DISPLAY COPY

DO NOT REMOVE

French Broad River

Basinwide Water Quality Plan

North Carolina
Department of Environment
and Natural Resources

Division of Water Quality
Water Quality Section May, 2000

Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E. Director
Division of Water Quality

April 22, 2003

Thank you for your interest in North Carolina's water quality issues. Enclosed is the basinwide water quality plan that you recently requested from the Division of Water Quality (DWQ).

The basinwide planning program aims to identify and restore full use to impaired waters, identify and protect highly valued resource waters, and protect the quality and intended uses of North Carolina's surface waters while allowing for sound economic planning and reasonable growth. North Carolina relies on the input and experience of its public to ensure that the water quality plans are effective. DWQ coordinates plan development; however, plan implementation and effectiveness entails the coordinated efforts and endorsement of many agencies, groups, local governments, and the general public. Your participation is essential for us to achieve our goals.

Our website (http://h2o.enr.state.nc.us/wqs/) provides detailed information on our program, other basin plans, current events, publications, and rules and regulations. Please visit us at this site.

DWQ appreciates your interest in water quality issues, and we hope to continue working with you into the future. Please contact me if you have any further questions or ideas on specific basins at (919) 733-5083, ext. 354.

Sincerely,

Darlene Kucken

Darlene Kucken
Basinwide Planning Program Coordinator

Enclosure

FRENCH BROAD RIVER
BASINWIDE WATER QUALITY PLAN

(Includes the French Broad, Pigeon and Nolichucky River Watersheds)

May 2000

Prepared by:

NC Department of Environment and Natural Resources
Division of Water Quality
Water Quality Section
1617 Mail Service Center
Raleigh, NC 27699-1617

(919) 733-5083 ext. 354

This document was approved and endorsed by the NC Environmental Management Commission on May 11, 2000 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the French Broad River basin. This plan is the first five-year update to the original French Broad River Basinwide Water Quality Management Plan approved by the NC Environmental Management Commission on May 11, 1995

TABLE OF CONTENTS

APPENDICES

I NPDES Dischargers in the French Broad River Basin

II Water Quality Data Collected by DWQ

- Benthic Macroinvertebrate Collections
- Fish Community Assessments

III Use Support Methodology and Use Support Ratings

IV 303(d) Listing and Reporting Methodology

V Workshop Summaries

VI French Broad River Basin Nonpoint Source Program Description and Contacts

VII Glossary of Terms and Acronyms

LIST OF FIGURES

LIST OF TABLES

Executive Summary

North Carolina's Basinwide Approach to Water Quality Management

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality for each of the seventeen major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by the Division of Water Quality, their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholders in the state. The first basinwide plan for the French Broad River basin was completed in 1995.

Goals of the Basinwide Approach

The primary goals of DWQ's basinwide program are to:

- identify water quality problems and restore full use to impaired waters;
- identify and protect high value resource waters;
- protect unimpaired waters while allowing for reasonable economic growth;
- develop appropriate management strategies to protect and restore water quality;
- assure equitable distribution of waste assimilative capacity for dischargers; and
- improve public awareness and involvement in the management of the state's surface waters.

French Broad River Basin Overview

The French Broad River basin drains to the Gulf of Mexico via the Tennessee, Ohio and Mississippi Rivers. The boundaries of the French Broad River basin within NC contain portions or all of Transylvania, Buncombe, Henderson, Madison, Haywood, Yancey, Mitchell and Avery counties.

The basin is composed of three major drainages: French Broad River, Pigeon River and Nolichucky River. These rivers individually flow northwest into Tennessee. There are seven man-made lakes in the basin monitored by DWQ: Lake Julian, Burnett Reservoir, Beetree Reservoir, Busbee Reservoir, Lake Junaluska, Allen Creek Reservoir and Walters (Waterville) Lake.

About one-half of the land in the basin is forested, with much of the basin within Pisgah National Forest or Pisgah Game Lands. The northwest corner of Haywood County is in the Great Smoky Mountains National Park. Steep slopes limit the land area suitable for development and crop production. Therefore, most agricultural and developed lands are concentrated within the river valleys. Between 1982 and 1992, cultivated and uncultivated croplands decreased by about 67 percent, while urban and developed lands increased by about 42 percent.

The population of the basin, based on 1990 census data, was estimated at 357,932. The overall population density of the basin of 128 persons per square mile is comparable to the statewide average of 139 persons per square mile. The percent population growth over the past ten years (1980 to 1990) was 8.5 % versus a statewide increase of 12.7%. Population density is greatest in and around the cities of Asheville and Hendersonville.

Water quality is generally good throughout the basin, although there are several areas of concern. Trout waters are abundant and many waters are classified as High Quality or Outstanding Resource Waters.

Assessment of Water Quality in the French Broad River Basin

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses is an important method of interpreting water quality data and assessing water quality. This determination results in a use support rating. The use support ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are fully supported, partially supported or not supported. For instance, waters classified for fishing and water contact recreation (Class C) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters are rated as partially supporting or not supporting, depending on the degree of exceedence. Streams rated as either partially supporting or not supporting are considered *impaired.*

A summary of current use support ratings for the French Broad River basin is presented in Table 1. For further information and definition of monitored and evaluated streams, refer to Appendix A-III.

Table 1 Use Support Summary Information for All Monitored and Evaluated Streams in the French Broad River Basin (1999)

		Monitored and Evaluated Streams*			Monitored Streams Only**	
		Miles	**%**		**Miles**	**%**
Fully Supporting		3190.9	77		812.2	90
Impaired		88.5	2			
	Partially Supporting	*50.6*	*1*		*50.1*	*6*
	Not Supporting	*37.9*	*1*		*37.9*	*4*
Not Rated		856.5	21			
Total		4135.9			900.2	

* = Percent based on total of all named and classified streams, both monitored and evaluated.

** = Percent based on total of all monitored streams.

Recommended Management Strategies for Restoring Impaired Waters

The long-range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the French Broad River basin's surface waters. In striving towards its mission, DWQ's highest priority near-term goals are to:

- identify and restore impaired waters in the basin;
- identify and protect high value resource waters and biological communities of special importance; and
- protect unimpaired waters while allowing for reasonable economic growth.

Within this basinwide plan, DWQ presents management strategies for those waters considered to be impaired. Table 2 presents impaired waters in the French Broad River basin, the sources of impairment, summaries of the recommended management strategies, and location of further information in the basinwide plan.

These waters are impaired, at least in part, due to nonpoint sources (NPS) of pollution. The tasks of identifying nonpoint sources of pollution and developing management strategies for these impaired waters is very resource intensive. Accomplishing these tasks is overwhelming, given the current limited resources of DWQ, other agencies (e.g., Division of Land Resources, Division of Soil and Water Conservation, Cooperative Extension Service, etc.) and local governments. Therefore, only limited progress towards restoring NPS impaired waters can be expected during this five-year cycle unless substantial resources are put toward solving NPS problems.

DWQ plans to further evaluate the impaired waters in the French Broad River basin in conjunction with other NPS agencies and develop management strategies for a portion of these impaired waters for the next French Broad River Basinwide Water Quality Plan.

Addressing Waters on the State's 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a DWQ priority. The waters in the French Broad River basin that are on this list are presented in the individual subbasin descriptions in Section B.

Section 303(d) of the federal Clean Water Act requires states to develop a 303(d) list of waters not meeting water quality standards or which have impaired uses. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. EPA issued guidance in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list within 8-13 years.

There are approximately 2,387 stream miles on the 303(d) list in NC. The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters. This task will be accomplished through the basinwide planning process and schedule.

