FINAL

Total Maximum Daily Loads (TMDLs)

for

pH, Siltation and Other Habitat Alterations in the Camp Branch Watershed

Camp Branch AL/03160111-140_01

Alabama Department of Environmental Management
Water Quality Branch
Water Division

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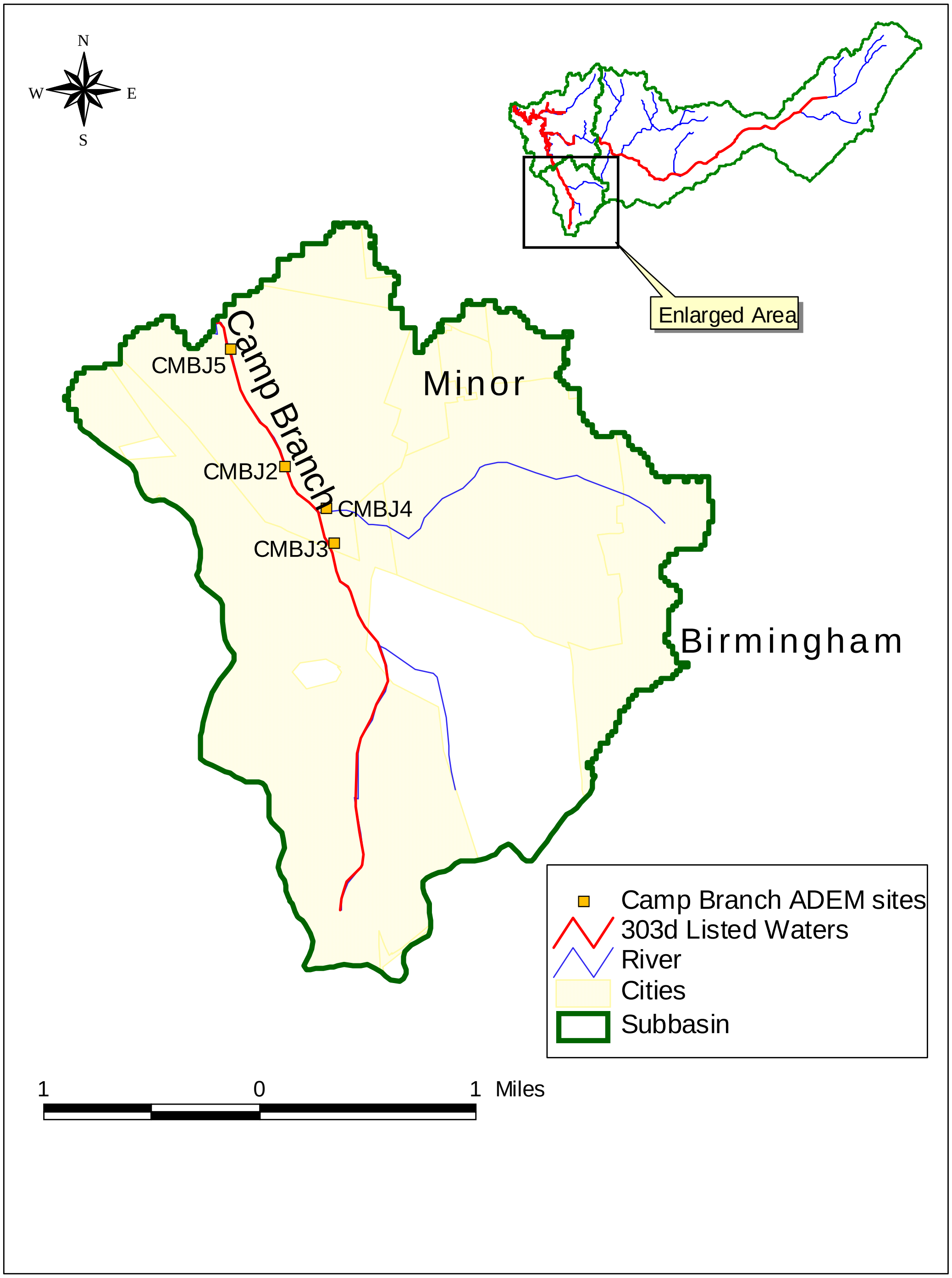

Figure I Camp Branch Watershed in the Black Warrior River Basin HUC AL/03160111-140_01

List of Abbreviations

ACIPCO	American Cast Iron Pipe Company
ADEM	Alabama Department of Environmental Management
AWW	Alabama Water Watch
BCF	Bioconcentration Factor
BMP	Best Management Practices
CAFO	Confined Animal Feeding Operation
CCC	Criteria Continuous Concentration
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CPF	Cancer Potency Factor
CWA	Clean Water Act
CWP	Clean Water Partnership
DEM	Digital Elevation Model
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
FCR	Fish Consumption Rate
FSA	Farm Services Agency
GIS	Geographic Information System
HBW	Human Body Weight
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Stormwater System
NED	National Elevation Database
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source Pollution
NRCS	Natural Resources Conservation Service
OE	Organic Enrichment
OEO	Office of Education and Outreach
RF3	Reach File 3
RfD	Reference Dose
RL	Risk Level
SIC	Source Industrial Code
STORET	STOrage RETrieval Database
SWMA	Storm Water Management Authority
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USF&WS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation

WCR	Water Consumption Rate
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

1.0 Executive Summary

Camp Branch is part of the Village Creek watershed located in the Black Warrior River basin in Jefferson County, Alabama. The Camp Branch watershed drains 5.6 square miles at its confluence with Bayview Lake (HUC AL/03160111-140_03). Forested land use activities dominate the small watershed.

Camp Branch (HUC AL/03160111-140_01) has been included on the State of Alabama's §303(d) list of impaired waters since 1996. This segment has been listed as impaired due to metals, pH, siltation, and other habitat alterations. These impairments are attributed to abandoned surface and subsurface mining, abandoned mine and mill tailings, and landfills. The use classification of Camp Branch is Fish and Wildlife (F&W).

This report presents the results of a Total Maximum Daily Load (TMDL) development for Camp Branch. Based on the assessment of all available physical, chemical, and biological data, ADEM determined that certain metals are not causing a water quality use impairment for this stream segment (Table 1-1). Therefore, a metals TMDL was developed where "more recent or accurate data" demonstrate that waterbodies are meeting water quality standards and EPA approved a delisting in July 2003. As shown in Tables 1-2 and Table 1-3, TMDLs were conducted for Camp Branch where recently collected data confirmed impairment.

Table 1-1 Delisting Decision for Pollutants in the Camp Branch Watershed

Impaired Segment	Pollutant	Decision
Camp Branch AL/03160111_140-01	Metals	DELISTING

Table 1-2 pH TMDLs for the Camp Branch Watershed HUC AL/03160111_140

Impaired Segment	Cause	WLA (Continuous Sources)	WLA (Stormwater Sources)(1)	LA (Stormwater Sources)	MOS	TMDL
Camp Branch AL/03160111-140_01	pH	6.0-8.5 s.u.	6.0-8.5 s.u.(1)	6.0-8.5 s.u.	N/A(2)	6.0-8.5 s.u.

(1) As per EPA Office of Water's TMDL Policy Memo dated November 22, 2002, NPDES-regulated stormwater sources may be controlled using best management practices (BMPs). Where effluent limits are specified as BMPs, the permit should also specify the monitoring necessary to assess if the expected load reductions attributed to BMP implementation are achieved.

(2) A MOS was not considered necessary due to the TMDL being established equal to the pH water quality criterion.

Table 1-3 Siltation TMDLs and Reductions Necessary to Meet the TMDL in the Camp Branch Watershed HUC AL/03160111_140

Impaired Segment	Area (acres)	Existing Loads			Allowable Loads			Reduction			TMDL
		WLA (Continuous Sources)	WLA(1) (Stormwater Sources)	LA	WLA (Continuous Sources)	WLA(1) (Stormwater Sources)	LA	WLA (Continuous Sources)	WLA(1) (Stormwater Sources)	LA	
Camp Branch AL/03160111_140-1	3,562	NA	964 lb/acre/yr	964 lb/acre/yr	NA	279 lb/acre/yr	279 lb/acre/yr	NA	71%	71%	499 tons/yr

(1) NPDES regulated stormwater discharges include and may not be limited to construction activities, mining activities, and MS4 discharges.

2.0 Basis for the §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] requires states to identify waterbodies which are not meeting water quality criteria applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. TMDLs for all pollutants resulting in violations of applicable water quality criteria are established for each identified waterbody. Such loads are established at levels necessary to implement the applicable water quality criteria with seasonal variations and margins of safety. The TMDL process establishes allowable loading of pollutants (or other quantifiable parameters 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 from both point and nonpoint sources and to restore and maintain the quality of their water resources (EPA, 1991).

Camp Branch was added to the §303(d) list based on data collected for the 1988 §305(b) Report to Congress. Site visits and data collected by ADEM between 1986 and 1991 identified impairments to this segment in the Black Warrior River basin. Table 2-1 describes the designated uses and causes as they appear on the 2000 §303(d) list.

Table 2-1 2000 §303(d) Impaired Segments in the Camp Branch Watershed AL/03160111_140-01

Waterbody Name (ID)	Use Classification	Causes of Impairment	Sources of Impairment	Size (Miles)	Downstream/ Upstream Locations
Camp Branch (03160111_140-01)	Fish and Wildlife	Metals pH Siltation Other Habitat Alterations	Surface Mining-abandoned Subsurface Mining-abandoned Mill Tailings-abandoned Mine Tailings-abandoned Landfills	10	Bayview Lake/ its Source

In 1989, in response to requirements of Section 319 of the Federal Water Pollution Control Act, Alabama published its Nonpoint Source Assessment Report. Because nonpoint source stream studies had not been completed in most states, including Alabama, prior to the implementation of the 319 Program, assessments were based on a combination of existing water quality data and an evaluation process.

