10S, R2W, S8, SW1/4).				
BDC-3	Brindley Creek @ AL Hwy 69. (T9S, R2W, S32, SE1/4).				

GSA Data

Biomonitoring in the Mulberry Fork Watershed: 1999-2001								
Three stations in the Broglen River watershed: 38, 39 and 40								
						IBI Index:		
Station locations:						<25 very poor		
	38: Broglen River @ Ala Hwy 91					26-37 poor		
	39: Eightmile Creek @ Buchman Bridge					38-46 fair		
	40: Brindley Creek approx 1 mile NW of Simcoe					47-55 good		
						>55 excellent		
	Coordinates						Biological Assessment	Habitat
Station	Map	Latitude	Longitude	Date	Time	Fish IBI Score	(based on Fish IBI score)	Score
38	T11S, R2W, Sec 15	34°04'56.6"N	86°44'16.1"W	7/14/2000	1310-1405	44	Fair	82
39	T10S, R2W, Sec 29	34°08'55"N	86°45'53.5"W	8/24/2000	1225-1325	36	Poor	80
40	T9S, R2W, Sec 28	34°13'49.4"N	86°45'28.1"W	5/17/2001	1200-1220	22	Very Poor	85

ADEM NPS Screening Biological Data

Table 3a. Habitat quality and aquatic macroinvertebrate assessments from the Mulberry Fork cataloging unit. In order to compare levels of habitat degradation between stations, values given for each of three major habitat parameters are presented as percent of maximum score.

	Station										
Parameter	BR-1	MARC-2a	SULC-10a	RICC-11a	SPRW-4a	WOLW-51c	BRIC-72a	MILW-6a	THAC-68a	EMIC-73a	BLAW-70a
Habitat assessment form*	Original	RR	RR	RR	RR	RR	RR	GP	GP	GP	GP
Instream habitat quality	94	87	67	83	80	65	70	68	75	67	55
Sediment deposition	66	63	70	35	65	73	83	47	43	60	37
% Sand	2	5	6	25	25	50	10	45	10	35	62
% Silt	5	13	10	7	2	10	3	10	11	2	10*
Sinuosity	90	90	80	70	95	80	25	40	45	40	45
Bank and vegetative stability	92	93	75	58	60	50	63	65	53	50	40
Riparian zone measurements	85	93	75	58	60	50	63	65	53	50	40
% Canopy Cover	30				50	70	60	70	50	50	30
% Maximum Score	85	76	74	69	66	66	65	61	59	56	45
Habitat Assessment Category	Excellent	Excellent	Excellent	Good	Good	Good	Good	Good	Good	Good	Fair
EPT Taxa Collected	8	10	8	9	10	9	6	11	6	11	9
Aq. Macroinvertebrate Assess.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Mod. Imp	Unimp.	Mod. Imp	Unimp.	Sl. Imp.

	Station		
Parameter	SPLW-71a	DORC-9a	DUCC-69c
Habitat assessment form*	GP	GP	GP
Instream habitat quality	48	43	43
Sediment deposition	33	30	30
% Sand	30	60	74
% Silt	30	15	3
Sinuosity	70	65	30
Bank and vegetative stability	35	48	53
Riparian zone measurements	35	48	53
% Canopy Cover	50		20
% Maximum Score	45	43	42
Habitat Assessment Category	Fair	Fair	Fair
EPT Taxa Collected	7	10	5
Aq. Macroinvertebrate Assess.	Mod. Imp.	Sl. Imp	Mod. Imp

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

ADEM NPS Screening Chemical Data

Appendix J. Results of physical and chemical measurements from stations sampled as part of the nonpoint source watershed screening of the Black Warrior, 1997