Table 2 Impaired Waters within the French Broad River Basin (as of 1999) •

Subbasin	Chapter in Section B	Listed Water	Use Support Rating	Potential Sources*	Recommended Management Strategy
04-03-01	1	Peter Weaver Creek	PS	P	DWQ will resample this creek to obtain information for a management strategy. Holders of individual NPDES permits may be required to conduct upstream/downstream sampling or obtain an individual permit.
04-03-01	1	Morgan Mill Creek	PS	P	DWQ will resample this creek to obtain information for a management strategy. Holders of individual NPDES permits may be required to conduct upstream/downstream sampling or obtain an individual permit.
04-03-02	2	Gash Creek	NS	NP	Local actions are needed on NPS inventory.
04-03-02	2	Mill Pond Creek	PS	NP	DWQ will continue to monitor to better identify problem parameters.
04-03-02	2	Mud Creek	NS	NP P	Local restoration initiatives are underway, and DWQ will continue to monitor results.
04-03-02	2	Bat Fork Creek	PS	NP	DWQ will continue to monitor the creek and increase coordination with other agencies to address the various pollution sources.
04-03-02	2	Clear Creek	PS	NP	Local actions are needed to expand buffer and BMP implementation.
04-03-02	2	Hominy Creek	PS	NP	There is a need to increase the funding and implementation of chemical handling facilities.
04-03-02	2	South Hominy Creek	NS	NP	There is a need to increase the funding and implementation of chemical handling facilities.
04-03-02	2	Ross Creek	NS	NP	Local initiatives are underway, and DWQ will continue to monitor results.
04-03-03	3	Mills River	NS	NP	Local initiatives are underway, and DWQ will continue to monitor results.
04-03-03	3	Brandy Branch	PS	NP	Local projects aimed at identifying sources of pollution and necessary actions would be very useful to DWQ and various funding agencies. DWQ will continue to monitor Brandy Branch to better identify problem parameters.
04-03-04	4	Little Ivy Creek	PS	NP	Local restoration initiatives are underway, and DWQ will continue to monitor results.
04-03-05	5	Pigeon River	PS	NP P	DWQ will continue to monitor process improvements made at BRPP and work with the Joint Watershed Advisory Group. Local nonpoint source initiatives are needed.
04-03-05	5	Richland Creek	PS	NP	Local restoration initiatives are underway, and DWQ will continue to monitor results.

Key: NS = Not Supporting PS = Partially Supporting NP = Nonpoint sources P = Point Sources

* = Only limited progress towards developing and implementing NPS strategies for these impaired waters can be expected without additional resources.

• = These waters are also on the 303(d) list, and a TMDL and/or management strategy will be developed to remove the water from the list.

Section A

General Basinwide Information

Chapter 1 -
Introduction to Basinwide Water Quality Planning

1.1 What is Basinwide Water Quality Planning?

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality for each of the seventeen major river basins in the state, as shown in Figure A-1 and Table A-1. Preparation of an individual basinwide management plan is a five-year process, which is broken down into four major phases as presented in Table A-2. While these plans are prepared by the Division of Water Quality, their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholder groups in the state. The first round of plans was completed in 1998. Each plan is now being updated at five-year intervals during round two.

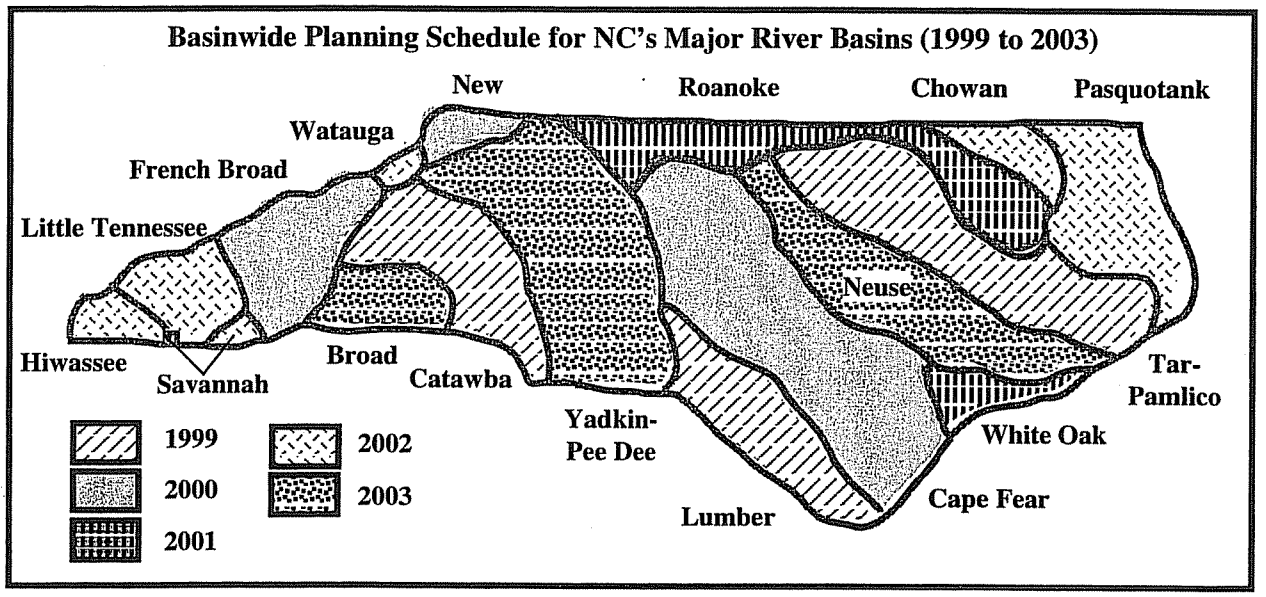


Figure A-1 Basinwide Planning Schedule (1999 to 2003)

1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide management are to:

- identify water quality problems and restore full use to impaired waters;
- identify and protect high value resource waters;
- protect unimpaired waters while allowing for reasonable economic growth;
- develop appropriate management strategies to protect and restore water quality;
- assure equitable distribution of waste assimilative capacity for dischargers; and
- improve public awareness and involvement in the management of the state's surface waters.

Table A-1 Schedule for Second Round of Basinwide Planning (1998 to 2003)

Basin	DQW Biological Data Collection	River Basin Public Workshops	Public Mtgs. and Draft Out For Review	Final Plan Receives EMC Approval	Begin NPDES Permit Issuance
Neuse	Summer 95	3/1997	9/1998	12/1998	1/1999
Lumber	Summer 96	4/1998	2/1999	5/1999	11/1999
Tar-Pamlico	Summer 97	6/1998	4/1999	7/1999	1/2000
Catawba	Summer 97	2/1999	9/1999	12/1999	3/2000
French Broad	**Summer 97**	**5/1999**	**2/2000**	**5/2000**	**8/2000**
New	Summer 98	6/1999	4/2000	7/2000	11/2000
Cape Fear	Summer 98	7/1999	4/2000	7/2000	12/2000
Roanoke	Summer 99	4/2000	2/2001	7/2001	1/2002
White Oak	Summer 99	10/2000	9/2001	12/2001	6/2002
Savannah	Summer 99	11/2000	11/2001	2/2002	8/2002
Watauga	Summer 99	11/2000	12/2001	3/2002	9/2002
Little Tennessee	Summer 99	11/2000	11/2001	2/2002	10/2002
Hiwassee	Summer 99	11/2000	11/2001	2/2002	8/2002
Chowan	Summer 2000	3/2001	1/2002	5/2002	11/2002
Pasquotank	Summer 2000	3/2001	1/2002	5/2002	12/2002
Broad	Summer 2000	11/2001	9/2002	12/2002	7/2003
Yadkin	Summer 2001	11/2001	12/2002	3/2003	9/2003

Note: A basinwide plan was completed for all 17 basins during Round 1 (1993 to 1998).

Table A-2 Five-Year Process for Development of an Individual Basinwide Management Plan

Years 1 to 3 **Water Quality Data Collection and Identification of Goals and Issues**	• Identify sampling needs • Canvass for information • Coordinate with other agencies and local interest groups to establish goals and objectives and identify and prioritize issues • Summarize data from ambient monitoring stations • Conduct biological monitoring activities • Conduct special studies and other water quality sampling activities
Years 3 to 4 **Data Assessment and Model Preparation**	• Gather data from special studies to prepare models and TMDLs • Develop preliminary pollution control strategies • Coordinate with local stakeholders and other agencies • Develop use support ratings
Year 4 **Preparation of Draft Basinwide Plan**	• Develop draft basinwide plan based on water quality data, use support ratings, modeling data and recommended pollution control strategies • Present preliminary findings at informal meetings and incorporate comments into draft plan
Year 5 **Public Review and Approval of Plan**	• Circulate draft plan for review • Hold public meetings after approval by NC Environmental Management Commission's Water Quality Committee • Revise plan after public review period • Submit final document to Environmental Management Commission for approval • Begin basinwide permitting and implementation at end of Year 5

1.3 Major Components of the Basinwide Plan

The second round of basinwide plans uses a different format from the earlier basinwide plans. Each plan is subdivided into three major sections. The intent of the format change is to make the plans easier to read and understand, but still comprehensive in content.