The 1989 Nonpoint Source Assessment Report, which outlined the status of waterbodies thought to be threatened or impaired by nonpoint sources of pollution, was prepared using a cooperative approach to evaluate and identify waters of concern. This was accomplished by using a combination of efforts that included a questionnaire, a series of public meetings held throughout the state and anecdotal information derived from a combination of sources. ADEM, in cooperation with USDA, prepared a nonpoint source questionnaire that was submitted to a comprehensive list of agencies, organizations and groups identified as having an interest or involvement in water quality issues. Results of the questionnaire were then combined with information obtained from Soil & Water Conservation Districts and placed in a database developed to prioritize segments. Other information used to develop the Assessment Report included anecdotal information obtained through the public meeting process and through agency contacts as well as personal knowledge of water quality issues by ADEM staff.

The majority of waterbodies listed in the 1989 Assessment Report were identified based on evaluations rather than actual water quality monitoring data. These evaluations were based on knowledge of complaints, fish kills, discharge monitoring report violations, and best professional judgment determinations. It should be noted that ADEM's intent of the 1989 Assessment Report was not to deny or confirm that waters of the State failed to meet applicable water quality standards. Rather, inclusion of waterbodies in the 1989 Report constituted reference to impairment, threat, or special concern related to Nonpoint Source activities. Subsequently, ADEM could use the information to effectively monitor and address the aforementioned concerns. However, some segments incorporated into Alabama's 303(d) List from the 1989 Nonpoint Source Assessment Report may have been inadvertently included on the 303(d) list prior to full documentation of support status (ADEM, 2002).

The TMDLs presented are consistent with a phased-approach; estimates are made of needed pollutant reductions, load reduction controls are implemented and water quality is monitored for plan effectiveness. Control actions may affect the loads of various pollutants. Flexibility is built into the plan so that load reduction targets and control actions can be reviewed and modified accordingly if monitoring indicates continuing water quality problems or improvement in water quality is occurring.

2.2 Problem Definition

Camp Branch drains a historic mining area of Edgewater, Alabama to Bayview Lake. This 10-mile §303(d) listed segment flows through Edgewater Mine/Exum Solid Waste Facility and is lined with abandoned mine tailings. The 5.6 square mile drainage area has been listed as impaired due to metals, pH, siltation and other habitat alterations from abandoned mining activities. As previously mentioned, EPA approved a metals delisting in July 2003.

Waterbody Impaired:	Camp Branch; from Bayview Lake to Its Source
Pollutant(s) of Concern:	pH, Siltation and Other Habitat Alterations
Water Use Classification:	Fish and Wildlife

Camp Branch is classified as Fish and Wildlife. Usages of waters in this classification are described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), (d), and (e). The usages are described below:

(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 from 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 criteria of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

(e) Specific criteria:
1. Sewage, industrial wastes, or other wastes: none, which are not effectively treated in accordance with Rule 335-6-10-.08.
2. pH: sewage, industrial wastes or other wastes shall not cause pH to deviate more than one unit from the normal or natural pH, nor be less than 6.0, nor greater than 8.5.
5. Toxic substances attributable to sewage, industrial wastes, or other wastes: only such amounts, whether alone or in combination with other substances, as will not exhibit acute toxicity or chronic toxicity, as demonstrated by effluent toxicity testing or by application of numeric criteria given Rule 335-6-10-.07, to fish and aquatic life, including shrimp and crabs in estuarine and salt waters; or unreasonably affect the aesthetic value of waters for any use under this classification.

The State has established a narrative criterion to maintain the biological integrity of waters of the State of Alabama where numerical criteria have not been established (ADEM 335-6-10-.06 (a) & (c)). Alabama's Water Quality Program does not include numerical water quality criteria for aquatic life protection due to sediment. However, ADEM uses its narrative criteria as shown in ADEM Rule 335-6-10-.06 to address impairments of this nature. ADEM and EPA guidance documents are used to establish numerical targets for the purposes of developing TMDLs.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

Alabama has defined water quality criteria as a numeric concentration or as a narrative statement representing a quality of water that meets the designated use. The TMDLs addressed in this report will include both of the aforementioned criteria.

3.1.1 pH Criteria

The pH criteria for Fish and Wildlife classified streams cannot be greater than 8.5 standard units nor less then 6.0 standard units. Since this criteria is not based on a concentration, the criteria were targeted.

3.1.2 Siltation and Other Habitat Alterations Criteria

Biological assessment data is used in combination with other physical and chemical data or information to arrive at an overall use support determination for siltation. Use support determinations for the State of Alabama's §303(d) list are made with the following guidelines for interpretation of biological data:

- Fully Supporting - Macroinvertebrates determined to be Excellent (Unimpaired), Good (Slightly Impaired), and Fair (Moderately Impaired) rating if Chemical/Physical/Field Data indicates compliance.
- Partial Supporting - Macroinvertebrates determined to be Fair (Moderately Impaired) and Chemical/Physical/Field Data indicates impairment.
- Not Supporting - Macroinvertebrates determined to be Poor (Severely Impaired) and Chemical/Physical/Field Data indicates impairment.

Alabama's water quality standards do not include numerical water quality criteria for aquatic life protection due to sediment. Narrative criteria are considered to maintain the biological integrity of the waters of the State of Alabama. Therefore, it is necessary to develop numerical targets based upon this narrative criterion for Camp Branch.

A numerical target for siltation on Camp Branch was established through the use of an Ecoregion reference watershed within the Tennessee River basin that reflects similar conditions within the listed segment, and that has been determined through biological assessment to be unimpaired. As the impairment of biological integrity is generally a long-term process of sediment build up, the use of the Sediment Tool, described in Section 4.1, to determine annual average loading conditions through the Universal Soil Loss Equation (USLE) is appropriate for developing numerical targets in reference watersheds, as well as determining existing loads and reductions in nonpoint source loads to the system. Baseline annual average loading conditions, numerical targets, are defined using a reference watershed.

3.2 Data Availability and Analysis

A wide range of data and information were used to characterize the watershed and instream conditions. The categories of data used include physiographic data that describe the physical conditions of the watershed, environmental monitoring data that identify potential pollutant sources and their contribution, and instream water quality monitoring data.

Instream water quality data are necessary to evaluate impairment and characterize watershed loads. Two collections of water chemistry samples have been made on Camp Branch since 1990. USX Corporation collected water quality samples in 1993-1994. As part of ADEM's §303(d)

Monitoring Program, data was collected in 2001 and 2002. Figure 3-1 illustrates the location of water quality stations utilized in the development of TMDLs presented in this report. Various data types and sources are listed in Table 3-1.

Table 3-1 Data Utilized in TMDL Development

Data Category	Description	Source(s)
Watershed Physiographic	Landuse – 1992 MRLC	USGS
	National Elevation Data-30 x 30 meter grid	USEPA
	National Hydrography Database Reach Network	USGS
	Level IV Ecoregion Coverage	ADEM, USEPA and NRCS
Environmental Monitoring	NPDES Permits	ADEM
	Discharge Monitoring Reports	ADEM
	303(d) Listed Waters	ADEM
	Water Quality Monitoring Data	ADEM, USEPA, USGS, B'ham SWMA, AWW, and STORET

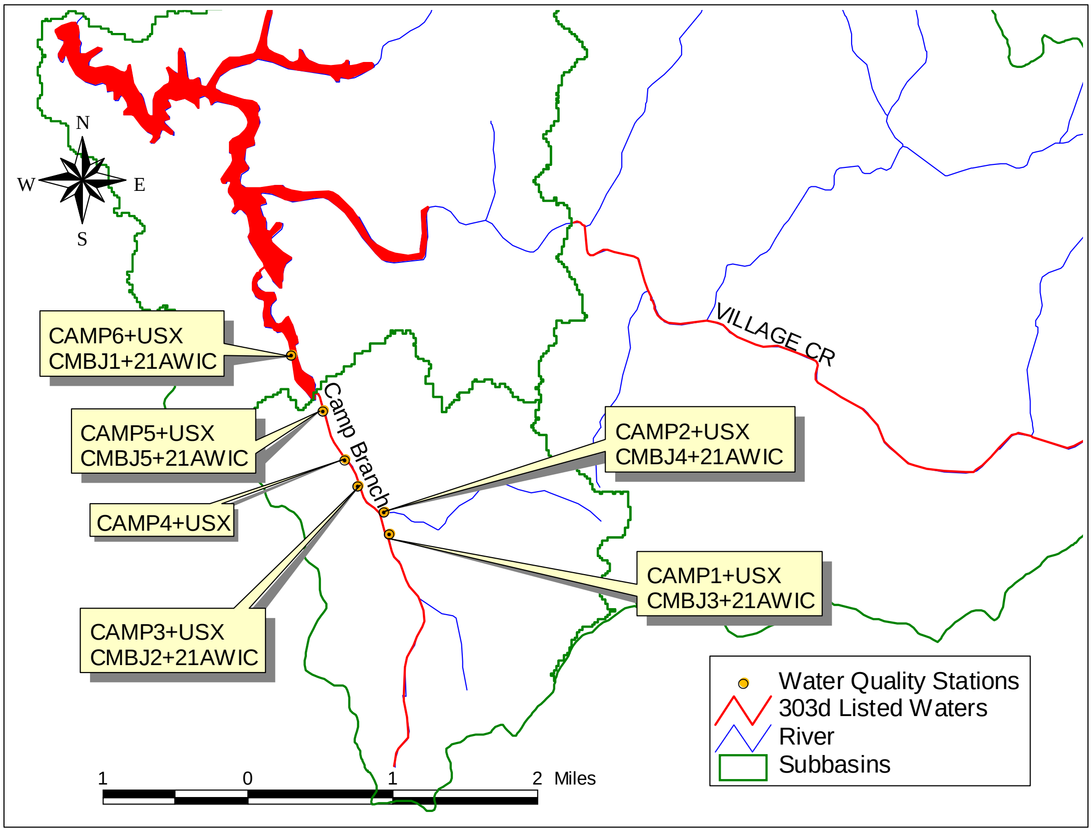

Figure 3-1 Water Quality Stations on the Impaired Segment of Camp Branch

3.2.1 pH

pH measured in Camp Branch during 2002 indicates consistent violations of the State criteria (Figure 3-2). These low measurements are consistent with areas affected by acid mine drainage due to historic activities.

