ADEM

Alabama Department of Environmental Management

FINAL

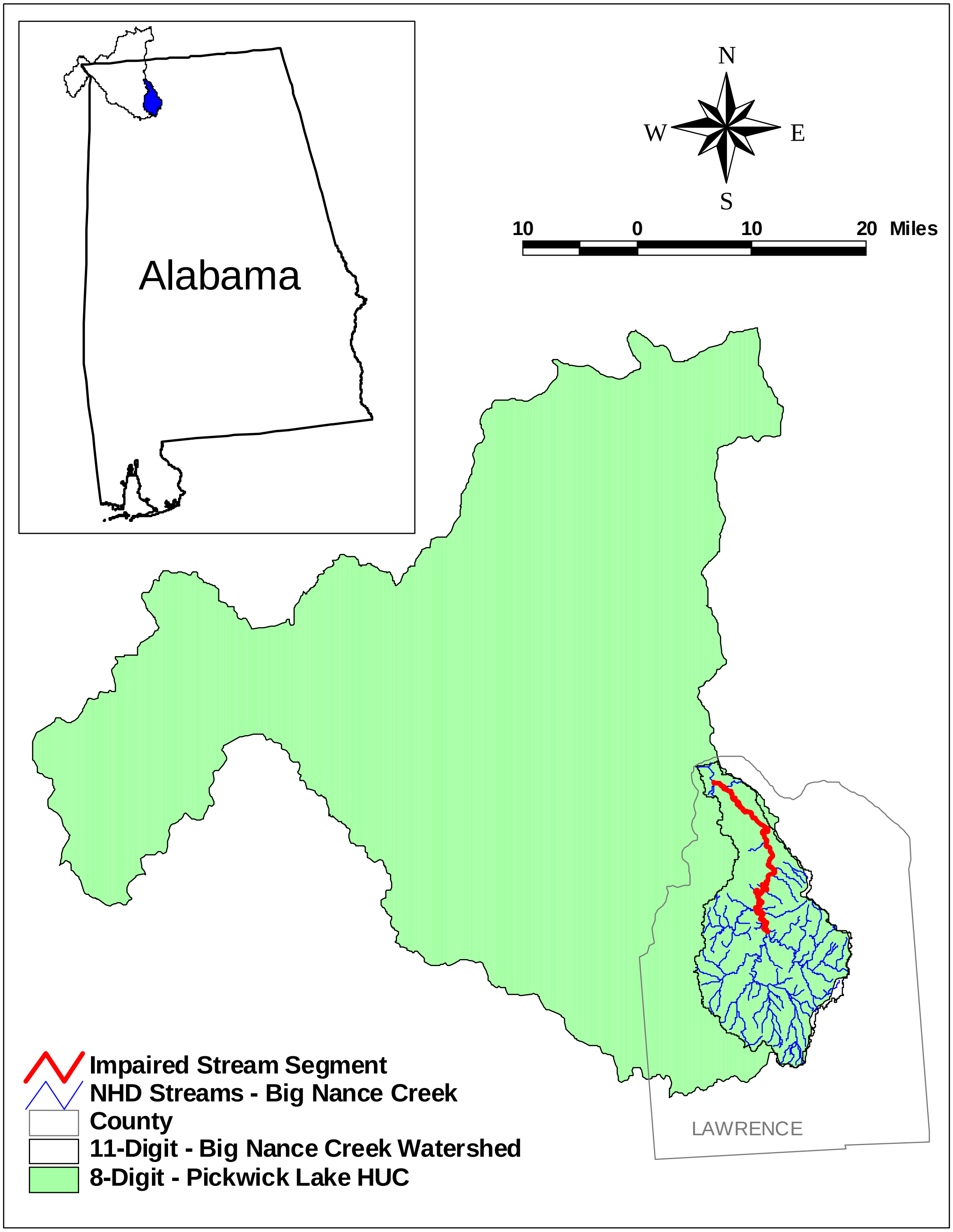
Big Nance Creek and Scarham Creek TMDL Development for Pesticides (Insecticides and Herbicides)

Water Quality Branch
Water Division
February 2002

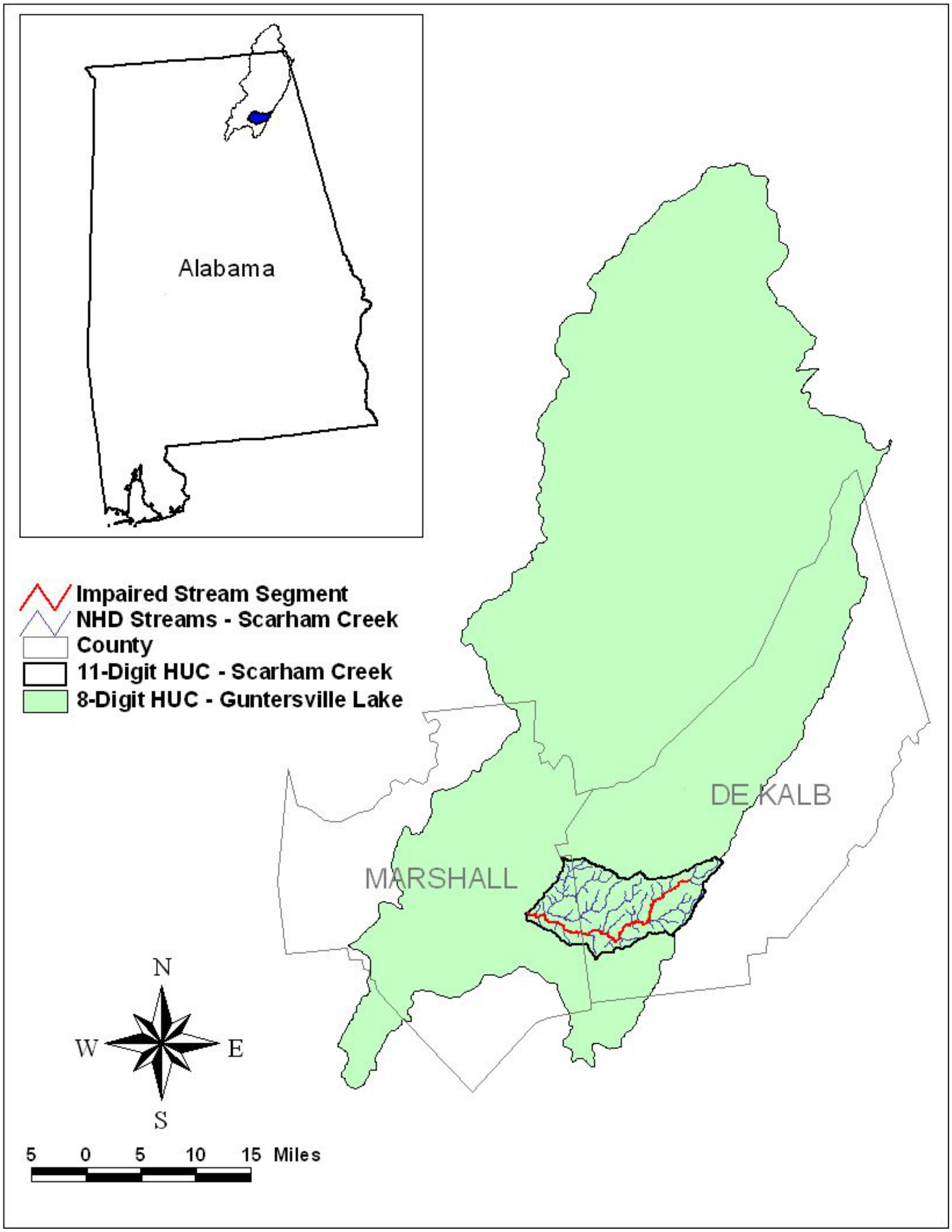
LIST OF ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
BMP	Best Management Practices
CFS	Cubic Feet per Second
DEM	Digital Elevation Model
DMR	Discharge Monitoring Report
DNR	Department of Natural Resources
DWPC	Division of Water Pollution Control
EPA	Environmental Protection Agency
GIS	Geographic Information System
HSPF	Hydrological Simulation Program - FORTRAN
HUC	Hydrologic Unit Code
LA	Load Allocation
LSPC	Loading Simulation Program C++
MGD	Million Gallons per Day
MOS	Margin of Safety
MPN	Most Probable Number
MRLC	Multi-Resolution Land Characteristic
NED	National Elevation Database
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NPSM	Nonpoint Source Model
NRCS	Natural Resources Conservation Service
RF3	Reach File 3
RM	River Mile
STORET	STORage RETrieval database
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WCS	Watershed Characterization System
WLA	Waste Load Allocation