Section A: Basinwide Information

- Introduces the basinwide planning approach used by the state.
- Provides an overview of the river basin including: hydrology, land use, local government jurisdictions, population and growth trends, natural resources, wastewater discharges, animal operations and water usage.
- Presents general water quality information including summaries of water quality monitoring programs and use support ratings in the basin.

Section B: Subbasin Information

- Summarizes recommendations from first basin plan, achievements made, what wasn't achieved and why, current priority issues and concerns, and goals and recommendations for the next five years by subbasin.

Section C: Current and Future Initiatives

- Presents current and future water quality initiatives and success stories by federal, state and local agencies, and corporate, citizen and academic efforts.
- Describes DWQ goals and initiatives beyond the five-year planning cycle for the basin.

1.4 Benefits of Basinwide Water Quality Planning

Several benefits of basinwide planning and management to water quality include:

- *Improved efficiency.* The state's efforts and resources focus on one river basin at a time.
- *Increased effectiveness.* The basinwide approach is in agreement with ecological principles.
- *Better consistency and equability.* By clearly defining the program's long-term goals and approaches, basinwide plans encourage *consistent* decision-making on permits and water quality improvement strategies.
- *Increased public participation in the state's water quality protection programs.* The basinwide plans are an educational tool for increasing public involvement and awareness of water quality issues.
- *Increased integration of point and nonpoint source pollution assessment and controls.* Once waste loadings from both point and nonpoint sources are established, management strategies are developed to ensure water quality standards are met.

1.5 How to Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for citizens and other local stakeholders to participate in the planning process. DWQ offers two opportunities for the public to participate in the process:

- Public workshops: Held prior to writing the basinwide plans. DWQ staff present information about basinwide planning and the water quality of the basin. Participants then break into smaller groups where they can ask questions, share their concerns, and discuss potential solutions to water quality issues in the basin.
- Public meetings: Held after the draft basinwide plan has been approved by the Water Quality Committee of the Environmental Management Commission. DWQ staff present more detailed information about the draft basinwide plan and its major recommendations. Then, the public is invited to comment and ask questions.
- Public Comment Period: Held after the draft plan has been approved by the Water Quality Committee of the Environmental Management Commission. The comment period is at least thirty days in length from the date of the first public meeting.

Citizens seeking involvement in efforts to restore and protect water quality can call the DWQ Planning Branch at (919) 733-5083 and ask to speak to the basinwide planner for your river basin.

1.6 Other References

There are several reference documents that provide additional information about basinwide planning and the basin's water quality:

- *French Broad River Basinwide Assessment Report.* November 1998. This technical report presents the physical, chemical and biological data in the French Broad River basin. 203 pp.
- *French Broad River Basinwide Water Quality Management Plan.* July 1995. This first basinwide plan for the French Broad River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 165 pp.
- NC Division of Water Quality Basinwide Planning Website at http://h2o.enr.state.nc.us. Then click on Water Quality Section and scroll down the menu to Basinwide Planning Program.
- NC Division of Water Quality Environmental Sciences Branch Website at http://esb.ehnr.state.nc.us/BAU.html.
- *A Guide to Water Quality in North Carolina.* This document will be available soon. The document will include general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description.* Creager, C.S. and J.P. Baker. 1991. DWQ Water Quality Section. Raleigh, NC.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the French Broad River Basin.* DWQ NC Wetlands Restoration Program. Raleigh, NC.

Anyone interested in receiving these documents can contact the
DWQ Planning Branch at (919) 733-5083, ext. 360

1.7 Division of Water Quality Functions and Locations

The major activities coordinated by DWQ through basinwide planning are listed in Figure A-2. Information on the location, address and phone numbers for each branch and regional office are also shown in Figure A-2 and Figure A-3.

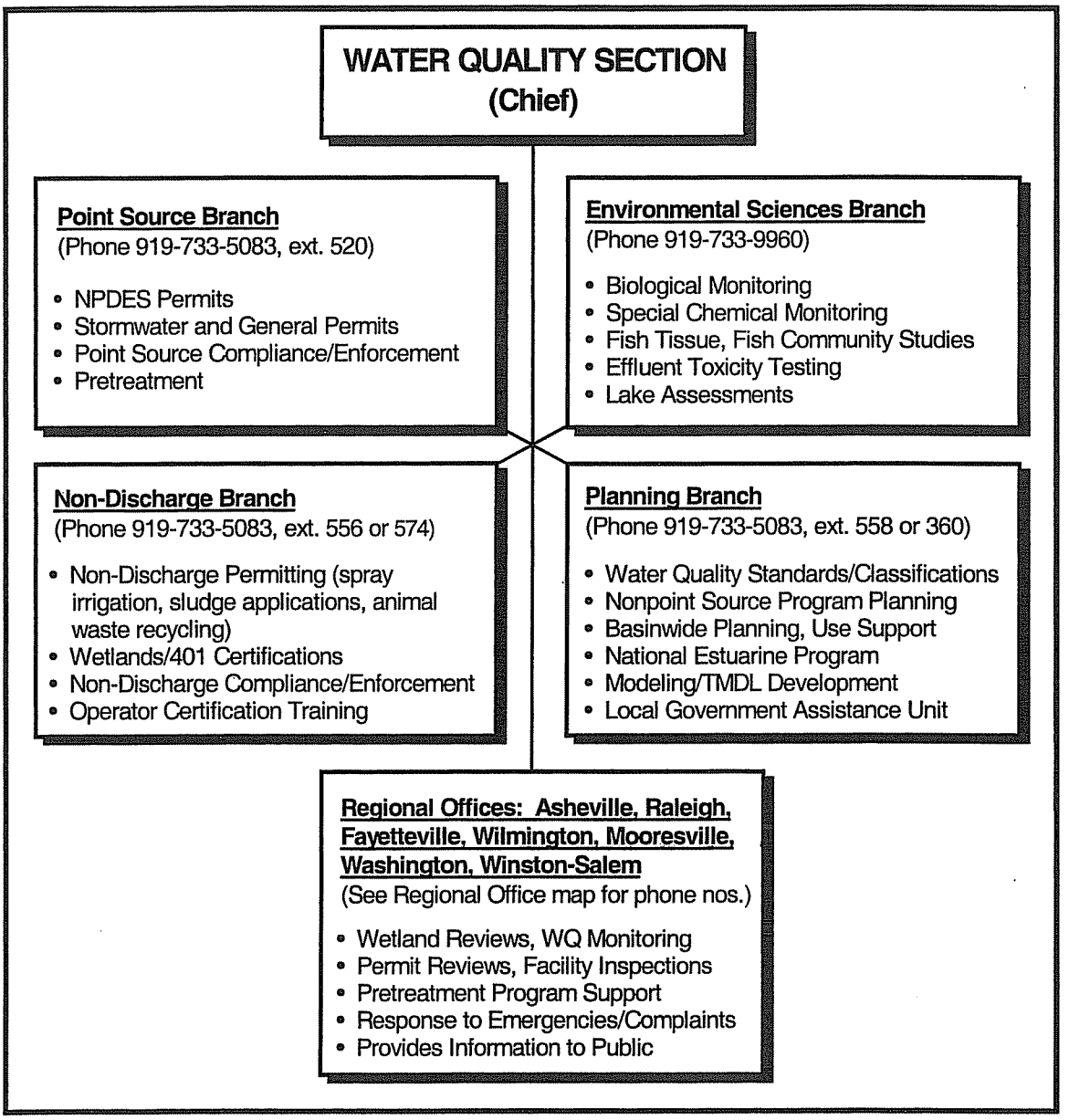
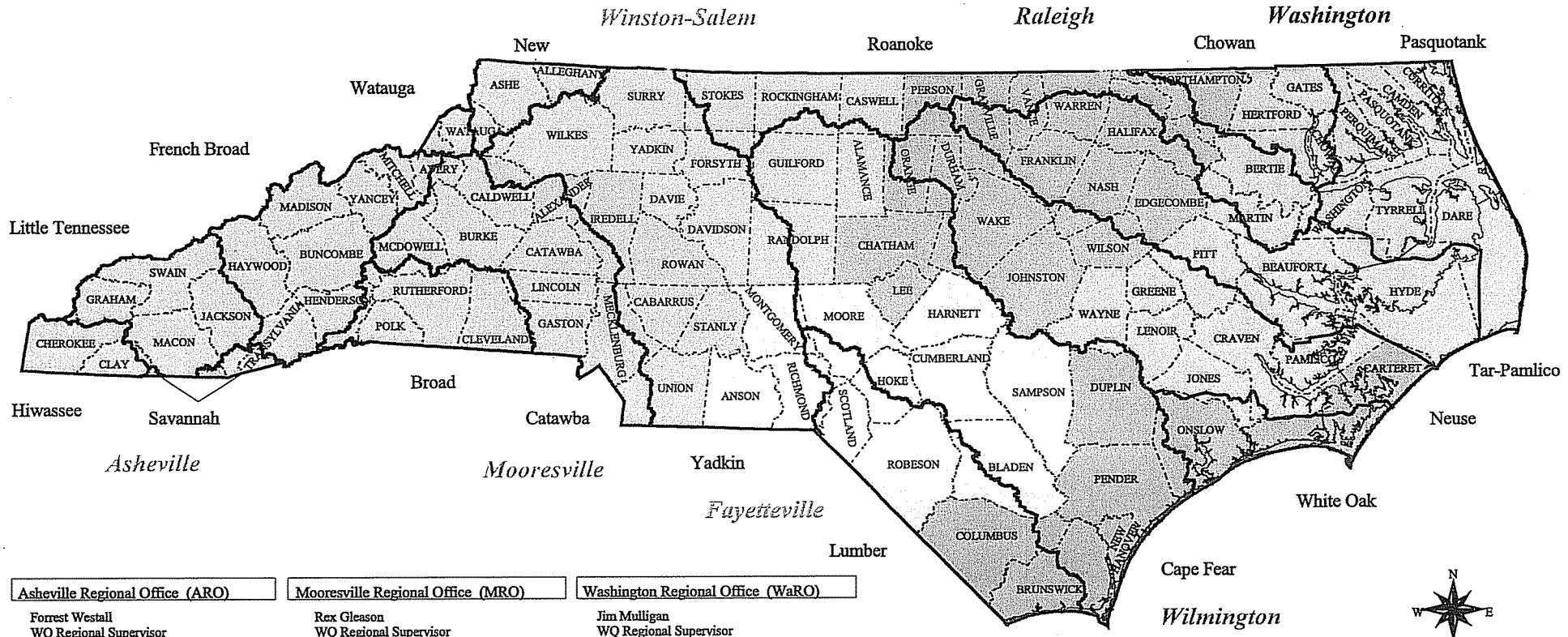