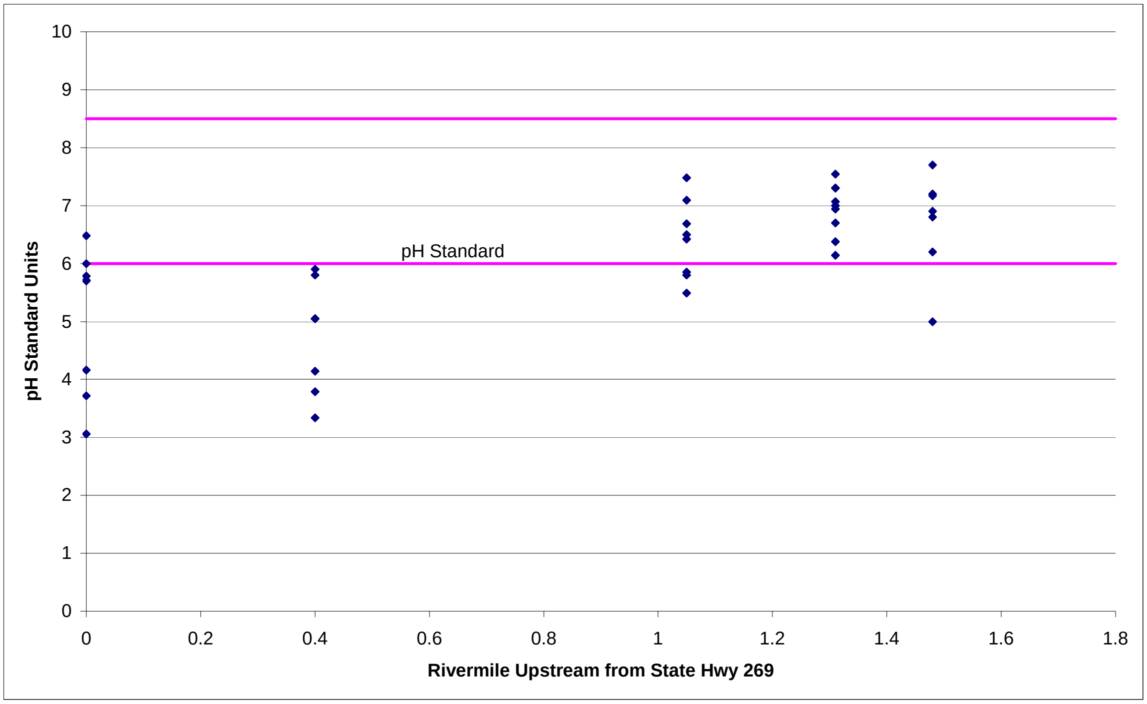

Figure 3-2 pH Measured on Camp Branch (ADEM, 2002)

3.2.2 Siltation and Other Habitat Alterations

ADEM performed macroinvertebrate and habitat assessments on two locations of Camp Branch in 2002. Assessments conducted at CMBJ3, Mulga Loop Rd., and CMBJ4, East Loop, received "good" and "excellent" habitat evaluations, but "poor" and "fair" macroinvertebrate assessments.

3.2.3 Special Studies

In 1993 and 1994 water quality samples were collected by the USX Corporation, in Camp Branch to determine the effectiveness of a wetland treatment system. Edgewater Mine/Exum Solid Waste Facility proposed a Demonstration Wetland Treatment System to remove metals from the water column. Sampling in the two years that followed this report was used to determine the effectiveness of the treatment system (USX, 1992). The current state of these activities is unknown.

3.3.1 Source Assessment

TMDL evaluations examine the known potential sources of pollutants in the watershed including point sources, nonpoint sources and background levels. For the purpose of these TMDLs, facilities permitted under the National Pollutant Discharge Elimination System (NPDES) Program are considered point sources. The source assessment was used as the basis of the TMDL allocations.

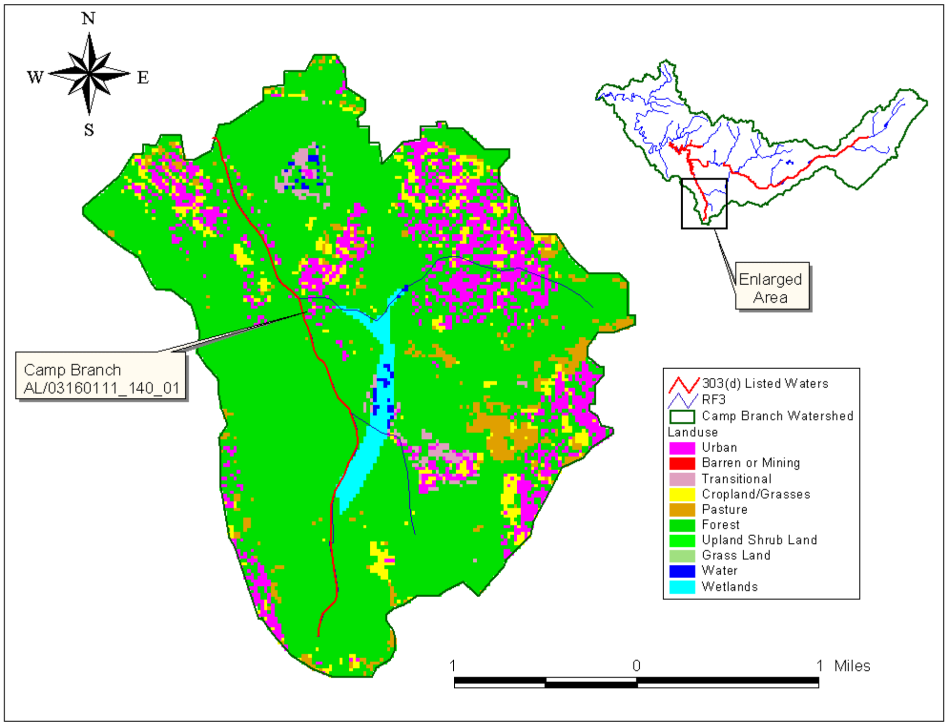

Figure 3-3 Landuse Map of the Camp Branch Watershed

Table 3-2 Landuse Characteristics within the Camp Branch Watershed

Landuse Classification	Percent of Watershed
Open Water	<1%
Low Intensity Residential	8.5%
High Intensity Residential	1.2%
High Intensity Commercial/Industrial/Transportation	1.6%
Quarries/Strip Mines/Gravel Pits	<<1%
Transitional	1.2%
Forest	76%
Pasture/Crops/Other Grasses (Urban/recreational; e.g. parks, lawns)	8.6%
Wetlands	2.1%

3.3.1 Nonpoint Sources

A landuse map of the Camp Branch watershed is presented in Figure 3-3. The predominant landuse within the watershed is forest, totaling 76 percent of the watershed. Table 3-2 lists landuse percentages determined from the 1992 Multi-Resolution Land Characteristics (MRLC) map. Each landuse type has the potential to contribute some sediment load during storm water runoff events.

The riverbanks of Camp Branch are lined with revegetated, historic mine tailings. The historic impacts of mining are a significant factor to impaired water quality, though current mining activities are much less than one percent of the area in the MRLC. High concentrations of hardness also influence the toxicity of metals and pH. The concentrations of calcium carbonate ($CaCO_3$), measured by hardness in mg/L, are elevated in this region because of the presence of shale and limestone. Camp Branch is in the Shale Hills (68f) Level IV Ecoregions (Omernik, 1995). Figure 3-4 illustrates the Village Creek watershed coverage for Ecoregions in the area draining to Bayview Lake, including Camp Branch.

The Shale Hills Ecoregion (68f), sometimes called the Warrior Coal Field, has more shale and less sandstone than 68e. The soils generally have silt loam surfaces rather than sandy loams and have a silty clay or clayey subsoil. Although it has the lowest elevations in Ecoregion 68, the surface features are characterized by extensive hills and mostly strongly sloping topography. The shale, siltstone, and sandstone are relatively impermeable, and streams do not have the base flow found in more permeable adjacent areas, such as 65i or 67f. The region is mostly forested, but coal mining is a major industry, and the extensive open-pit mines have altered the landscape, soils, and streams.