Big Nance Creek Watershed in the Pickwick Lake Basin



Scarham Creek Watershed in the Guntersville Lake Basin



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1.0 Executive Summary

Big Nance Creek, a part of the Pickwick Lake hydrologic unit of the Tennessee River Basin, is located in Lawrence County near Courtland, Alabama. It has been on the State of Alabama’s §303(d) use impairment list since 1992 for pesticides. The use classification for the impaired segment is Fish and Wildlife. In August 1995 a fish kill occurred in Big Nance Creek. An estimated 240,000 fish were killed. Water quality data collected in 1997 for Big Nance Creek indicated less than detection for pesticides.

Scarham Creek, a part of the Guntersville Lake Basin, is located in Marshall and Dekalb counties near Crossville, Alabama. It has been on the State of Alabama’s §303(d) use impairment list since 1992 for pesticides. The use classification for the impaired segment is Fish and Wildlife. There have been no reported fish kills on Scarham Creek due to pesticides. Scarham Creek was listed as being impaired for pesticides based on observations. There is no water quality data to support its listing.

The following report addresses five constituents for the TMDL analysis. These constituents are Endosulfan, Methyl Parathion, Chlorpyrifos, Glyphosate, and Atrazine. The most commonly used trade names for these constituents are presented in Table 1-1.

Table 1-1. Common Names and Trade Names for the TMDL Insecticides and Herbicides.

Common Name	CAS Number	Trade Names
Ensosulfan	115-29-7	Afidan, Beosit, Cyclodan, Devisulfan, Endocel, Endocide, Endosol, FMC 5462, Hexasulfan, Hildan, Hoe 2671, Insectophene, Malix, Phaser, Thiodan, Thimul, Thifor, Thionex
Methyl Parathion	298-00-0	Bladan M, Cekumethion, Dalf, Dimethyl Parathion, Devithion, E601, Folidol-M, Fosferno M50, Gearphos, Kilex Parathion, Metacide, Metaphos, Metron, Nitrox 80, Partron M, Penncap-M, Tekwaisa
Chlorpyrifos	2921-88-2	Brodan, Detmol UA, Cowco 179, Dursban, Empire, Eradex, Lorsban, Paqeant, Piridane, Scout, Stipend
Glyphosate	1071-83-6	Gallup, Landmaster, Pondmaster, Ranger, Roundup, Rodeo, Touchdown
Atrazine	1912-24-9	Aatrex, Aktikon, Alazine, Atred, Atranex, Atrataf, Atratol, Azinotox, Crisazina, Farmco Atrazine, G30027, Gesaprim, Fiffex 4L, Malermais, Primatol, Simazat, Zeapos

In accordance with the State of Alabama’s Water Quality Criteria (ADEM Admin. Code R. 335-6-10-.07), the maximum allowable acute concentration for Endosulfan in a freshwater stream classified as Fish and Wildlife is 0.220 ug/L. The acute criterion is the one hour maximum average concentration that can occur once in a three year period. The maximum allowable chronic concentration is 0.056 ug/L. The chronic criterion is the four day maximum average concentration that can occur once in a three year period. The human health concentration for fish consumption is 0.430 ug/L. For the purpose of this TMDL, the maximum acute and chronic concentration levels were used to develop a load versus flow relation. This relation incorporates seasonality by covering a broad range of flow values. The human health concentration level was not used because the acute and chronic levels are more restrictive. Methyl Parathion, Chlorpyrifos, Glyphosate and Atrazine are not listed in the State of Alabama's Water Quality Criteria. Endosulfan and Methyl Parathion are the most commonly used insecticides in the Big Nance Creek Watershed. Endosulfan, Methyl Parathion, and Chlorpyrifos are frequently used in the Scarham Creek Watershed. Glyphosate and Atrazine are the most commonly used herbicides in the Scarham Creek Watershed. These herbicides are included in the TMDL due to their wide use. Best professional judgment was used to select water quality criteria for the pesticides that are not listed in the State of Alabama's Water Quality Criteria.

A summary of the TMDLs for both watersheds are provided in Figures 1-1 to 1-7. Figures 1-1 and 1-2 are for Endosulfan and Methyl Parathion. Figures 1-3 and 1-4 are for Chlorpyrifos. Figures 1-5 through 1-7 are for Glyphosate and Atrazine.