Figure A-2 Water Quality Section Organization Structure

North Carolina Department of Environment and Natural Resources
Division of Water Quality Regional Offices



Asheville Regional Office (ARO)

Forrest Westall
WQ Regional Supervisor
59 Woodfin Place
Asheville, NC 28801
COURIER 12-59-01
Phone: (828) 251-6208
Fax: (828) 251-6452

Avery	Haywood	Polk
Buncombe	Henderson	Rutherford
Burke	Jackson	Swain
Caldwell	Macon	Transylvania
Cherokee	Madison	Yancey
Clay	McDowell	
Graham	Mitchell	

Mooresville Regional Office (MRO)

Rex Gleason
WQ Regional Supervisor
919 North Main Street
Mooresville, NC 28115
COURIER 09-08-06
Phone: (704) 663-1699
Fax: (704) 663-6040

Alexander	Lincoln	
Cabarrus	Mecklenburg	
Catawba	Rowan	
Cleveland	Stanly	
Gaston	Union	
Iredell		

Washington Regional Office (WaRO)

Jim Mulligan
WQ Regional Supervisor
943 Washington Square Mall
Washington, NC 27889
COURIER 16-04-01
Phone: (252) 946-6481
Fax: (252) 946-9215

Beaufort	Gates	Pamlico
Bertie	Greene	Pasquotank
Camden	Hertford	Perquimans
Chowan	Hyde	Pitt
Craven	Jones	Tyrrell
Currituck	Lenoir	Washington
Dare	Martin	Wayne

Winston-Salem Regional Office (WSRO)

Larry Coble
WQ Regional Supervisor
585 Waughtown Street
Winston-Salem, NC 27107
COURIER 13-15-01
Phone: (336) 771-4600
Fax: (336) 771-4630

Alamance	Forsyth	Watauga
Alleghany	Guilford	Wilkes
Ashe	Randolph	Yadkin
Caswell	Rockingham	
Davidson	Stokes	
Davie	Surry	

Central Office

DENR
DIVISION OF WATER QUALITY
WATER QUALITY SECTION
1617 MAIL SERVICE CENTER
RALEIGH NC 27699-1617
COURIER 52-01-00
Phone: (919) 733-5083
Fax: (919) 733-9919

Fayetteville Regional Office (FRO)

Paul Rawls
WQ Regional Supervisor
225 Green Street
Suite 714 / Systel Building
Fayetteville, NC 28301-5043
COURIER 14-56-25
Phone: (910) 486-1541
Fax: (910) 486-0707

Anson	Moore
Bladen	Richmond
Cumberland	Robeson
Harnett	Sampson
Hoke	Scotland
Montgomery	

Raleigh Regional Office (RRO)

Ken Schuster
WQ Regional Supervisor
3800 Barrett Drive
Raleigh, NC 27609
INTEROFFICE
Phone: (919) 571-4700
Fax: (919) 571-4718

Chatham	Johnston	Vance
Durham	Lee	Wake
Edgecombe	Nash	Warren
Franklin	Northampton	Wilson
Granville	Orange	
Halifax	Person	

Wilmington Regional Office (WiRO)

Rick Shiver
WQ Regional Supervisor
127 Cardinal Drive Extension
Wilmington, NC 28405-2845
COURIER 04-16-33
Phone: (910) 395-3900
Fax: (910) 350-2004

Brunswick	New Hanover
Carteret	Onslow
Columbus	Pender
Duplin	

NCDENR

Planning Branch
Planning & Assessment Unit
September 1, 1999

FIGURE A-3

Chapter 2 -
French Broad River Basin Overview

2.1 General Overview

The French Broad River basin drains to the Gulf of Mexico via the Tennessee, Ohio and Mississippi Rivers (Figure A- 4). The boundaries of the French Broad River basin within NC contain portions or all of Transylvania, Buncombe, Henderson, Madison, Haywood, Yancey, Mitchell and Avery counties (Figure A- 5).

French Broad Basin Statistics

Total Area: 2,830 sq. miles
Stream Miles: 4,136
No. of Counties: 8
No. of Municipalities: 25
No. of Subbasins: 7
Population (1990): 357,932*
Estimated Pop. (2016): 418,252*
% Increase (1990-2016): 19%
Pop. Density (1990): 128 persons/sq. mi.

* Based on % of county land area estimated to be within the basin.

The basin includes Mount Mitchell, the highest point in the United States east of the Mississippi River (elevation 6,684 feet). Much of the basin is within Pisgah National Forest or Pisgah Game Lands. The northwest corner of Haywood County is in the Great Smoky Mountains National Park. About one-half of the land in the basin is forested. Steep slopes limit the land area suitable for development and crop production. Therefore, most agricultural and developed lands are concentrated within the river valleys.

The basin is composed of three major drainages: French Broad River, Pigeon River and Nolichucky River. These rivers individually flow northwest into Tennessee. There are seven man-made lakes in the basin monitored by DWQ: Lake Julian, Burnett Reservoir, Beetree Reservoir, Busbee Reservoir, Lake Junaluska, Allen Creek Reservoir and Walters (Waterville) Lake.

The population of the basin, based on 1990 census data, was estimated at 357,932. The overall population density of the basin is 128 persons per square mile versus a statewide average of 139 persons per square mile. The percent population growth over the past ten years (1980 to 1990) was 8.5 % versus a statewide increase of 12.7%.

Water quality is generally good throughout the basin, although there are several areas of concern. Trout waters are abundant and many waters are classified as High Quality or Outstanding Resource Waters.