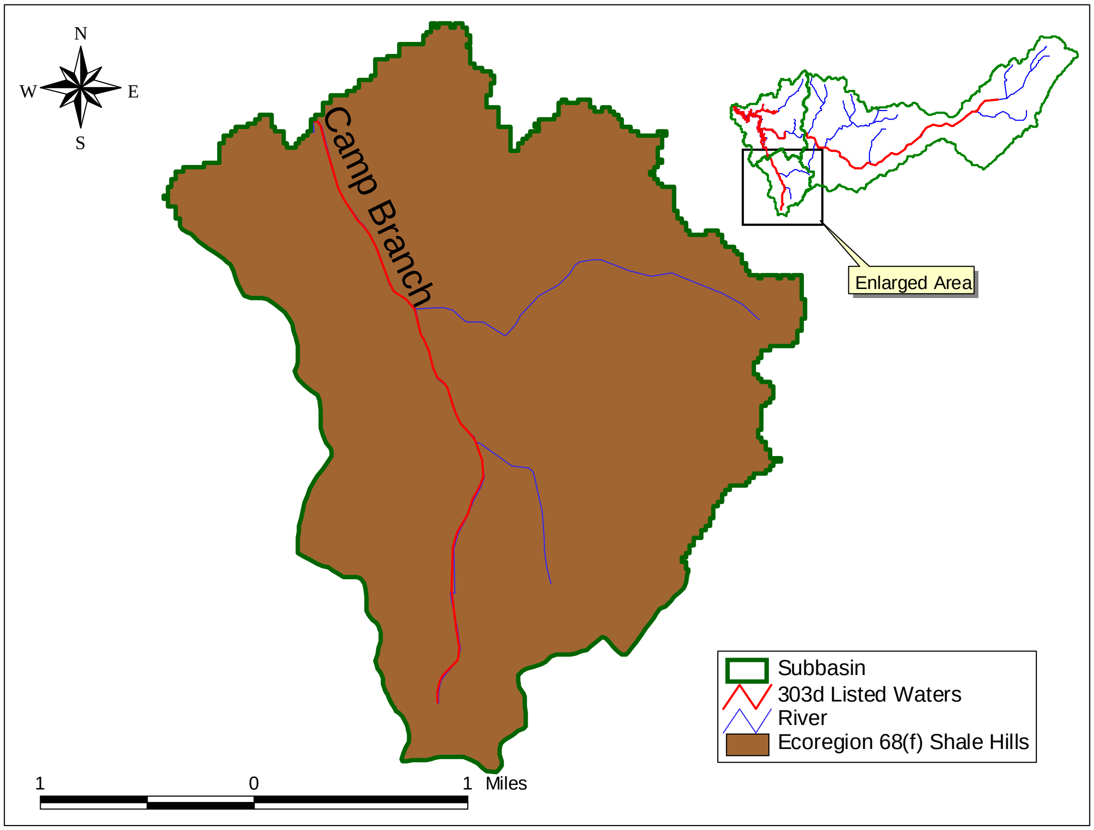

Figure 3-4 Ecoregions in the Village Creek Watershed including Camp Branch

3.3.2 Point Sources

ADEM maintains a database of current NPDES permits and GIS files that locate each permitted outfall. This database includes municipal, semi-public/private, industrial, mining, industrial storm water and concentrated animal feeding operations (CAFO) permits.

The entire Camp Branch watershed is within a Municipal Separate Stormwater System (MS4) permitted area. The Stormwater Phase I MS4 permit is also regulated by the NPDES program and considered a point source discharge. Other point source activities, such as NPDES construction permits, that are stormwater discharges will be included in the stormwater allowable load.

4.0 Model Development

Establishing the relationship between instream water quality and source loading is an important component of TMDL development. It allows the determination of the relative contribution of sources to total pollutant loading and the evaluation of potential changes to water quality resulting from implementation of various management options. This relationship can be developed using a variety of techniques ranging from qualitative assumptions based on scientific principles to numerical computer modeling. In this section, the WCS Sediment Tool developed to quantify the sediment load from landuse activities in the Camp Branch watershed will be described.

4.1 The Sediment Tool

The WCS Sediment Tool was utilized for analyzing sediment loading to the Camp Branch listed segment and for determining the control watershed loading value. The Sediment Tool incorporates the USLE equation and sediment delivery to estimate sediment load to streams based on landuse activities and best management practices, BMPs.

4.1.1 Universal Soil Loss Equation

The Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith, has remained the most widely accepted and utilized soil loss equation for over 30 years. Designed as a method to predict average annual soil loss caused by sheet and rill erosion, the USLE is often criticized for its lack of applications. While it can estimate long-term annual soil loss and guide conservationists on proper cropping, management, and conservation practices; it cannot be applied to a specific year or a specific storm. The USLE is mature technology and enhancements to it are limited by the simple equation structure. However, based on its long history of use and wide acceptance by the forestry and agriculture communities, it was selected as an adequate tool for estimating long-term annual soil erosion, for evaluating the impacts of landuse changes and the benefits of various Best Management Practices (BMP).

The Sediment Tool, which incorporates the USLE equation, is an extension of the Watershed Characterization System (WCS). For more detailed information on WCS, refer to the WCS User's Manual. The Sediment Tool can be used to perform the following tasks:

- Estimate extent and distribution of potential soil erosion in the watershed,
- Estimate potential sediment delivery to receiving waterbodies,
- Evaluate effects of landuse, BMP, and road network on erosion and sediment delivery.

Soil loss from sheet and rill erosion is mainly due to detachment of soil particles during rainfall. It causes the majority of soil loss in crop production, grazing areas, construction sites, mine sites, logging areas and unpaved roads. The magnitude of soil erosion is normally estimated through the use of the USLE. The USLE equation is a multiplicative function of crop and site specific factors that represent rainfall erosivity *(R)*, soil erodibility *(K)*, soil slope *(S)*, slope length *(L)*, cropping or conservation management practices *(C)* and erosion control practices *(P)*. The *R* factor describes the kinetic energy generated by the frequency and intensity of rainfall. The *K* factor represents the susceptibility of soil to erosion (i.e. soil detachment). The *L* and *S* factors represent the effect of slope length and slope steepness on erosion, respectively. The *C* factor represents the effect of plants, soil cover, soil biomass and soil disturbing activities on erosion including crop rotations, tillage and residue practices. Finally, the *P* factor represents the effects of conservation practices such as contour farming, strip cropping and terraces. The USLE equation for estimating average annual soil erosion is:

$$A = R \times K \times LS \times C \times P$$

where: A = average annual soil loss in t/a (tons per acre)
R = rainfall erosivity index
K = soil erodibility factor
LS = topographic factor - L is for slope length and S is for slope
C = cropping factor
P = conservation practice factor

Evaluating the factors in USLE:

R - the rainfall erosivity index

Most appropriately called the erosivity index, it is a statistic calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30-minute intensity. As expected, it varies geographically.

K - the soil erodibility factor

This factor quantifies the cohesive or bonding character of a soil type and its resistance to dislodging and transport due to raindrop impact and overland flow.

LS - the topographic factor

Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. Thus, both result in increased erosion potential, but in a non-linear manner. For convenience, *L* and *S* are frequently lumped into a single term.

C - the crop management factor

This factor is the ratio of soil loss from land cropped under specified conditions to corresponding loss under tilled continuous fallow conditions. The most computationally complicated of USLE factors, it incorporates effects of tillage management (dates and types), crops, seasonal erosivity index distribution, cropping history (rotation) and crop yield level (organic matter production potential).

P - the conservation practice factor

Practices included in this term are contouring, strip cropping (alternate crops on a given slope established on the contour) and terracing.

Appropriate values for USLE parameters should be provided for each management activity. Literature values are available, but site-specific values should be used when available. Estimates of the USLE parameters, and thus the soil erosion as computed from the USLE equation, are provided by the Natural Resources Conservation Service’s National Resources Inventory (NRI) 1994. The NRI database contains information of the status, condition and trend of soil, water and related resources collected from approximately 800,000 sampling points across the country.

Soil loss from gully erosion occurs in sloping areas mainly as a result of natural processes. Farming practices such as livestock grazing exacerbates it. The deepening of rill erosion causes gullies. The amount of sediment yield from gully erosion is generally less than that caused by sheet and rill erosion. Sheet and rill erosion relates to the flow of water over sediments and the resultant small rills formed as sheet flow erodes the material. There are no exact methods or equations to quantify gully erosion, but Dunne and Leopold (1978) provide percent sediment yield estimates for various regions of the country. In a small grazed catchment near Santa Fe, New Mexico, gully erosion was found to contribute only 1.4 percent of the total sediment load as compared to sheet erosion and rain splash, which contributed 97.8 percent of the sediment load. Dunne and Leopold report that in most cases (nationally and internationally) gully erosion contributes less than 30 percent of the total sediment load, although the percentages have ranged from zero to 89 percent contribution (Dunne and Leopold, 1978).

The soil losses from the erosion processes described above are localized losses and not the total amount of sediment that reaches the stream. The fraction of the soil lost in the field that is eventually delivered to the stream depends on several factors. These include the distance of the source area from the stream, the size of the drainage area and the intensity and frequency of rainfall. Soil losses along the riparian areas will be delivered into the stream with runoff-producing rainfalls.

4.1.2 Sediment Analysis

Watershed sediment loads for selected watersheds were determined by use of the USLE and available GIS coverage. The Sediment Tool produces the following outputs:

- Source Erosion and Sediment Delivery
- Road Erosion and Sediment Delivery

The Sediment Tool is also able to evaluate default scenarios by, for example, changing landuses and BMPs. The following are some of the parameters that may be altered:

- C and P Lookup values
- Landuse Change Layer
- BMP Layers
- Add/Delete Roads
- Create Road Control Structure Layer