Figure 1-1. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Endosulfan and Methyl Parathion. Acute and Chronic. Flow Range 0 to 20,000 cfs.

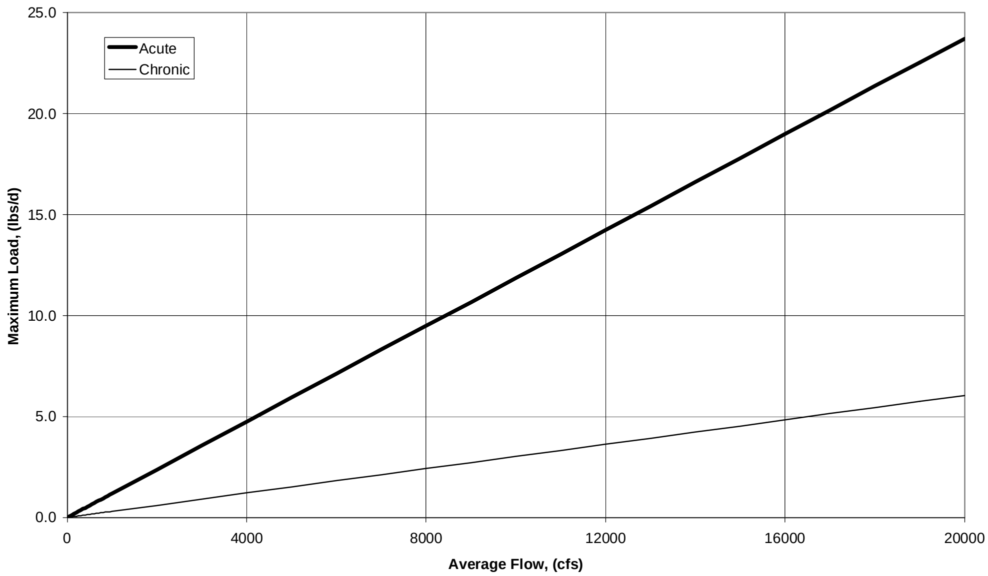


Figure 1-2. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Endosulfan and Methyl Parathion. Acute and Chronic. Flow Range 0 to 350 cfs.

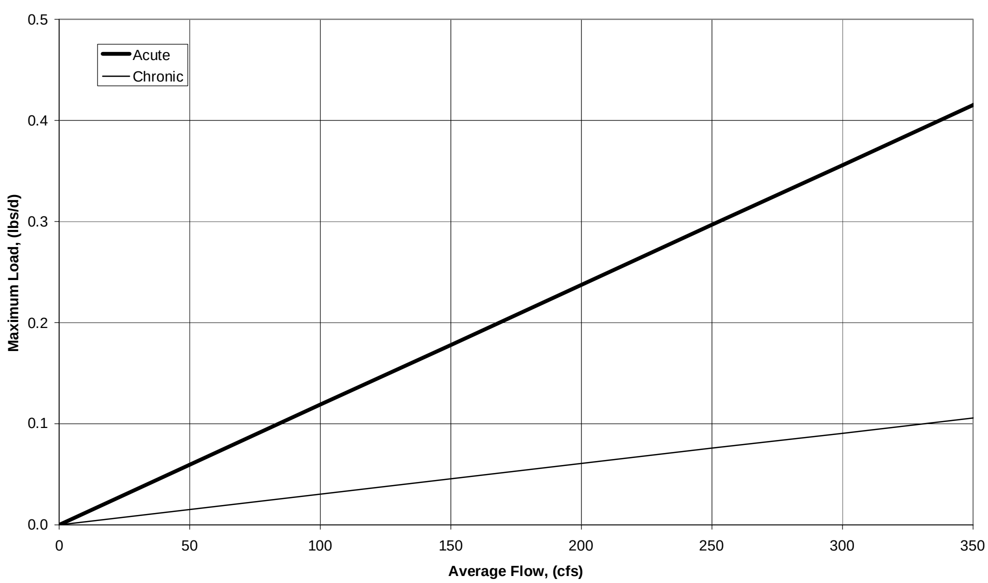


Figure 1-3. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Chlorpyrifos. Acute and Chronic. Flow Range 0 to 20,000 cfs.

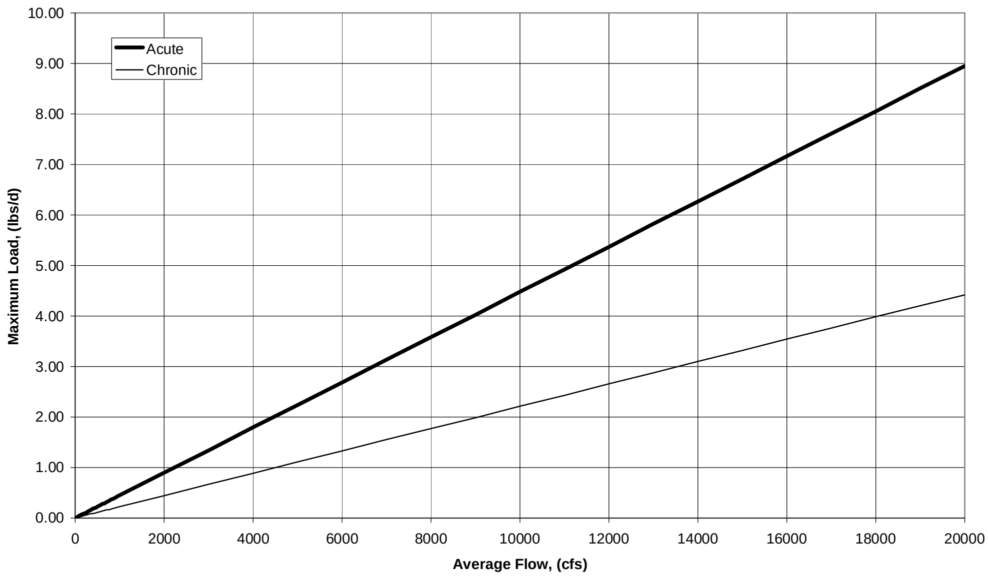


Figure 1-4. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Chlorpyrifos. Acute and Chronic. Flow Range 0 to 350 cfs.