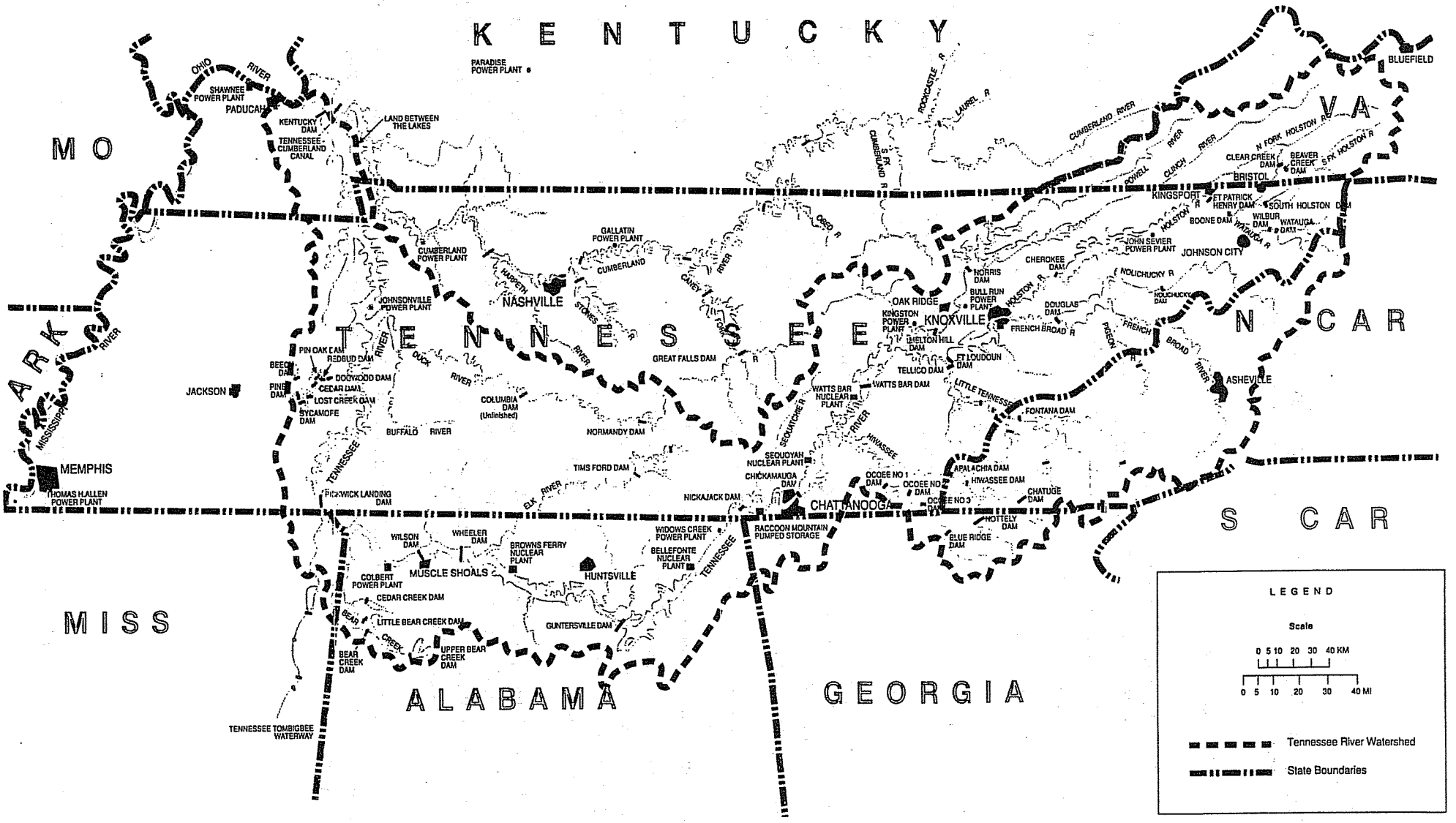


Figure A-4 General Map of the Entire French Broad River Basin

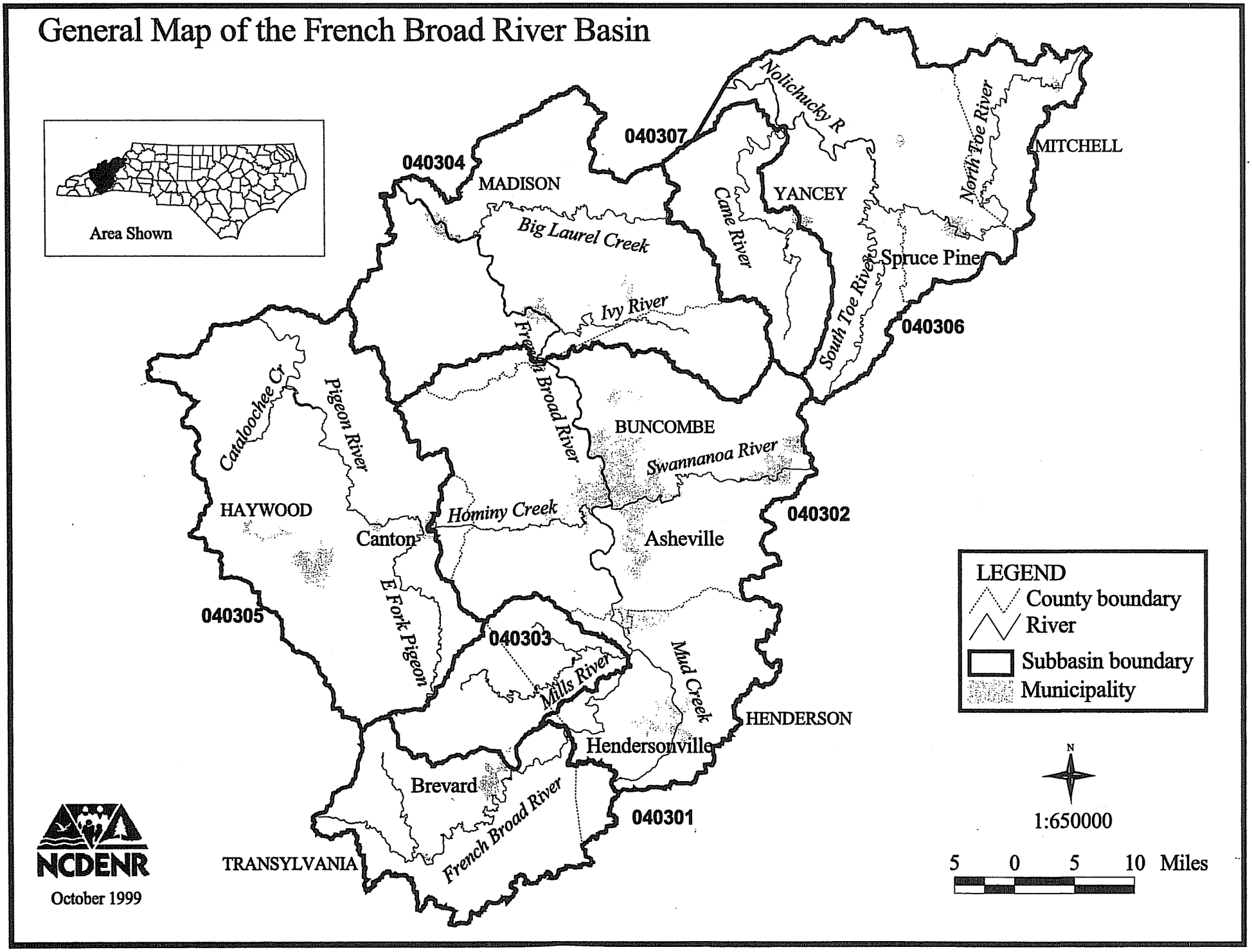


Figure A-5 General Map of the French Broad River Basin in North Carolina

2.2 Local Governments and Planning Jurisdictions in the Basin

The basin encompasses all or part of eight counties and twenty-five municipalities. Table A-3 provides a listing of these municipalities, along with an identification of the regional planning jurisdiction (Council of Governments) and an estimation of what percentage of the county area is within the river basin.

Table A-3 Local Governments and Planning Units within the French Broad River Basin

County	% of County in Basin *	Council of Government Region	Municipalities
Avery	38%	D	Newland Sugar Mountain
Buncombe	93%	B	Asheville Biltmore Forest Black Mountain Montreat Weaverville Woodfin
Haywood	100%	A	Canton Clyde Hazelwood Maggie Valley Waynesville
Henderson	71%	B	Flat Rock Fletcher Hendersonville Laurel Park
Madison	100%	B	Hot Springs Mars Hill Marshall
Mitchell	100%	D	Bakersville Spruce Pine
Transylvania	82%	B	Brevard Rosman
Yancey	100%	D	Burnsville

* Source: North Carolina Center for Geographic Information and Analysis

Region	Name	Location
A	Southwestern NC Planning and Economic Development Commission	Bryson City
B	Land-of-Sky Regional Council	Asheville
D	Region D Council of Governments	Boone

2.3 Surface Water Hydrology

2.3.1 Major Hydrologic Divisions

Most federal government agencies, including the US Geological Survey and the US Natural Resources Conservation Service (NRCS), use a system of defining watersheds that is different from that used by the Division of Water Quality (DWQ) and many other state agencies in North Carolina. Under the federal system, the French Broad River basin is made up of three hydrologic areas referred to as hydrologic units. An 8-digit number defines each hydrologic unit. By contrast, DWQ has a two-tiered system in which the state is divided into 17 river basins with each basin further subdivided into subbasins. The French Broad River basin is subdivided by DWQ into seven subbasins. Table A-4 compares the two systems. Maps of each subbasin are included in Section B of this basinwide plan.