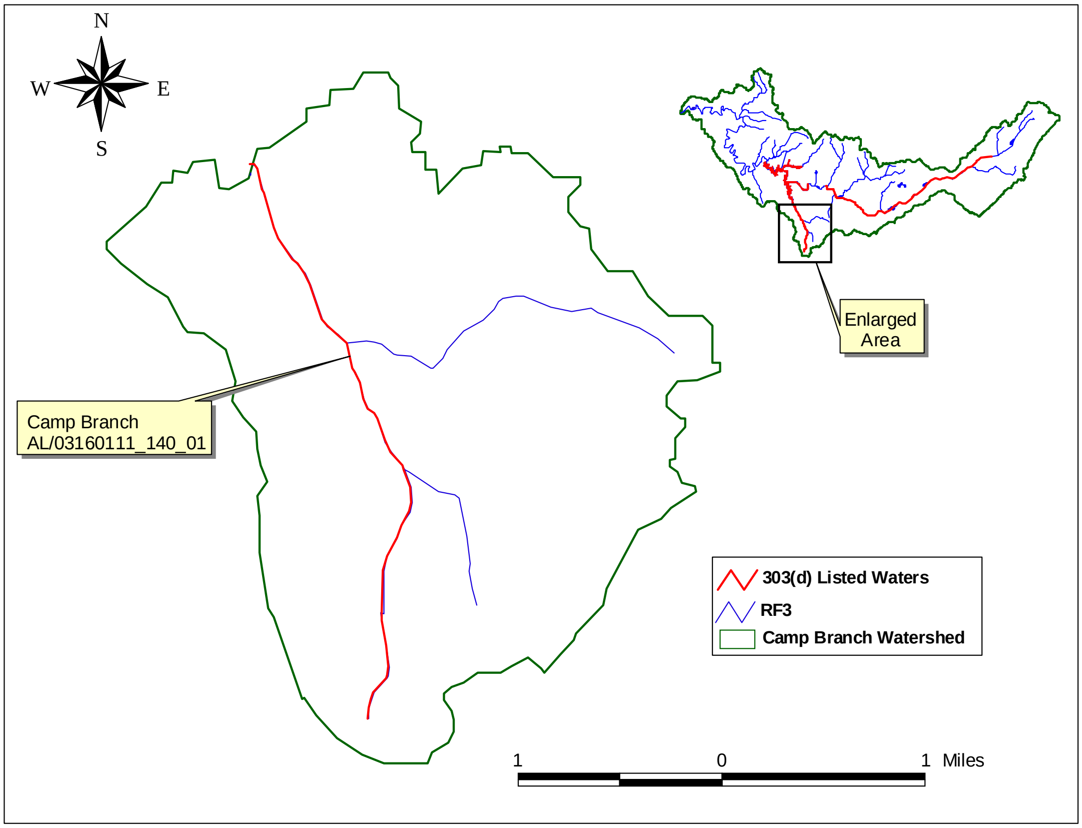

Figure 4-1 RF3 Utilized in Camp Branch Sediment Model

Sediment analysis can be performed for a single watershed, as well as multiple watersheds. For TMDL development purposes, the Sediment Tool was used for developing relative impacts between impaired segments and relatively unimpaired reference watersheds.

4.1.3 Sediment Modeling Methodology

Watersheds of interest are first delineated. Stream grids for each delineated watershed, based on the Digital Elevation Maps (DEM) data, is created so that the stream matches the elevation (i.e. the stream corresponds to the lower elevations in the watershed). The system uses this threshold to determine whether a particular cell within the watershed area delivers load to a corresponding stream segment. Grid cells having flow accumulation values higher than the threshold will be considered as part of the stream network. The RF3 stream network is used as a reference or basis of comparison to obtain the desired stream density. Figure 4-1 presents the present RF3 stream network used throughout the Camp Branch watershed. A stream grid corresponding to a stream network that has fifty 30x30 meter headwater cells is the default.

For each 30x30 meter grid cell, the potential erosion based on USLE and potential sediment delivery to the stream network is estimated. The potential erosion from each cell is calculated using the USLE and the sediment delivery to the stream network is calculated using one of four available sediment delivery equations.

-Distance-based equation (Sun and McNulty, 1998)

$$Md = M * (1-0.97 * D/L)$$

where: Md = mass moved (tons/acre/yr)
M = sediment mass eroded (ton)
D = least cost distance from a cell to the nearest stream grid (ft)
L = maximum distance the sediment may travel (ft)

-Distance Slope-based equation (Yagow et al., 1998)

$$DR = \exp(-0.4233 * L * Sf)$$
$$Sf = \exp(-16.1 * r/L + 0.057)) - 0.6$$

where: DR = sediment delivery ration
L = distance to the stream (m)
r = relief to the stream (m)

-Area-based equation (USDASCS, 1983)

$$DR = 0.417762 * A^{(-0.134958)} - 1.27097, \quad DR <= 1.0$$

where: DR = sediment delivery ratio
A = area (sq miles)

-WEPP-based regression equation (Swift, 2000)

$$Z = 0.9004 - 0.1341 * X^2 + X^3 - 0.0399 * Y + 0.0144 * Y^2 + 0.00308 * Y^3$$

where: Z = percent of source sediment passing to the next grid cell
X = cumulative distance downslope (X > 0)
Y = percent slope in the grid cell (Y > 0)

The distance slope based equation (Yagow et al., 1998) was selected to simulate sediment delivery in the Camp Branch watershed. USLE parameters applied to the Camp Branch watershed are summarized in Table 4-1.

The sediment analysis provides the calculations for the following six new parameters:

- Source Erosion – estimated erosion from each grid cell due to the land cover,
- Road Erosion – estimated erosion from each grid cell representing a road,
- Composite Erosion – composite of the source and road erosion layers,
- Source Sediment – estimated fraction of the soil erosion from each grid cell that reaches the stream (sediment delivery),
- Road Sediment – estimated fraction of the road erosion from each grid cell that reaches the stream, and
- Composite Sediment – composite of the source and erosion sediment layers.

The sediment delivery can be calculated based on the composite sediment, road sediment or source sediment layer. The sources of sediment by each landuse type is determined showing the types of landuse, the acres of each type of landuse and the tons of sediment estimated to be generated from each landuse.

4.1.4 Sediment Analysis Inputs

A number of data layers must be available before conducting a sediment analysis. These include the following:

- DEM (grid) – The DEM layers that come with the WCS distribution system are shape files and are of coarse resolution (300 m x 300 m). The user needs to import a DEM grid layer. A higher resolution DEM grid layer (30m x 30m) was downloaded from USGS web site or from a state's GIS data clearinghouse.
- Road – The road layer is needed as a shape file and requires additional attributes such as C (road type), P (road practice) and ditch (value of either 3 or 4, indicating presence or absence of side ditch, respectively). If these attributes are not provided, the Sediment Tool automatically assigns default values of road type 2 (secondary paved roads); ditch 3 (with ditch) and road practice 1 (no practices).
- Soil – The SSURGO (1:24k) soil data may be imported into the WCS project if higher-resolution soil data is required for the estimation of potential erosion. If the SSURGO soil database is not available, the system uses the STATSGO Soil data (1:250k) by default.
- Landuse – The Multi-Resolution Landuse Classification (MRLC) data are also used.
- Erosivity – Rainfall erosivity index is based on a rainfall index of the USA or can be calculated based on precipitation data.

Detailed maps of the model inputs to the Sediment Tool for Camp Branch are presented in Figures 3-3 and 4-2 through 4-5. Table 4-1 shows the sediment tool coefficients used in the model development.