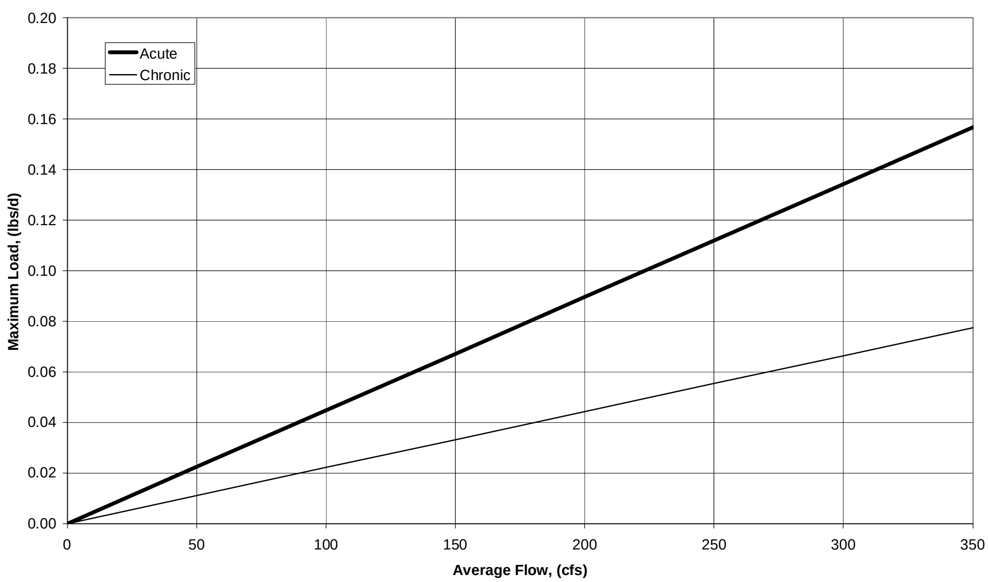


Figure 1-5. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Glyphosate and Atrazine. Acute and Chronic. Flow Range 0 to 20,000 cfs.

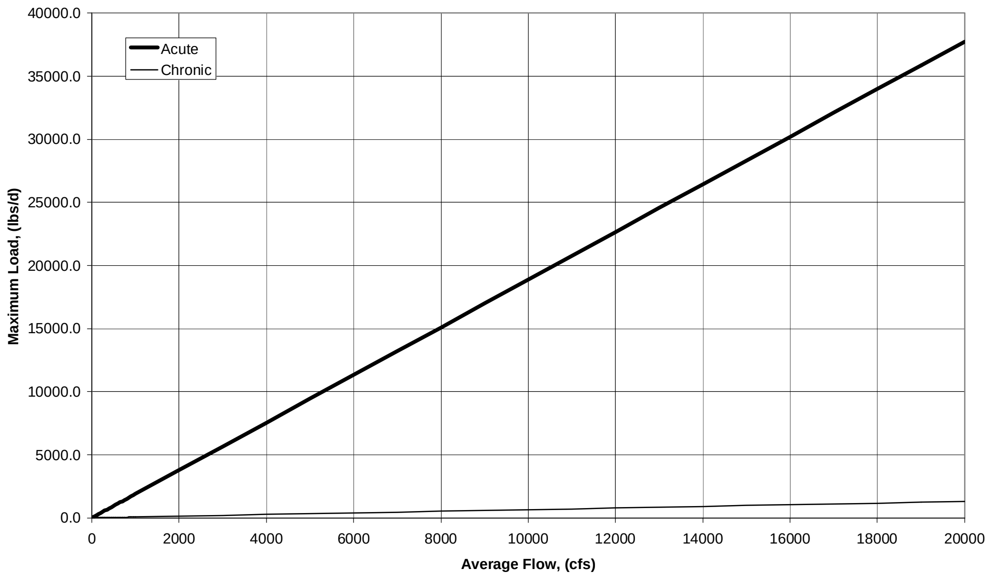


Figure 1-6. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Glyphosate and Atrazine. Acute and Chronic. Flow Range 0 to 350 cfs.

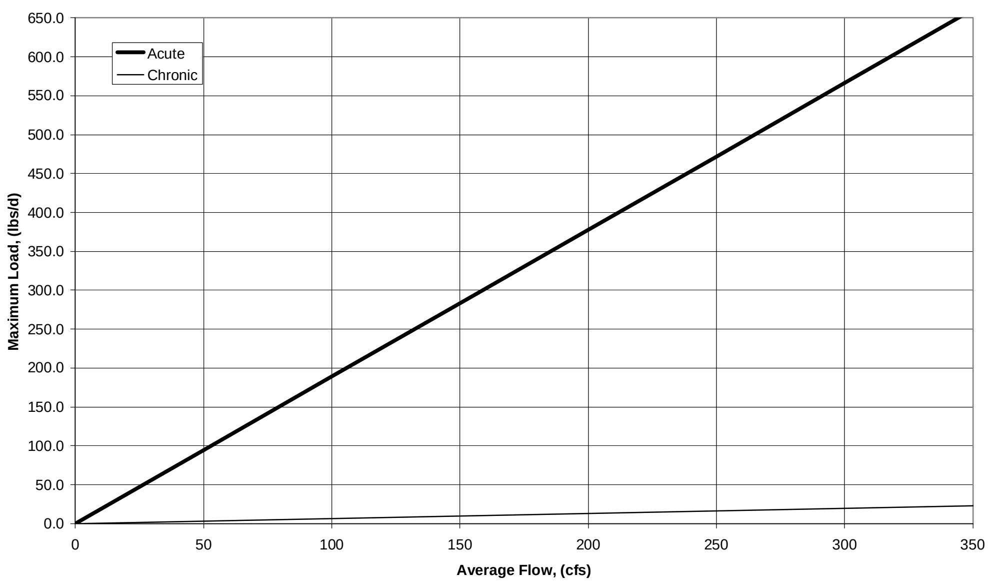
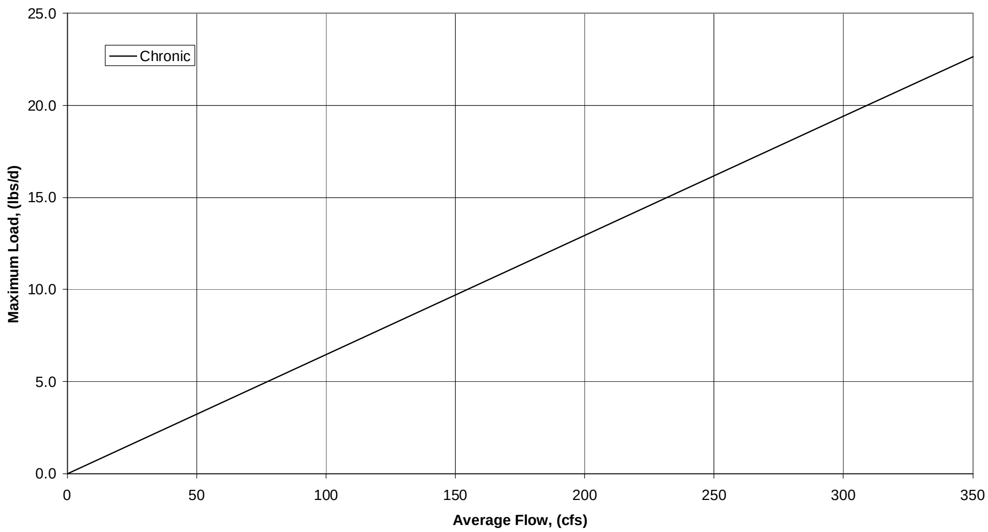