Table A-4 Hydrologic Subdivisions in the French Broad River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ 6-digit Subbasin Codes
French Broad River and Major Tributaries	06010105	
Upper mainstem and headwater streams	"	
North, West and East Fork of French Broad		04-03-01
Little River		04-03-01
Middle mainstem and tribs	"	
Mud Creek, Cane Creek, Swannanoa River,		04-03-02
Hominy Creek, Sandymush Creek		04-03-02
Mills and Davidson River	"	04-03-03
Lower mainstem and tribs	"	
Big Ivy Creek (River), Big Laurel Creek and		04-03-04
Spring Creek		04-03-04
Pigeon River and Major Tributaries	06010106	
East and West Forks Pigeon River	"	04-03-05
Jonathan, Richland, Cataloochee and Big Creeks	"	04-03-05
Nolichucky River and Tributaries	06010108	
Nolichucky mainstem	"	
North and South Toe Rivers		04-03-06
Big Rock Creek		04-03-06
Cane River	"	04-03-07

2.4 Land Cover

Land cover information in this section is from the National Resources Inventory (NRI) of 1992 and 1982, as developed by the Natural Resources Conservation Service (USDA, 1994). The NRI is a multi-resource national inventory based on soils and other resource data collected at scientifically selected random sample sites. It is considered accurate to the 8-digit hydrologic unit scale established by the US Geological Survey.

Table A-5 summarizes acreage and percentage of land cover from the 1992 NRI for the basin as a whole and for the major watersheds within the basin as defined by the USGS 8-digit hydrologic

units and compares the coverages to 1982 land cover. Refer to Part 2.3.1 for a comparison between state and federal hydrologic divisions. Descriptions of land cover types identified by the NRI are found in Table A-6.

Table A-5 Land Cover in the French Broad River Basin by Major Watersheds (8-Digit USGS Hydrologic Units)

	MAJOR WATERSHED AREAS *						1992 TOTALS		1982 TOTAL		%
	French Broad		Pigeon		Nolichucky						change
LAND COVER	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	since 1982
Cult. Crop	45.6	4.4	0.0	0.0	0.0	0.0	45.6	2.5	55.0	3.0	-17.1
Uncult. Crop	12.1	1.2	3.8	1.1	4.5	1.1	20.4	1.1	40.4	2.2	-49.5
Pasture	163.0	15.6	38.6	11.4	36.2	8.5	237.8	13.1	253.0	14.0	-6.0
Forest	500.9	47.8	125.1	37.0	270.2	63.7	896.2	49.5	924.1	51.1	-3.0
Urban & Built-up	129.2	12.3	27.5	8.1	25.0	5.9	181.7	10.0	127.8	7.1	42.2
Other	196.3	18.7	143.4	42.4	88.1	20.8	427.8	23.6	409.2	22.6	4.5
Totals	1047.1	100.0	338.4	100.0	424.0	100.0	1809.5	100.0	1809.5	100.0	
% of Total Basin		57.9		18.7		23.4		100.0			
SUBBASINS	04-03-01 04-03-02 04-03-03 04-03-04		04-03-05		04-03-06 04-03-07						
8- Digit Hydraulic Units	06010105		06010106		06010108						

* = Watershed areas as defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.
Source: USDA, Soil Conservation Service - 1982 and 1992 NRI

Land cover in the basin is dominated by forestland, which covers approximately 50 percent of the land area. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 17 percent. The urban and built-up category covers 10 percent of the land area. The remaining 24 percent of land cover is in the other category. Comparisons of land cover types between 1982 and 1992 show a significant decrease in the agriculture-related categories (72%) and a substantial increase in the urban and built-up category (42%).

The most recent land cover information for the French Broad River basin is based on satellite imagery collected from the North Carolina Corporate Geographic Database. The state's Center for Geographic Information and Analysis (CGIA) developed statewide land cover information based on this 1993-1995 satellite imagery. This land cover data is divided into 24 categories. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-7. Figure A-7 provides an illustration of the relative amount of land area that falls into each major cover type for the French Broad River basin. Section B of this plan provides land cover data specific to each subbasin.

Table A-6 Description of Land Cover Type from the 1992 National Resources Inventory

Land Cover Type	Land Cover Description
Cultivated Cropland	Harvestable crops including row crops, small grain and hay crops, nursery and orchard crops, and other specialty crops.
Uncultivated Cropland	Summer fallow or other cropland not planted.
Pastureland	Forage plants for livestock grazing, including land that has a vegetative cover of grasses, legumes and /or forbs, regardless of whether or not it is being grazed by livestock.
Forestland	At least 10 percent stocked (a canopy cover of leaves and branches of 25 percent or greater) by single-stemmed trees of any size, which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover. The minimum area for classification of forestland is 1 acre, and the area must be at least 1,000 feet wide.
Urban and Built-up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	*Rural Transportation*: Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes). *Small Water Areas*: Waterbodies less than 40 acres in size and streams less than one-half mile wide. *Census Water*: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width. *Minor Land*: Lands not in one of the other categories.

Source: USDA, Soil Conservation Service -1992 NRI

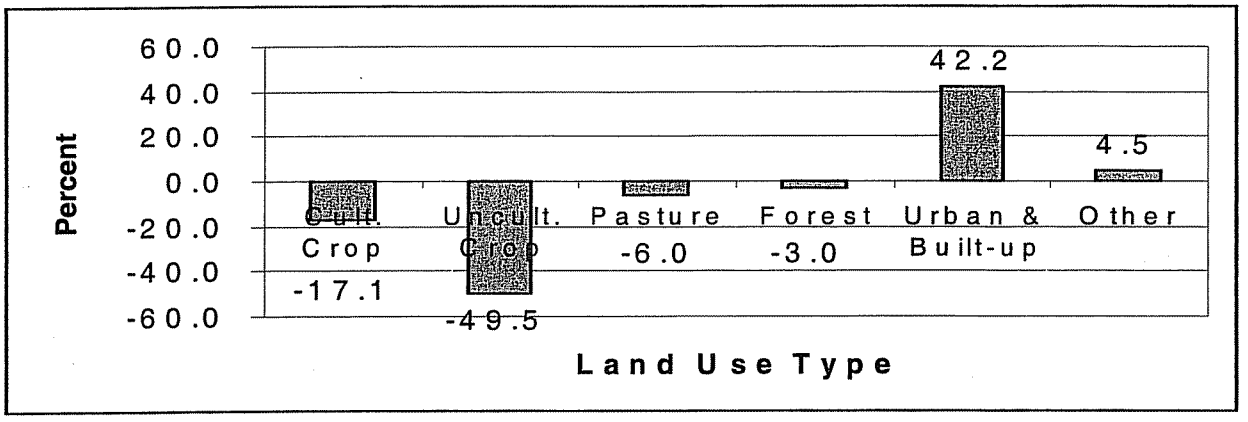


Figure A-6 Land Cover Changes from 1982 to 1992 for the French Broad River Basin (Source: USDA-NRCS 1992 NRI)

Table A-7 Description of Land Cover Categories

Land Cover Type	Land Cover Description
Urban	Greater than 50% coverage by synthetic land cover (built-upon area) and municipal areas.
Cultivated	Areas that are covered by crops that are cultivated in a distinguishable pattern (such as rows).
Pasture/Managed Herbaceous	Areas used for the production of grass and other forage crops and other managed areas such as golf courses and cemeteries. Also includes upland herbaceous areas not characteristic of riverine and estuarine environments.
Forest/Wetland	Includes salt and freshwater marshes, hardwood swamps, shrublands and all kinds of forested areas (such as needleleaf evergreens, conifers, deciduous hardwoods).
Water	Areas of open surface water, areas of exposed rock, and areas of sand or silt adjacent to tidal waters and lakes.