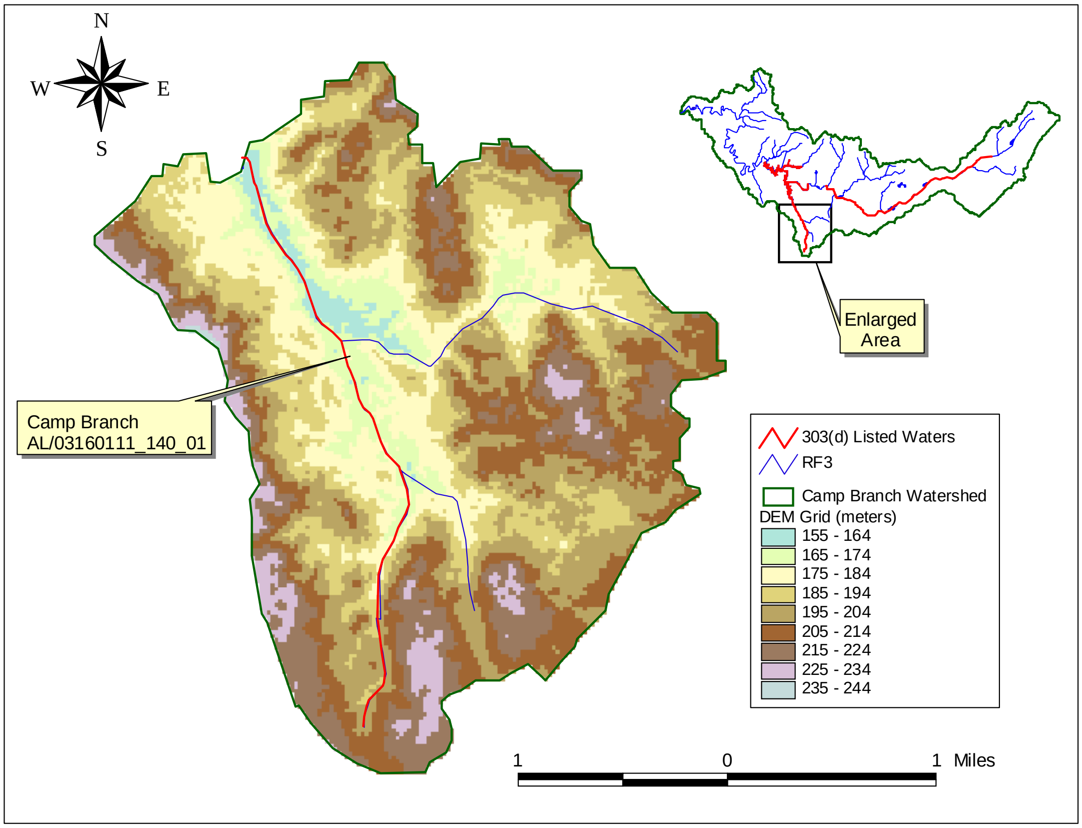

Figure 4-2 Camp Branch DEM Grid

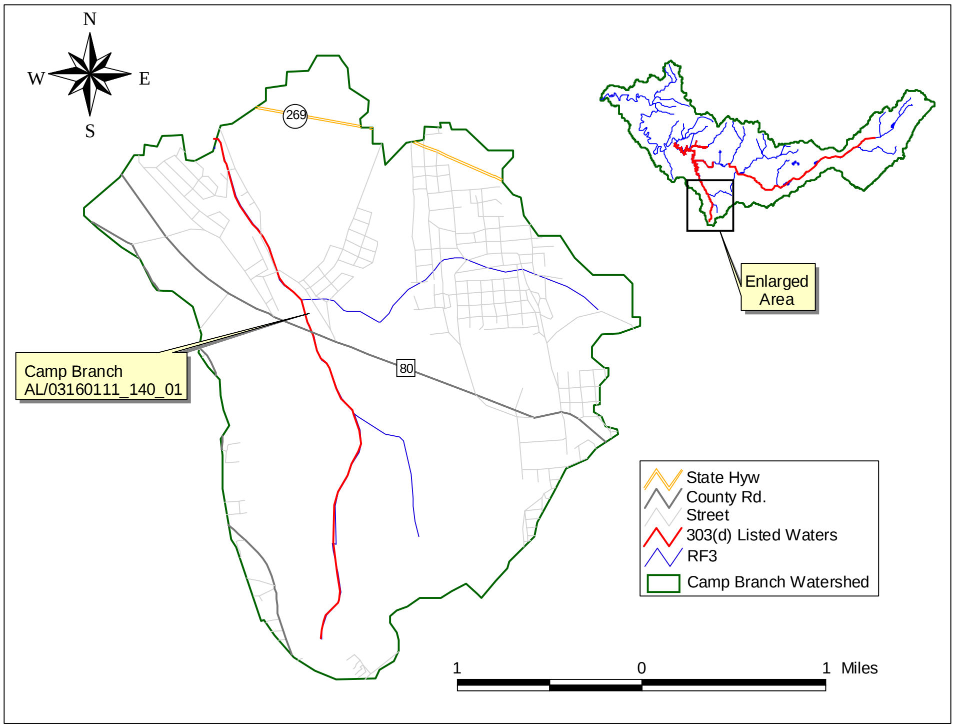

Figure 4-3 Camp Branch Roads

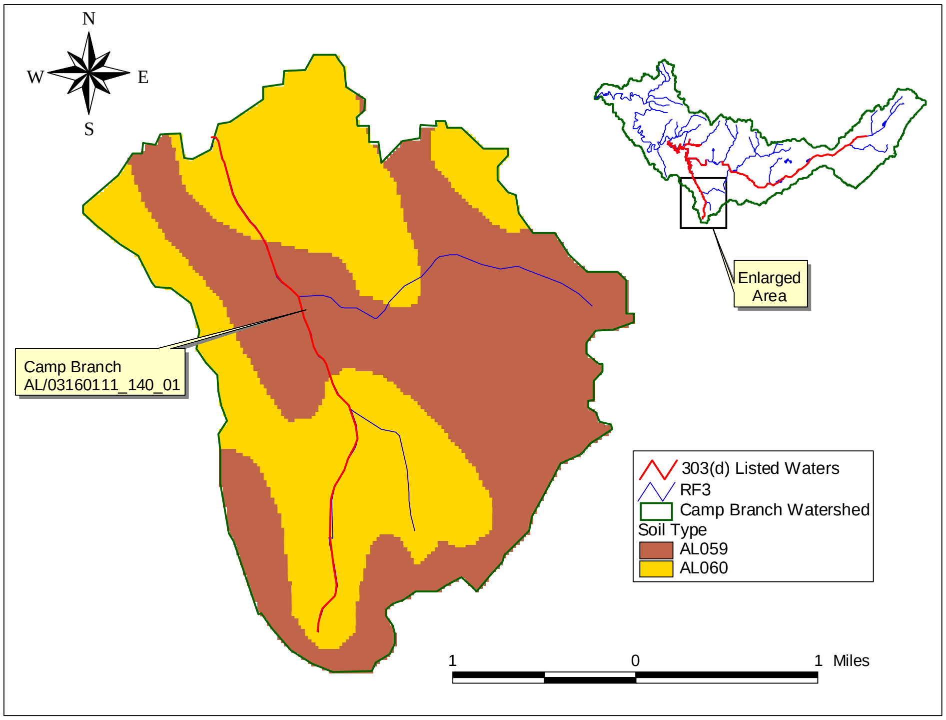

Figure 4-4 Camp Branch Soils

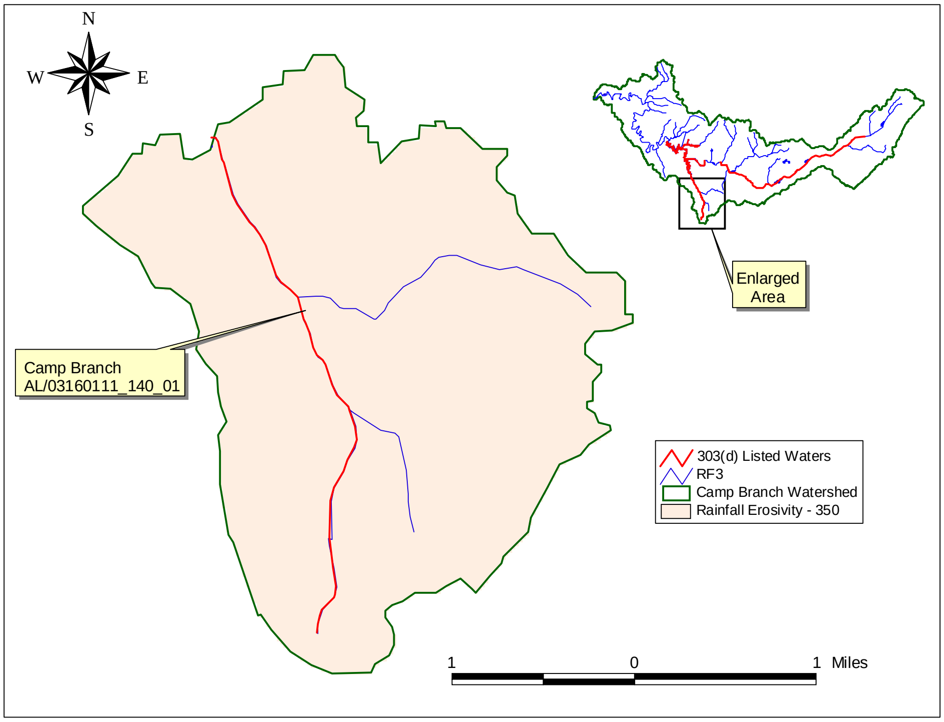

Figure 4-5 Camp Branch Erosivity

4.1.5 Sediment Load Development Methodology

For each watershed of interest, the "existing" long-term sediment loading was estimated via the USLE sediment analysis for Camp Branch and Bryant Creek, the reference site. The USLE is designed to predict average annual soil loss caused by sheet and rill erosion. While it can estimate long-term annual soil loss and provide guidance towards proper cropping, management and conservation practices, it cannot be applied to a specific year or a specific storm event.

Resultant sediment load calculations for each watershed are therefore expressed as long-term annual soil loss expressed in tons per year calculated for the *R* - the rainfall erosivity index, a statistic calculated from the annual summation of rainfall energy in every storm (correlated to raindrop size) times its maximum 30-minute intensity.

The watershed sediment load target is based on the long-term annual soil loss expressed in tons per year calculated for relatively unimpacted watersheds with demonstrated healthy biology and habitat. For initial sediment load development, consistent default parameters and inputs were used for each watershed. These include MRLC landuse data, the USGS DEM data, STASTGO soil information and watershed average *C* and *P* values for each landuse type. The USLE coefficients utilized within each of the listed segment watersheds are presented in Table 4-1.

Table 4-1 USLE Coefficients Utilized for Camp Branch

Watershed	LS Factor			K Factor			P Factor			C Factor			R Factor		
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
Camp Branch	0.08	6.48	1.05	0.29	0.31	0.3	1	1	1	0	0.02	0	350	350	350

To refine the sediment tool and calculated sediment loads, C and P values utilized within the modeling effort represent site-specific values as defined by the various counties. The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) was contacted to incorporate county *C*-factors in the sediment tool. These C-factors were dependent upon the dominant crop and crop management practices in each county. Site-specific (county) information was important in the determination of the source erosion in the watershed. According to the Jefferson County NRCS, few row crops exist in the county. C-factors were changed to representative values for pastures where the MRLC identified row crops. Although the use of county specific *C* and *P* values does represent use of actual data, these parameters have been developed through an evaluation of local crop management practices.

5.0 Development of Total Maximum Daily Load

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality criteria, in this case Alabama's water quality criteria for aquatic life. TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measures. TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

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

This section presents the TMDLs developed for Camp Branch (HUC AL/03160111-140_01).

5.1 Numeric Targets for TMDLs

EPA regulations define loading, or assimilative capacity, as the greatest amount of loading that a waterbody can receive without violating water quality standards (40 CFR Part 130.2(f)). As stated in Section 3.1, the numeric criteria and targets vary for each pollutant.

5.1.1 Linking pH Targets and Pollutant Sources

No load was targeted for pH because the water quality criterion is not based on a concentration. Instead, the pH criteria for Fish and Wildlife will be equal to the TMDL, between 6.0 standard units and 8.5 standard units for Camp Branch.

5.1.2 Linking Sediment and Other Habitat Alteration Targets and Pollutant Sources

Alabama's water quality criteria do not include numerical water quality criterion for aquatic life protection due to sediment. Instead, the State of Alabama's water quality criteria document (ADEM Admin. Code R. 335-6-10-06-(a) & (c)) provides a narrative criteria that establishes that biological integrity within the stream segment must be maintained.