Figure 1-7. Maximum Allowable Pollutant Loads as a Function of Stream Flow, Glyphosate and Atrazine. Chronic. Flow Range 0 to 350 cfs.



2.0 Basis for §303(d) Listing

2.1 Introduction

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)] require states to identify water bodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters for a water body, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama has identified both Big Nance Creek and Scarham Creek as being impaired by pesticides for a length of 24 and 12 miles, respectively, as reported on the 1998 §303(d) list of impaired waters. Big Nance Creek and Scarham Creek are both prioritized as "high" on the list. Big Nance Creek is located in Lawrence County and lies within the Pickwick Lake Watershed of the Tennessee River Basin. Scarham Creek is located in Marshall and Dekalb Counties and lies within the Guntersville Lake Watershed of the Tennessee River Basin.

The TMDL developed for Big Nance Creek and Scarham Creek illustrates the steps that can be taken to address a water body impaired by pesticides. The TMDL sets a maximum loading limit. A water quality monitoring plan will be required to evaluate the TMDLs effectiveness. Flexibility is built into the plan so that load targets and control actions can be reviewed if monitoring indicates continuing water quality problems.

2.2 Problem Definition

Pesticides are commonly used to control nuisance crop insects, weeds, and fungi. They are identified further as insecticides, herbicides, and fungicides. Insecticides are typically quite toxic and require strict adherence to instructions to minimize adverse impacts; wheras herbicides are slightly to moderately toxic to humans and other animals.

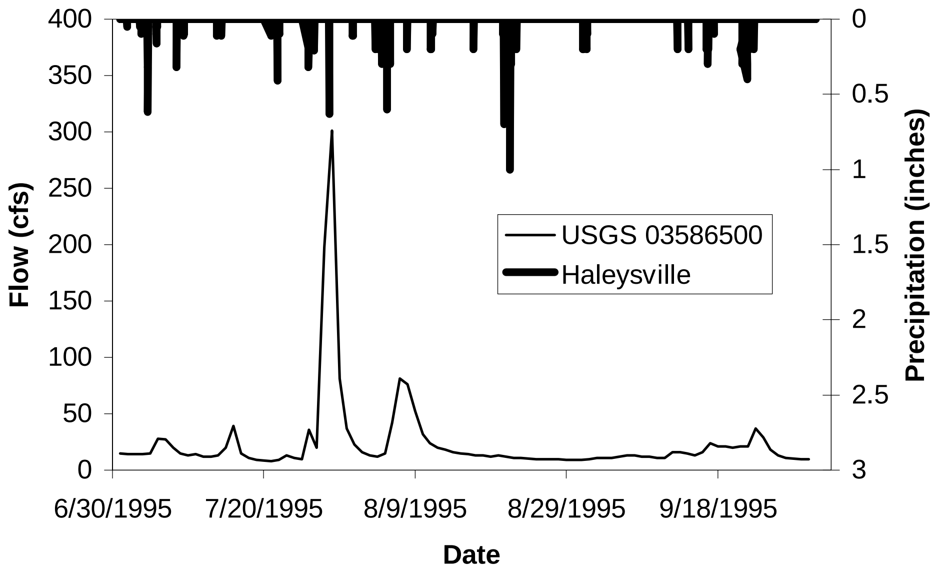
Big Nance Creek Watershed

Big Nance Creek is a headwater stream with a drainage area of 200 square miles. Dry weather flows are relatively low. The USGS flow station number 03586500 at Courtland is in the Big Nance Creek Watershed. The highest and lowest annual mean flow rates are 580.0 and 98.0-cfs, respectively. The lowest daily mean flow rate is 0.4-cfs (USGS 1999). Water quality monitoring of pesticides in 1997 (Appendix 9.0) did not result in any values above the detection limit. Generally, pesticides have the highest probability of reaching the stream when a rain event occurs soon after a pesticide application.

In the Big Nance watershed, cotton is the dominant crop, accounting for 20 percent of the landuse in that watershed. In 1995 the boll weevil was endangering the cotton crops, causing significant concern. Pesticide applications were made on a 7-10 day cycle over large areas. The pesticides used were Endosulfan and Methyl Parathion. Endosulfan and Methyl Parathion are known as broad insecticides. After one application, an isolated summer thunderstorm occurred and washed the pesticides into Big Nance Creek. This resulted in a large fish kill, estimated at 240,000. The hydrology around this event are presented in Figure 2-1. The flow values are from the USGS flow gage station number 03586500 at Courtland. The rain values are from the Haleysville station.

In 1995, approximately 10 percent of the cotton crops in the Big Nance watershed were maintained with conservation tillage. Conservation tillage is defined to be any tillage/planting system which leaves at least 30 percent of the field surface covered with crop residue after planting has been completed. Currently, 100 percent of the cotton crops in the Big Nance watershed are maintained with conservation tillage (Frost, 2001). This results in a marked decrease of sediment and pesticide runoff reaching the stream.

Figure 2-1. Hydrology Around Big Nance Fish Kill.



<u>Scarham Creek Watershed</u>

Scarham Creek is a small, headwater stream with a relatively small drainage area of 87 square miles. There is a USGS flow station number 03573182 on the stream. The period of record for this gaging station is from October 1998 to the present. A provisional annual mean flow rate from the gage is 61- cfs. ADEM has made intermittent measurements of instantaneous flow concomitant with water quality monitoring. There are no records of a fish kill in Scarham Creek. There is no water quality data available to support the stream being listed as impaired for pesticides.