Source: Center for Geographic Information and Analysis

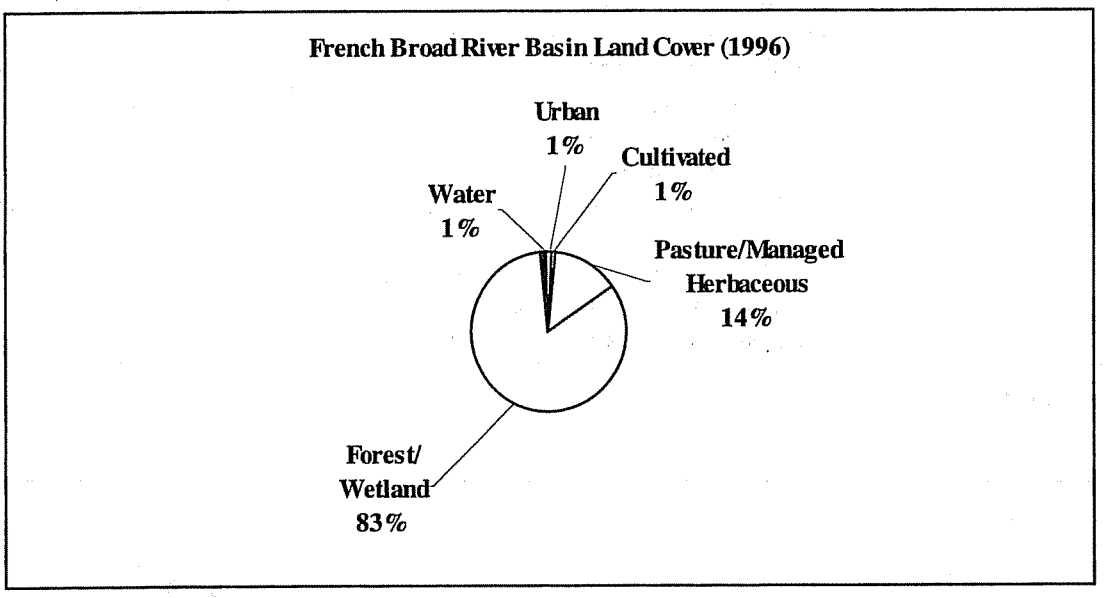


Figure A-7 Percentages within Major Land Cover Categories in the French Broad River Basin

Unfortunately, due to differences in the system of categorizing various land cover classes, it is not possible to establish trends in land cover changes by comparing this data set to previously attained land cover data. However, it is anticipated that comparisons will be possible with future satellite data since a strong consensus-based effort was made to develop the classification system that was used with the 1996 data.

2.5 Population and Growth Trends

Population

Based on 1990 census data, approximately 357,932 people live in the French Broad River basin. Table A-8 presents census data for 1970, 1980 and 1990, the percent population change and population density (persons per square mile) within each subbasin. It also includes land and water area by subbasin.

Figure A-8 shows 1990 population densities by census block group for the French Broad River basin. The overall population density was 128 persons per square mile versus a statewide average of 139 persons per square mile. Subbasin population densities, as of 1990, are highest in the subbasin containing the City of Asheville. Other areas of the basin have relatively low population density.

In using these data, it should be noted that some of the population figures are estimates because the census block group boundaries do not generally coincide with subbasin boundaries. The census data are collected within boundaries such as counties and municipalities. By contrast, the subbasin lines are drawn along natural drainage divides separating watersheds. Therefore, where a census block group straddles a subbasin line, the percentage of the population that is located in the subbasin is estimated. This is done by simply estimating the percentage of the census block group area located in the subbasin, and then taking that same percentage of the total census block group population and assigning it the subbasin. This method assumes that population density is evenly distributed throughout a census block group, which is not always the case. However, the level of error associated with this method is not expected to be significant for the purposes of this document. It is also important to note that the census block groups change every ten years so comparisons between years must be considered approximate.

Table A-8 French Broad River Subbasin Population (1970, 1980 and 1990) and Land Area Summaries

SUBBASIN	POPULATION (Number of Persons)			POPULATION DENSITY (Persons/Square Mile)			LAND AND WATER AREAS			
							Total Land and Water Area		Water Area	Land Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
04-03-01	14,269	16,111	17,853	67	75	83	137,498	215	1	214
04-03-02	182,108	209,252	232,903	227	261	291	515,494	806	5	801
04-03-03	4,576	7,279	7,530	32	52	53	90,317	141	0	141
04-03-04	19,092	20,205	20,660	39	41	42	317,139	496	2	494
04-03-05	38,670	42,322	43,746	73	80	82	340,710	532	1	531
04-03-06	25,862	29,858	29,806	56	64	64	298,054	466	1	465
04-03-07	4,637	4,878	5,434	30	32	36	98,265	153	0	153
TOTALS	289,214	329,905	357,932	103	118	128	1,797,477	2,809	10	2,799

Source: State Center for Health Statistics using US Census Data

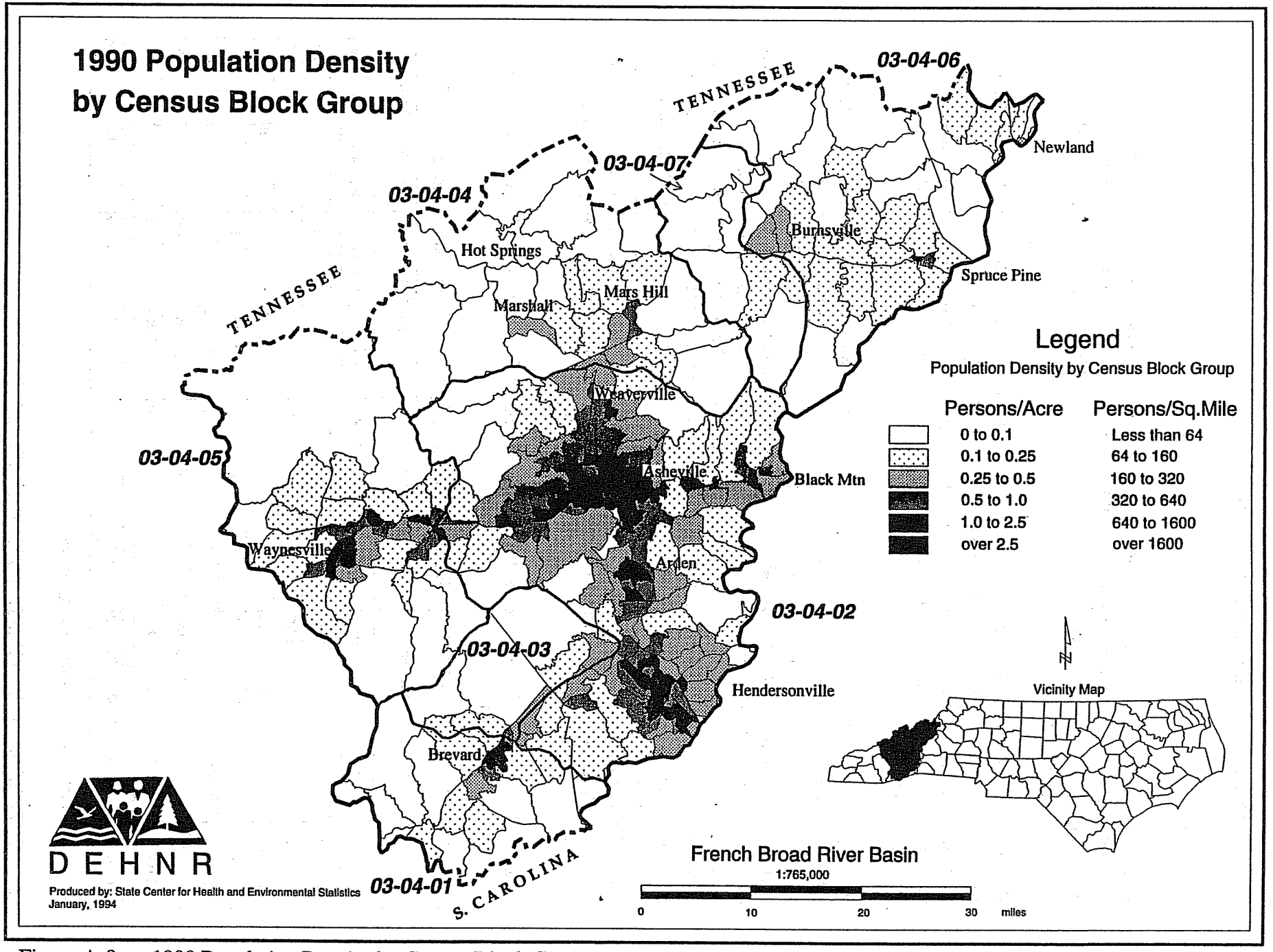


Figure A-8 1990 Population Density by Census Block Group

Growth Trends

Figure A-9 presents population growth by subbasin for the entire French Broad River basin. The percent population growth over the last ten-year census period (1980-1990) was 8.5 percent, as compared to the statewide average of 12.7 percent.