In order to develop a numeric criterion that protects the designated use(s) of Camp Branch, a target annual average loading of sediment to the listed reach was determined. The target represents loading conditions within a reference watershed where physical conditions are similar and biological assessments have identified the waterbody as fully supporting its designated use(s). It has been determined that biological impairment of waterbodies due to excessive siltation is a long-term process and therefore the use of annual average loading conditions, as calculated through the Universal Soil Loss Equation (USLE), are appropriate as the TMDL target loading conditions.

Determining a reference watershed for the Camp Branch siltation TMDL was based upon Ecoregion reference site monitoring data as well as other biological monitoring data. A control site was established as least impacted with good biology and habitat within the Ecoregion, Shale Hills (68f) as discussed in Section 3.3.1.

Ideally, Ecoregion reference sites (or fully supporting sample sites) would be available for each of the Level IV Ecoregions in order to establish reference annual average loads that coincide with fully supporting segments. Under the "Water Quality Report to Congress" submitted in June 1996, upon which the 1996 §303(d) list was developed, applicable reference sites were only available for the Southern Table Plateaus (68d). This location was:

- Bryant Creek in (68d) – AL/06030001_180

No applicable reference site information, or fully supporting biological monitoring station was available for the Shale Hills Ecoregion. It is important that the biological evaluations utilized in the determination of the reference site conditions, coincide with the conditions upon which the site was listed in order to provide consistency with the methodology that established the 303(d) list being evaluated.

Based upon the limited data available under the 1998 listing conditions, reference site loading conditions were generalized for the Level IV Ecoregion according to the available reference site. The applicable annual average sediment load was then calculated using the methodology described in Section 4.0. The reference annual average unit load for each Ecoregion was then set at:

- Southwestern Appalachians (68) – 0.1396 tons/acre/year

5.2 Existing Conditions

5.2.1 pH

Camp Branch pH data collected in 2002 is consistently less than the minimum criteria, 6.0 standard units (Figure 3-2).

5.2.2 Siltation and Other Habitat Alterations

Using the sediment tool to establish sediment load from landuse activities in Camp Branch the existing annual load is 0.4818 tons/acre/year (Table 5-1).

Table 5-1 Camp Branch Existing Sediment Conditions from Landuse Activities

Watershed	Area		Road Erosion	Source Erosion	Composite Erosion	Road Sediment	Source Sediment	Composite Sediment	Unit Sediment	
	sq. miles	acres	(tons/year)	(tons/year)	(tons/year)	(tons/year)	(tons/year)	(tons/year)	tons/acre/year	lb/acre/year
Camp Branch	5.57	3,562	2,947	713	3,661	1390	326	1,716	0.48	964

5.3 Critical Conditions

5.3.1 pH

Critical conditions for pH exist at the headwaters of the watershed where hardness concentrations are low, decreasing the pH.

5.3.2 Siltation and Other Habitat Alterations

The critical condition for the siltation TMDL on Camp Branch is the storm water runoff events.

5.4 Margin Of Safety (MOS)

There are two methods for incorporating a MOS in the analysis: a) by implicitly incorporating the MOS using conservative model assumptions to develop allocations; or b) by explicitly specifying a portion of the TMDLs as the MOS and using the remainder for allocations.

5.4.1 pH

The pH TMDL for Camp Branch includes an implicit MOS for pH. The targets require that individual loads from point and nonpoint sources meet the pH target of 6.0 to 8.5. It is ADEM’s position that water quality standards in Camp Branch will be met if pH from both point and nonpoint source activities are consistent with the allocations in this TMDL. Therefore, an additional MOS was not necessary.

5.4.2 Siltation and Other Habitat Alterations

An implicit MOS was incorporated in the Camp Branch siltation TMDL through the use of conservative modeling assumptions. These included: target values based on subecoregion reference sites, which represent the most unimpacted streams with good habitat/biology in the subecoregion, the use of appropriate Ecoregion reference site average annual sediment loads as target values for the calculation of needed load reductions, and the use of the sediment delivery process that results in the most sediment transport to surface waters refers to Section 4.1.

5.5 Seasonal Variation

5.5.1 pH

The pH data for Camp Branch did not show a seasonal fluctuation. Violations of the criteria are measured in throughout the year. Therefore a seasonal variation was not necessary.

5.5.2 Siltation and Other Habitat Alterations

In the sediment tool approach for Camp Branch, the determination of sediment loads on an average annual basis accounts for these differences through the rainfall erosivity index in the USLE used in the Camp Branch TMDL. The rainfall erosivity index is a statistic calculated from the annual summation of rainfall energy in every storm and its maximum 30-minute intensity.

5.6 Wasteload Allocations

There are no facilities with continuous discharges that have individual NPDES permits in Camp Branch. The Camp Branch watershed has a stormwater NPDES permit for a MS4. The TMDL presents stormwater discharges as a reduction that equals the load reduction calculated for the watershed.

5.7 Load Allocations

Significant nonpoint source loads within the Camp Branch watershed are associated with acid mine drainage causing impairment to pH.

5.8 TMDL Results

5.8.1 pH

Since pH is not a load, but rather a measure of acidity and/or alkalinity of a given solution, this TMDL uses an *other appropriate measure* (40 CFR §130.2(i)) rather than an actual mass-per-unit time measure. For this TMDL, the State's numeric pH criterion of 6.0-8.5 s.u. is used as the TMDL target (*other appropriate measure*). Thus, the pH wasteload allocation (WLA) for this TMDL requires that effluent pH levels in current and future point sources shall be no less than 6.0 s.u. and no greater than 8.5 s.u. However, in accordance with EPA Office of Water's policy memorandum dated November 22, 2002, NPDES-regulated stormwater sources may be controlled using best management practices (BMPs).

Table 5-2 pH TMDLs for the Camp Branch Watershed HUC AL/03160111_140

Impaired Segment	Cause	WLA (Continuous Sources)	WLA (Stormwater Sources)(1)	LA (Stormwater Sources)	MOS	TMDL
Camp Branch AL/03160111-140_01	pH	6.0-8.5 s.u.	6.0-8.5 s.u.(1)	6.0-8.5 s.u.	N/A(2)	6.0-8.5 s.u.

(1) As per EPA Office of Water's TMDL Policy Memo dated November 22, 2002, NPDES-regulated stormwater sources may be controlled using best management practices (BMPs). Where effluent limits are specified as BMPs, the permit should also specify the monitoring necessary to assess if the expected load reductions attributed to BMP implementation are achieved.

(2) A MOS was not considered necessary due to the TMDL being established equal to the pH water quality criterion.

5.8.2 Siltation and Other Habitat Alterations

The WCS Sediment Tool was used to calculate the existing average annual sediment load for Camp Branch. The estimated existing average annual sediment load for Camp Branch was compared to the estimated existing average annual sediment load for the appropriate biologically healthy subwatershed to determine the percent reduction of sediment loading required to fully attain the Fish and Wildlife (F&W) designated use. The estimated percent reduction from the current load for Camp Branch is 71%, summarized in Table 5-2.

Table 5-3 Siltation TMDL in the Camp Branch Watershed HUC AL/03160111_140-01

Impaired Segment	Area (acres)	Existing Loads			Allowable Loads			Reduction			TMDL
		WLA (Continuous Sources)	WLA(1) (Stormwater Sources)	LA	WLA (Continuous Sources)	WLA(1) (Stormwater Sources)	LA	WLA (Continuous Sources)	WLA(1) (Stormwater Sources)	LA	
Camp Branch	3,562	NA	964	964	NA	279 lb/acre/yr	279	NA	71%	71%	499

AL/03160111_140-1			lb/acre/yr	lb/acre/yr			lb/acre/yr				tons/yr

(1) NPDES regulated stormwater discharges include and may not be limited to construction activities, mining activities, and MS4 discharges.

6.0 TMDL Implementation

6.1 Nonpoint Source Approach

The listed segments within the Camp Branch watershed are primarily impaired by nonpoint sources. For 303(d) listed waters impaired solely or primarily by nonpoint source pollutants, necessary reductions will be sought during TMDL implementation using a phased approach. Voluntary incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired water. Cooperation and active participation by the general public and various industrial, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. Therefore, TMDL implementation activities will be coordinated through interaction with local entities in conjunction with Clean Water Partnership efforts.

The primary TMDL implementation mechanism used will employ concurrent education and outreach, training, technology transfer and technical assistance with incentive-based pollutant management measures. The ADEM Office of Education and Outreach (OEO) will assist in the implementation of TMDLs in cooperation with public and private stakeholders. Planning and oversight will be provided by or coordinated with the Alabama Department of Environmental Management’s Section 319 nonpoint source grant program in conjunction with other local, state and federal resource management and protection programs and authorities. The CWA Section 319 grant program may provide limited funding to specifically ascertain NPS pollution sources and causes, identify and coordinate management programs and resources, present education and outreach opportunities, promote pollution prevention, and implement needed management measures to restore impaired waters.

Depending on the pollutant of concern, resources for corrective actions may be provided, as applicable, by the Alabama Cooperative Extension System (education and outreach); the USDA-Natural Resources Conservation Service (NRCS) (technical assistance) and Farm Services Agency (FSA) (federal cost-share funding); and the Alabama Soil and Water Conservation Committee (state agricultural cost share funding and management measure implementation assistance) through local Soil and Water Conservation Districts, or Resource Conservation and Development Councils (funding, project implementation, and coordination). Additional assistance from such agencies as the Alabama Department of Public Health (septic systems), Alabama Department of Agriculture and Industries (pesticides), and the Alabama Department of Industrial Relations and Department of Interior - Office of Surface Mining (abandoned minelands), Natural Heritage Program and U.S. Fish and Wildlife Service (threatened and endangered species), may also provide practical TMDL implementation delivery systems, programs, and information. Landuse and urban sprawl issues will be addressed through the Nonpoint Source for Municipal Officials (NEMO) education and outreach program. Memorandums of Agreements (MOAs) may be used as a tool to formally define roles and responsibilities.