C.U.	Sub-Watershed Number	Station Number	Date (YYMMDD)	Time (24hr)	Water Temp. (C)	Dissolved Oxygen (mg/l)	pH (s.u.)	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)	Fecal Coliform (col/100ml)	Total Alkalinity (mg/l)	Hardness (mg/l)	BOD-5 (mg/l	TSS (mg/l)	TDS (mg/l)	NH3 (mg/l)	NO2/NO3 (mg/l)
109	010	MULC-1a	971001	1415	18	8.7	7.2	26	4.3	37.6	120	22	26.6	0.6	3	66	LDL	1.82
109	020	DUCC-69c	970516	0730	15	8.7	6.9	102	6.0	15.6	<3							
109	030	BRIC-72a	970521	0700	18	6.6	6.3	90	11.0	3.2	70							
109	030	BRIC-72a	971001	1500	21	6.6	6.8	106	5.0	3.2	202	25	34	1	1	67	LDL	0.91
109	040	EMIC-73a	970521	0950	17	8.3	6.1	80	5.3	2.8	31							
109	080	THAC-68a	970516	1000	16	8.6	7.0	90	5.0	2.7	107							
109	110	SULC-10a	970918	------	------	------	------	------	------	Dry	------							
109	120	BLAW-70a	970515	1220	18	8.0	7.1	113	8.0	11.9	53 Est.							
109	120	SPLW-71a	970515	1405	19	8.1	6.8	43	11.0	27.8	60 Est.							
109	120	SPLW-71a	970924	1710	23	6.5	7.0	53	6.8	7.4	31	21	17.6	0.4	1	25	LDL	0.1
109	130	SPRW-4a	970514	0725	17	8.8	7.0	135	8.0	5.6	53 Est.							
109	170	MILW-6a	970515	1630	18	8.7	7.8	359	47.0	19.6	27 Est.							
109	170	MILW-6a	970924	1625	23	6.8	8.1	849	1.5	3.1	147	179	445.5	0.5	LDL	609	LDL	0.05
109	180	WOLW-51c	970514	1740	20	8.7	6.7	197	11.0	4.8	20 Est.							
109	180	WOLW-51c	970924	1525	23	4.0	7.3	1354	1.9	<Detect.	34	152	714.5	LDL	1	1147	LDL	0.02
110	010	TPSL-1	970715	1300	24	8.2	7.5	89	3.8	6.1	100							
110	020	CANW-13a	970522	1320	16	9.0	6.2	43	6.0	2.5	52							
110	020	CANW-13a	970925	1020	20	8.2	7.2	62	226.0	40.1	GDL	12	22.4	3.2	194	53	LDL	0.38
110	020	SANW-12a	970522	1600	17	8.8	5.8	25	4.8	13.5	27							
110	020	SANW-12a	970925	0920	20	7.9	6.7	37	147	57.6	GDL	10	9.8	3.7	146	31	LDL	0.5
110	030	INMW-1	970715	1720	25	8.0	7.0	31	4.9	1.9	40							
110	050	CLCW-53b	970515	1605	20	8.6	7.1	54	6	15.4	80 Est.							
110	050	CLCW-53b	970925	0815	21	6.7	6.5	53	542	High	>600	14	17.3	2.7	472	41	LDL	0.37
110	050	CLCW-53c	970515	1740	19	8.7	7.1	39	7.0	14.2	53 Est.							
110	050	CLCW-53c	970925	0840	21	6.5	6.3	32	266	High	GDL	9	8.9	3.7	256	48	LDL	0.3
110	080	ROCW-52b	970521	1600	18	8.5	6.0	44	4.0	2.4	100							
110	090	CROC-54a	970521	1355	19	8.6	6.5	77	6.0	6.2	----							
110	100	WHEC-17a	970522	0725	14	9.0	6.0	50	6.5	2.6	34							
110	100	WHOC-16a	970522	1000	15	9.4	6.4	55	4.8	3.0	37							
110	100	WHOC-16a	970925	1142	20	7.6	7.0	72	59.3	10.4	GDL	19	21.2	4.5	39	55	LDL	1
110	130	MILW-18a	970523	0715	17	8.4	7.9	949	1.8	11.0	14 Est.							
110	130	MILW-18a	970918	1010	21	8.0	8.1	1205	0.6	5.7	35	334	725.4	0.4	1	1317	LDL	4.67
111	030	CLEM-76a	970520	0945	18	7.1	6.1	107	3.0	7.9	400							
111	030	CLEM-76a	971001	1209	18	8.3	7.0	102	4.1	27.2	130	21	29.7	0.4	LDL	72	0.22	1.75
111	040	SLAM-22c	970520	0720	18	7.0	6.2	208	8.6	11.2	520							
111	040	SLAM-22c	971001	1250	20	7.3	7	226	7.7	15.3	340	36	66	0.4	1	158	LDL	4.17
111	050	DRYB-75a	970519	1200	21	9.6	8.0	579	4.8	6.2	3675							
111	050	DRYB-75a	970918	1210	29	12.0	8.1	1077	2.2	0.3	30 Est.	123	621	1.3	3	1241	LDL	0.08
111	050	GRAB-77a	970519	1350	19	6.7	6.4	98	5.7	3.8	35							
111	050	GRAB-77a	970918	1240	23	6.5	7.5	179	2.1	0.8	67	80	86.2	0.5	LDL	15	LDL	0.24
111	050	WHIB-74a	970520	1200	20	8.5	6.1	207	5.0	8.7	1800							
111	050	WHIB-74a	971001	1120	19	8.4	7.5	204	4.8	10.6	160	49	84.5	0.7	2	154	LDL	1.03
111	060	LCPB-23a	970519	1620	21	8.4	6.2	62	8.4	3.3	3600							
111	060	LCPB-23a	971001	1019	18	8.1	7.7	281	8.3	22.8	>270	95	151	0.6	LDL	197	LDL	0.37