In the Scarham Creek watershed soybeans and corn are the primary crops. Glyphosate is the most commonly used herbicide for soybean crops. For corn, Atrazine is the most commonly applied herbicide in the watershed (Wisener, 2001).

As in the Big Nance Creek watershed, Methyl Parathion and Clorpyrifos are frequently used insecticides. Endosulfan is not used as much in the Scarham Creek watershed due to the fact that cotton is not the dominant crop.

<u>Water bodies Impaired:</u>	Big Nance Creek and Scarham Creek
<u>Water Quality Standard Violation:</u>	Endosulfan, Methyl Parathion, Chlorpyrifos, Glyphosate, and Atrazine
<u>Pollutant of Concern:</u>	Pesticides (Insecticides and Herbicides)

Water Use Classification: Fish and Wildlife

The impaired stream segments, Big Nance Creek and Scarham Creek, are classified as Fish and Wildlife. Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), (d), and ADEM Admin. Code R. 335-6-10-.06(c).

(a) Best usage of waters:

Fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food processing purposes.

(b) Conditions related to best usage:

The waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters:

It is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage:

The waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

ADEM Admin. Code R. 335-6-10-.06(c).

(c) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

The TMDL was developed for three insecticides: Endosulfan, Methyl Parathion, and Chlorpyrifos; and two herbicides: Glyphosate and Atrazine. In accordance with the State of Alabama's Water Quality Criteria, the maximum acute concentration for Endosulfan in a freshwater stream classified as Fish and Wildlife is 0.220 ug/L. The maximum chronic concentration is 0.056 ug/L. For the purpose of this TMDL, the maximum acute and chronic concentration levels were used to develop a load versus flow relation. This relation incorporates seasonality by considering how allowable loading varies with flow. Methyl Parathion, Chlorpyrifos, Glyphosate and Atrazine are not listed in the State of Alabama's Water Quality Standards. Best professional judgment was used to select water quality criteria for these pesticides. In addition to Endosulfan, Methyl Parathion and Chlorpyrifos are widely-used insecticides in both watersheds. Glyphosate and Atrazine are the most commonly used herbicides in the Scarham Creek Watershed. Water quality criteria for this TMDL are presented in Table 3-1.

Table 3-1. Water Quality Criteria for TMDL Development.

Pesticide (Type)	Acute (ug/L), Fresh	Chronic (ug/L), Fresh	Source
Endosulfan (Insecticide)	0.220	0.056	State of Alabama's Water Quality Criteria.
Methyl Parathion (Insecticide)	0.220	0.056	Assumed the criteria for Endosulfan apply.
Chlorpyrifos (Insecticide)	0.083	0.041	(USEPA 1986).
Glyphosate (Herbicide)	350	12	Assumed the criteria for Atrazine apply.
Atrazine (Herbicide)	350	12	Federal Register, Vol. 66, No. 187, Sep. 26, 2001.

Methyl Parathion is less toxic to aquatic life than Endosulfan or Chlorpyrifos. Therefore, the criteria for Endosulfan was assumed as the criteria for Methyl Parathion. Glyphosate is less toxic to aquatic life than Atrazine. Therefore, the criteria for Atrazine was assumed as the criteria for Glyphosate (OSU, 2001).

3.2 Source Assessment

Big Nance CreekWatershed

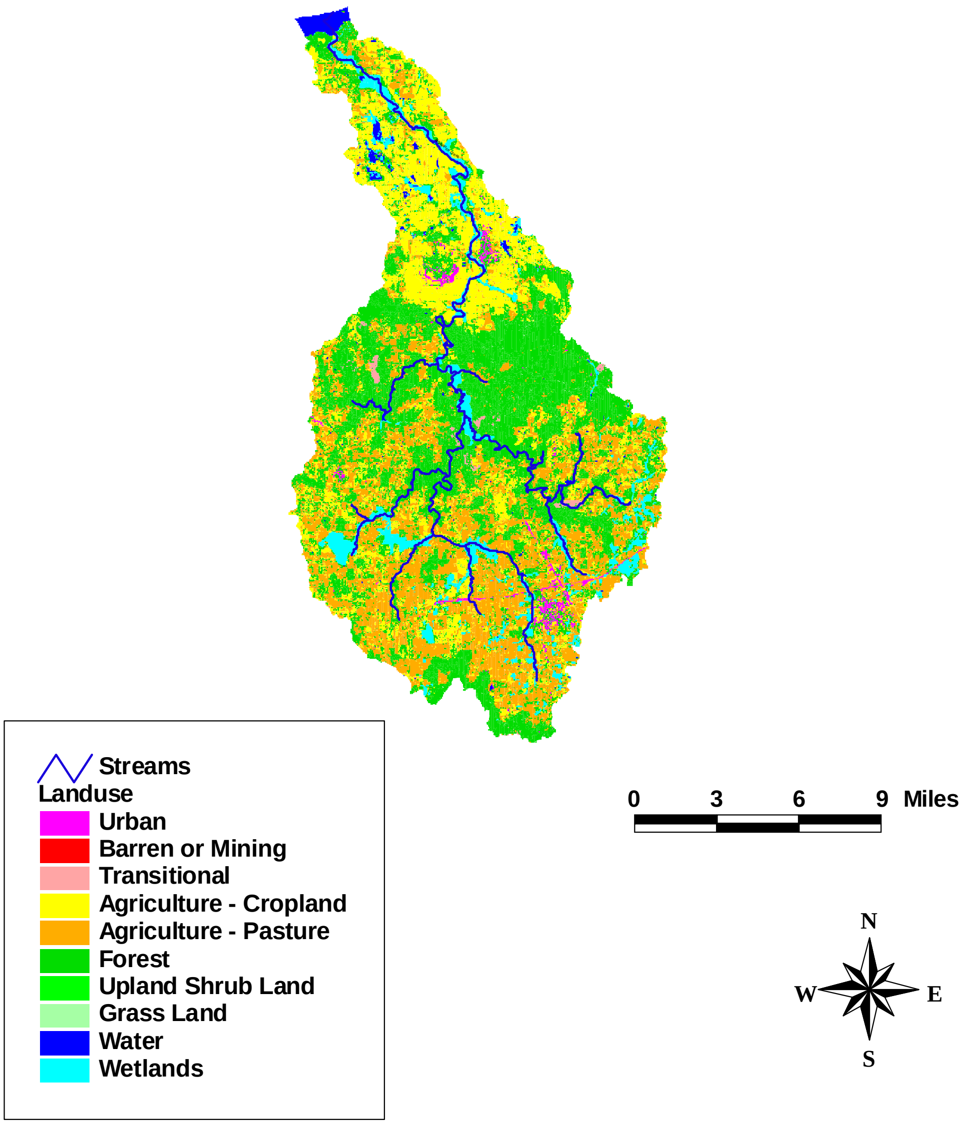
In Big Nance Creek Watershed, beginning in 1996, cotton crops were grown with a genetically pest-resistant variety of cotton. Over the last half-decade, the use of this genetically pest-resistant variety of cotton has radically decreased spray applications of pesticides for these crops. At present, only spot applications of pesticides are used on an infrequent basis. Contractors are hired to set traps and periodically walk the fields to look for boll weevils. If boll weevils are detected, spot applications of pesticide are used in the affected area (Frost, 2001). Such spot applications use pesticides such as Methyl Parathion which are not listed in the State of Alabama's Water Quality Criteria.