Additional public/private assistance is available through the Alabama Clean Water Partnership (CWP) Program. The CWP program uses a local citizen-based environmental protection approach to coordinate efforts to restore and protect the state's resources in accordance with the goals of the Clean Water Act. Interaction with the state or river basin specific CWP will facilitate TMDL implementation by providing improved and timely communication and information exchange between community-based groups, units of government, industry, special interest groups, and individuals. The CWP can assist local entities to plan, develop, and coordinate restoration strategies that holistically meet multiple needs, eliminate duplication of efforts and allow for effective and efficient use of available resources to restore the impaired waterbody or watershed.

Other mechanisms that are available and may be used during implementation of these TMDLs include local regulations or ordinances related to zoning, landuse, or storm water runoff controls. Local governments can provide funding assistance through general revenues, bond issuance, special taxes, utility fees and impact fees. If applicable, reductions from point sources will be addressed by the NPDES permit program. The Alabama Water Pollution Control Act empowers ADEM to monitor water quality, issue permits, conduct inspections and pursue enforcement of discharge activities and conditions that threaten water quality. In addition to traditional "end-of-pipe" discharges, the ADEM NPDES permit program addresses animal feeding operations and land application of animal wastes. For certain water quality improvement projects, the State Clean Water Revolving Fund (SRF) can provide low interest loans to local governments.

Long-term physical, chemical, and biological improvements in water quality will be used to measure TMDL implementation success. As may be indicated by further evaluation of stream water quality, the effectiveness of implemented management measures may necessitate revisions of these TMDLs. The ADEM will continue to monitor water quality according to the rotational river basin monitoring schedule as allowed by resources. In addition, assessments may include local citizen-volunteer monitoring through the Alabama Water Watch Program and/or data collected by agencies, universities or other entities using standardized monitoring and assessment methodologies. Core management measures will include, but not be limited to water quality improvements and designated use support, preserving and enhancing public health, enhancing ecosystems, pollution prevention and load reductions, implementation of NPS controls, and public awareness and attitude/behavior changes.

7.0 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 basin groups. One goal is to continue to monitor §303(d) listed waters. This monitoring will occur in each basin according to the schedule listed below.

Table 7-1 Monitoring Schedule for Alabama

River Basin Group	Scheduled Year
Choctawhatchee, Chipola, Perdido-Escambia and Chattahoochee	2004
Tallapoosa, Alabama and Coosa	2005
Escatawpa, Upper Tombigbee, Lower Tombigbee and Mobile	2006
Cahaba and Black Warrior	2007
Tennessee	2008

Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed.

8.0 Public Participation

As part of the public participation process, this TMDL was be 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.

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Appendix A Data Used In TMDL Development

Table A-1 Sampling Stations

Year	STUDY	Station	AGENCY	Stream Section	Road Crossing	Latitude	Longitude
1993	USX Study	CAMP1+USX	USX	Camp Branch	Mulga Loop Road	33.5170	-86.9531
1993	USX Study	CAMP2+USX	USX	Camp Branch	Finland Ave	33.5194	-86.9535
1993	USX Study	CAMP3+USX	USX	Camp Branch	Inverness Street	33.5224	-86.9565
1993	USX Study	CAMP4+USX	USX	Camp Branch	Wooden Bridge	33.5252	-86.9579
1993	USX Study	CAMP5+USX	USX	Camp Branch	Denmark Ave	33.5306	-86.9600
1993	USX Study	CAMP6+USX	USX	Camp Branch	Al Hwy 269	33.5367	-86.9634
1994	USX Study	CAMP1+USX	USX	Camp Branch	Mulga Loop Road	33.5170	-86.9531
1994	USX Study	CAMP2+USX	USX	Camp Branch	Finland Ave	33.5194	-86.9535
1994	USX Study	CAMP3+USX	USX	Camp Branch	Inverness Street	33.5224	-86.9565
1994	USX Study	CAMP4+USX	USX	Camp Branch	Wooden Bridge	33.5252	-86.9579
1994	USX Study	CAMP5+USX	USX	Camp Branch	Denmark Ave	33.5306	-86.9600
1994	USX Study	CAMP6+USX	USX	Camp Branch	Al Hwy 269	33.5367	-86.9634
2001	303(d) Monitoring Program	CMBJ-1	ADEM	Camp Branch	Al Hwy 269	33.5367	-86.9634
2001	303(d) Monitoring Program	CMBJ-2	ADEM	Camp Branch	Inverness Street	33.5224	-86.9565
2001	303(d) Monitoring Program	CMBJ-3	ADEM	Camp Branch	Mulga Loop Road	33.5170	-86.9531
2001	303(d) Monitoring Program	CMBJ-4	ADEM	Camp Branch	Finland Ave	33.5194	-86.9535
2001	303(d) Monitoring Program	CMBJ-5	ADEM	Camp Branch	Denmark Ave	33.5306	-86.9600
2002	303(d) Monitoring Program	CMBJ-1	ADEM	Camp Branch	Al Hwy 269	33.5367	-86.9634
2002	303(d) Monitoring Program	CMBJ-2	ADEM	Camp Branch	Inverness Street	33.5224	-86.9565
2002	303(d) Monitoring Program	CMBJ-3	ADEM	Camp Branch	Mulga Loop Road	33.5170	-86.9531
2002	303(d) Monitoring Program	CMBJ-4	ADEM	Camp Branch	Finland Ave	33.5194	-86.9535
2002	303(d) Monitoring Program	CMBJ-5	ADEM	Camp Branch	Denmark Ave	33.5306	-86.9600

Table A-2 Camp Branch pH

Station_ID	Date	Time (24hr)	pH (SU)
CAMP1+USX	07/01/93	12:55	11.23
CAMP1+USX	12/17/93	10:15	8.2
CAMP1+USX	04/06/94	9:20	8.5
CAMP1+USX	07/12/94	10:10	7.4
CAMP1+USX	08/24/94	13:35	8.1
CAMP2+USX	05/20/93	10:30	8.05
CAMP2+USX	07/01/93	2:00	7.92
CAMP2+USX	12/17/93	10:00	7.7
CAMP2+USX	04/06/94	9:05	8.5
CAMP2+USX	07/12/94	10:00	7.22
CAMP2+USX	08/24/94	13:55	8.1
CAMP3+USX	05/20/93	9:45	9.58
CAMP3+USX	07/01/93	11:30	10.3
CAMP3+USX	12/17/93	9:35	7.9
CAMP3+USX	04/06/94	8:40	8.4
CAMP3+USX	07/12/94	9:28	7.64
CAMP3+USX	08/24/94	14:45	7.8
CAMP4+USX	05/19/93	11:08	5.32
CAMP4+USX	07/01/93	8:00	9.52
CAMP4+USX	12/17/93	8:30	6.4
CAMP4+USX	04/06/94	8:00	8.6
CAMP4+USX	07/12/94	8:17	7.98
CAMP4+USX	08/24/94	11:00	7.5
CAMP5+USX	05/20/93	13:47	5.97
CAMP5+USX	07/01/93	3:10	4.2
CAMP5+USX	12/17/93	11:20	8
CAMP5+USX	04/06/94	11:26	8.6
CAMP5+USX	07/12/94	11:15	4.55
CAMP5+USX	08/24/94	15:00	4.9
CAMP6+USX	05/19/93	4:08	6.53
CAMP6+USX	07/01/93	3:30	3.91
CAMP6+USX	12/17/93	1:15	6.8
CAMP6+USX	04/06/94	11:08	8.4
CAMP6+USX	07/12/94	11:40	3.92
CAMP6+USX	08/24/94	15:20	4.8
CMBJ-1	11/20/01	1140	3.06
CMBJ-1	12/10/01	1055	5.70
CMBJ-1	01/23/02	1015	6.00
CMBJ-1	02/26/02	1010	4.16
CMBJ-1	03/13/02	1000	6.48
CMBJ-1	04/10/02	1025	5.71
CMBJ-1	05/15/02	1100	5.78
CMBJ-1	06/12/02	1035	3.72
CMBJ-2	11/20/01	1410	7.09
CMBJ-2	12/10/01	1150.00	5.49
CMBJ-2	01/23/02	1110	6.42
CMBJ-2	02/26/02	1105	5.85

Station_ID	Date	Time (24hr)	pH (SU)
CMBJ-2	03/13/02	1055	5.80
CMBJ-2	04/10/02	1120	6.50
CMBJ-2	05/15/02	1215	7.48
CMBJ-2	06/12/02	1145	6.69
CMBJ-3	12/10/01	1305	6.90
CMBJ-3	01/23/02	1150	6.80
CMBJ-3	02/26/02	1205	5.00
CMBJ-3	03/13/02	1155	6.20
CMBJ-3	04/10/02	1145	7.17
CMBJ-3	05/15/02	1315	7.70
CMBJ-3	06/12/02	1235	7.20
CMBJ-4	11/20/01	1345	6.94
CMBJ-4	12/10/01	1250	6.38
CMBJ-4	01/23/02	1200	6.70
CMBJ-4	02/26/02	1200	6.14
CMBJ-4	03/13/02	1215	7.00
CMBJ-4	04/10/02	1205	7.07
CMBJ-4	05/15/02	1305	7.54
CMBJ-4	06/12/02	1245	7.30
CMBJ-4	06/12/02	1245	7.30
CMBJ-5	11/20/01	1245	3.79
CMBJ-5	01/23/02	1055	5.90
CMBJ-5	02/26/02	1040	4.14
CMBJ-5	03/13/02	1030	5.80
CMBJ-5	04/10/02	1100	5.05
CMBJ-5	05/15/02	1145	5.05
CMBJ-5	06/12/02	1110	3.34