Non-point sources in the Big Nance Creek Watershed are the sole source of pesticide loadings. Shown in Table 3-2, is a detailed summary of land usage in the Big Nance Creek watershed. A land-use map of the watershed is presented in Figure 3-1. The dominant land uses within the watershed are pasture and forest. The towns of Courtland and Moulton comprise a small urban component.

Table 3-2. Land Use in the Big Nance Creek Watershed.

Land Use	Area (acres)	Percentage
Cropland	24,822	20.0%
Forest	59,811	49.0%
High Commercial/ Industrial/Transportation	886	1.0%
High Residential	89	0.0%
Low Residential	556	0.5%
Pasture	33,750	28.0%
Transitional	543	0.5%
Water	1,027	1.0%
TOTAL	121,484	100.0%

Figure 3-1. Map of Land Use for the Big Nance Creek Watershed.



Scarham Creek Watershed

In the Scarham Creek Watershed, soybeans and corn are the dominant crops. Croplands are 21 percent of the land use in the watershed. Glyphosate is the mostly used herbicide with soybean crops, while Prowl and Classic are used less frequently. Soybean crops have been genetically modified to survive the effects of Glyphosate application. Atrazine is the mostly used herbicicide with corn crops, while Glyphosate and Dual are used less frequently. As in the Big Nance Creek Watershed, the insecticide Methyl Parathion is used, but predominantly for cotton crops. The herbicides Glyphosate and Atrazine are typically applied once a year around March or April (Wisener, 2001).

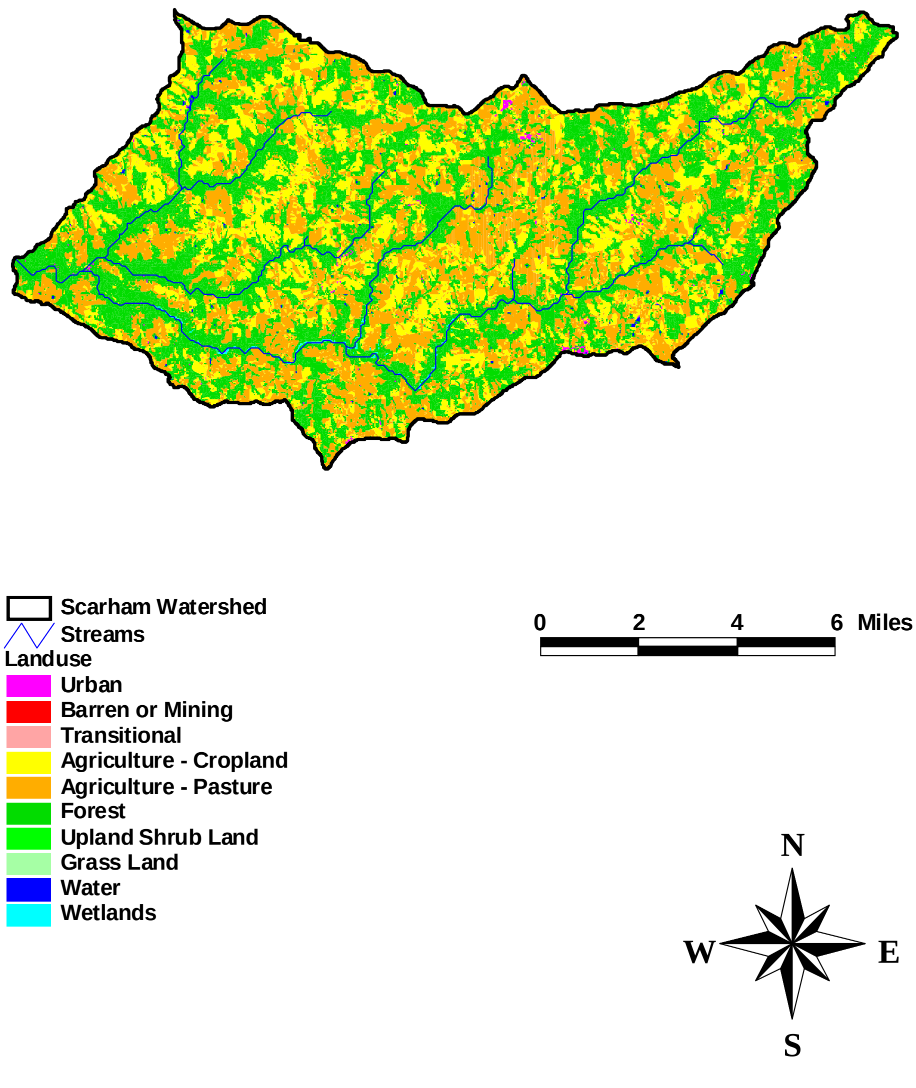
Shown in Table 3-3, is a detailed summary of land usage in the Scarham Creek watershed. A land use map of the watershed is presented in Figure 3-2. The predominant land uses within the watershed are pasture and forest.

Table 3-3. Land Use in the Scarham Creek Watershed.

Land Use	Area (acres)	Percentage
Cropland	11,694	21.0%
Forest	25,376	45.6%
High Commercial/ Industrial/Transportion	83	0.1%
High Residential	6	0.0%
Low Residential	77	0.1%
Pasture	18,316	32.9%
Transitional	0	0.0%
Water	135	0.3%
TOTAL	55687	100.0%

There are no point sources of pesticides in Big Nance Creek and Scarham Creek Watersheds.

Figure 3-2. Map of Land Use for the Scarham Creek Watershed.



3.3 Loading Capacity – Linking Numeric Water Quality Targets and Pollutant Sources

A load versus flow evaluation has been made as part of this TMDL. The load of pesticides that can be received by the stream is based on flow conditions. These figures have been developed for the load of pollutant that can reach the stream. Note that the characterization and/or description of volatilization, ground water seepage, decay, and adsorption behavior of the pesticide are not directly calculated or analyzed. This represents an implicit margin of safety. It is assumed that recommended application rates, application procedures, and label instructions are followed.

The equation used to calculate load in Figures 1-1 through 1-5 follows:

Load = (0.646) X (8.35×10^{-3}) X Flow X Concentration

Where:		
	[Load]	= lbs/day
	0.646	= conversion from (cfs) to (mgd)
	8.35×10^{-3}	= conversion from (ug) to (lbs) and from (liters) to (gal.)
	[Flow]	= cfs
	[Concentration]	= ug/L

The State of Alabama's Water Quality Criteria document lists Endosulfan. An empirical relationship, for Endosulfan, between load and flow has been evaluated based on this criteria. The pesticides Methyl Parathion, Chlorpyrifos, Glyphosate, and Atrazine have been evaluated using the concentration provided in Table 3-1.

The peak discharge in Big Nance Creek during the August 1995 fish kill was approximately 300- cfs. Using this discharge rate and assuming that it is the average flow rate over a one hour, acute period, an example load can be evaluated using the loading Figures 1-1 and 1-2 for Endosulfan. An acute criterion violation would occur if the load that reached the stream was 0.36 pounds per day or greater and occurred for at least one hour.

Using the discharge rate of 300- cfs and assuming that it is the average flow rate over a four day, chronic period, an example load can be evaluated using the loading Figure 1-1 for Endosulfan. A chronic criterion violation would occur if the load that reached the stream was 0.09 pounds per day or greater and occurred for four consecutive days.

3.4 Critical Conditions

Critical conditions with respect to pesticides (insecticides and herbicides) occur when a rain event immediately succeeds pesticide application. Detailed instructions on the pesticides label prescribe the manner of application and concerns regarding surface water runoff.

3.5 Margin of Safety

The margin of safety of this TMDL is implicit in the approach. The load versus flow relations are developed assuming that the pesticide application occurrs immediately before a rain event. This TMDL does not quantify the effects of proper application, following instructions, buffer zones, or conservation tillage practice. These factors may minimize or eliminate the likelihood of pesticides reaching the surface water system.

4.0 Conclusions

A summary of the TMDL load versus flow relations is presented in Figures 1-1 through 1-4. These figures present a maximum loading per day based on average flow conditions. Since currently there are no pesticide point sources present in the Big Nance Creek and Scarham Creek Watersheds, the TMDL consists of a Load Allocation (LA) for non-point sources. Without sufficient water quality data, no required numeric reductions can be calculated as part of the TMDL. Follow up monitoring to be conducted in accordance with the State of Alabama's basin rotation monitoring will be used to revise the TMDL, if so indicated by the data. At this time, the use of proper pesticide application procedures is the appropriate measure that should be taken for implementation of the TMDL.

5.0 TMDL Implementation

5.1 Non-Point Source Approach

For 303(d) listed waters impaired solely or primarily by nonpoint source (NPS) 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 industry, 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 (ADEM) 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 Dept of Interior - Office of Surface Mining (abandoned minelands), Natural Heritage Program and US Fish and Wildlife Service (threatened and endangered species), may also provide practical TMDL implementation delivery systems, programs, and information. Land use 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 water body or watershed.

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 this TMDL. 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.

5.2 Point Source Approach

If applicable, reductions from point sources will be addressed by the NPDES permit program.

6.0 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 following schedule:

Table 6-1. Basin Schedule for Monitoring.

River Basin Group	Schedule
Cahaba / Black Warrior	2002
Tennessee	2003
Choctawhatchee / Chipola / Perdido-Escambia / Chattahoochee	2004
Tallapoosa / Alabama / Coosa	2005
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2006

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

7.0 Public Participation

A thirty-day public notice will be provided for this TMDL. During this time, the availability of the TMDL will be public noticed, a copy of the TMDL will be provided as requested, and the public will be invited to provide comments on the TMDL.

Appendix 8.0
References

References

Alabama Cooperative Extension Service, 2001 Alabama Pest Management Handbook.

C&P Press, Material Safety Data Sheet, 2000, Glyphosate.

Frost, Billy, Lawrence County, NRCS, Personal Communication, September 2001.

Oregon State University, 2001, Extension Toxicology Network, <http://ace.orst.edu/info/extoxnet/>.

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

United States Environmental Protection Agency. 1986. Quality Criteria for Water, 1986, (The Gold Book), Office of Water, EPA 440/5-86-001.

United States Geological Survey. 1999. The Quality of our nation's Waters: Nutrients and Pesticides, USGS Circular 1225.

United States Geological Survey. 1999. Water Resources Data Alabama Water Year 1999, Water Data Report AL-99-1.

Wisener, Jerry, Dekalb County, NRCS, Personal Communication, September 2001.

Appendix 9.0
Big Nance Creek Watershed Monitoring Data

					Pesticides (ug/L)									
Watershed	Stream Name	TVA Station Number	Date	Time	Aldrin	alpha-BHC	beta-BHC	gamma-BHC (Lindane)	delta-BHC	Chlordane	P'P"DDT	P'P"DDE	P'P"DDD
BIG NANCE CREEK	BIG NANCE CREEK A	BNC-A	7/22/1997	15:30	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K
BIG NANCE CREEK	BIG NANCE CREEK A	BNC-A	8/14/1997	8:00	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K
					Dieldrin	alpha-Endosulfan	beta-Endosulfan	Endosulfan sulfate	Endrin	Endrin aldehyde	Heptachlor	Heptachlor epoxide	Toxaphene
BIG NANCE CREEK	BIG NANCE CREEK A	BNC-A	7/22/1997	15:30	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.5 K
BIG NANCE CREEK	BIG NANCE CREEK A	BNC-A	8/14/1997	8:00	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.01 K	0.5 K

K-less than