Table A-9 presents population data for municipalities located at least in part within the basin and having populations greater than 1,000 persons. The Town of Hendersonville is one of the fastest growing municipalities in the basin. The small Town of Black Mountain has also been growing very quickly.

Table A-9 Population and Percent Change (1980, 1990, 1996) for Municipalities Greater than 1,000 Located Wholly or Partly in the French Broad River Basin

Municipality	County	Apr-80	Apr-90	Jul-97	Percent Change (1980-90)	Percent Change (1990-97)
Asheville	Buncombe	54,022	61,855	68,133	14.5	10.1
Biltmore Forest	Buncombe	1,499	1,324	1,347	-11.7	1.7
Black Mountain	Buncombe	4,083	5,533	7,409	35.5	33.9
Brevard	Transylvania	5,323	5,388	6,079	1.2	12.8
Burnsville	Yancey	1,452	1,482	1,570	2.1	5.9
Canton	Haywood	4,631	3,790	3,718	-18.2	-1.9
Clyde	Haywood	1,008	1,041	1,138	3.3	9.3
Fletcher	Henderson	2,233	2,787	3,288	24.8	18.0
Hendersonville	Henderson	6,862	7,284	9,624	6.1	32.1
Laurel Park	Henderson	764	1,322	2,035	73.0	53.9
Mars Hill	Madison	2,126	1,611	1,573	-24.2	-2.4
Spruce Pine	Mitchell	2,282	2,010	1,909	-11.9	-5.0
Waynesville	Haywood	8,576	8,438	9,687	-1.6	14.8
Weaverville	Buncombe	1,495	2,107	2,425	40.9	15.1
Woodfin	Buncombe	3,260	2,736	3,349	-16.1	22.4

Source: Office of State Planning North Carolina Municipal Population 1995 and 1997

Table A-10 shows the projected percent change in growth between 1990 and 2016 for counties within the basin (Office of State Planning, 1996). Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the French Broad River basin. They are instead presented as an estimate of possible countywide population changes. With the exception of Mitchell County, all counties are expected to experience population increases. Buncombe and Henderson counties are expected to experience the greatest growth.

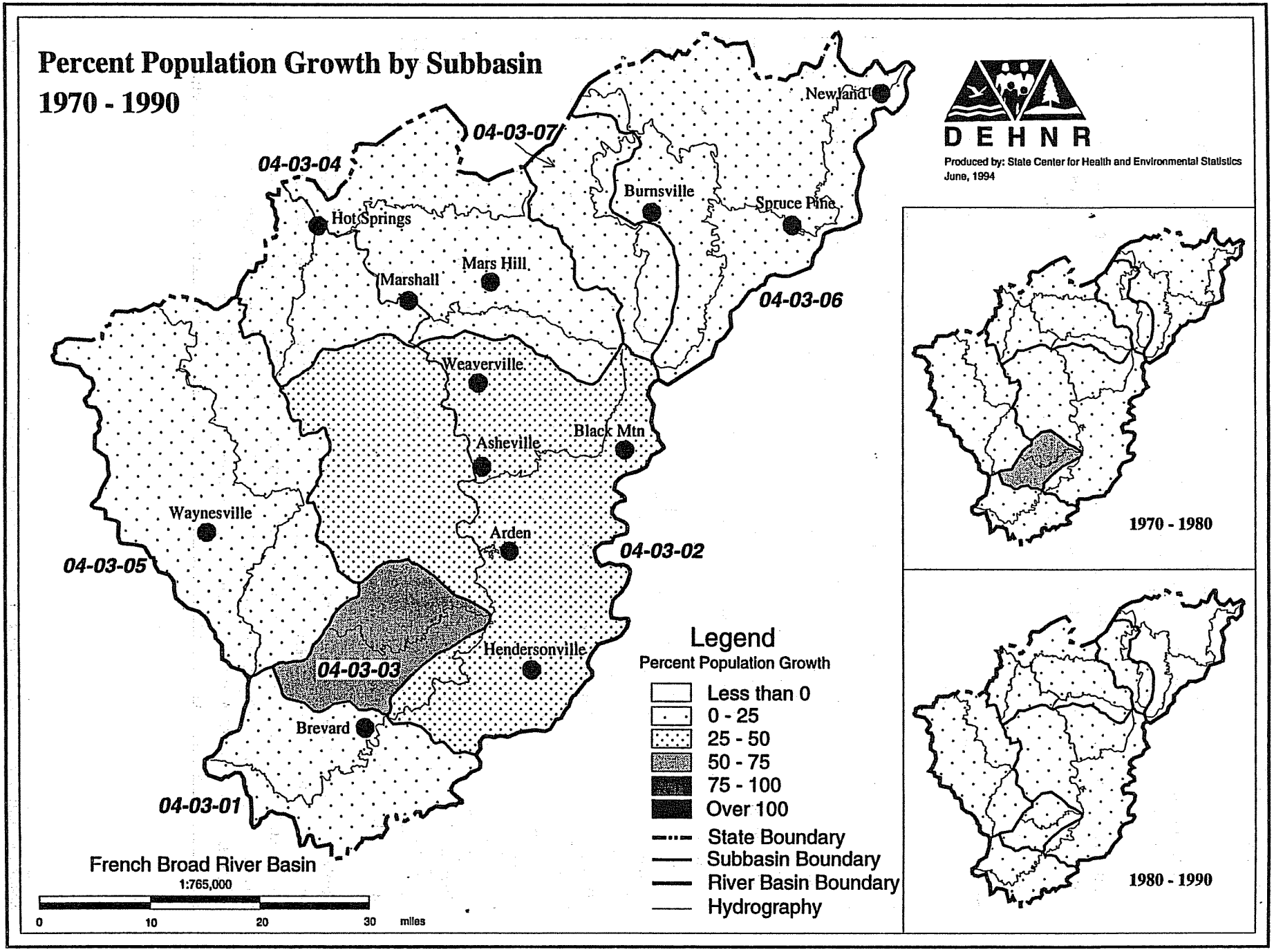


Figure A-9 Population Growth by Subbasin (1970 to 1990)

Table A-10 Past and Projected Population and Percent Changes (1990 to 2016) by County *

County	Population in 1990	Estimated Population in 1996	Estimated % Growth 1990 - 1996	Estimated Population in 2016	Estimated % Growth 1996 - 2016
Avery	14,867	15,205	2.3	15,295	0.6%
Buncombe	174,778	191,798	9.7	227,434	18.6%
Haywood	46,942	50,443	7.5	53,792	6.6%
Henderson	69,326	77,549	11.9	95,604	23.3%
Madison	16,953	18,020	6.3	19,288	7.0%
Mitchell	14,433	14,864	3.0	14,797	-0.5%
Transylvania	25,520	27,447	7.6	30,317	10.5%
Yancey	15,419	16,278	5.6	17,269	6.1%
Totals	378,238	411,604	8.8	473,796	15.1

Source: Office of State Planning 1996
* For counties with >5 percent of land area within basin

2.6 Natural Resources

2.6.1 Rare Aquatic Species and Significant Natural Areas

The French Broad River basin is comprised of the Pigeon, French Broad and Nolichucky watersheds. Two rare aquatic species found in all three watersheds of the French Broad River basin are the Hellbender (a large, uncommon aquatic salamander) and the Appalachian Elktoe (a federally endangered freshwater mussel). Hellbenders are found elsewhere in North Carolina in the mountain counties, while the Appalachian Elktoe is only found elsewhere in the state in the Little Tennessee River basin. An uncommon aquatic lichen is found in the French Broad and Pigeon River watersheds, as well as scattered throughout the mountains.

French Broad River Watershed

The most ecologically significant aquatic area in the French Broad River watershed is the lower section of the French Broad River from the Town of Marshall in Madison County to the Tennessee state line. As part of the Tennessee Valley River system, the French Broad River provides habitat for numerous fish species found in no other river systems in North Carolina. While many of these fish appear to have been extirpated from the French Broad River, several other kinds of these fish, including Freshwater Drum, Banded Sculpin, Mooneye and perhaps the Paddlefish, still survive in this stretch of the river.

Other aquatic species that make their appearance in North Carolina only in the French Broad River watershed are the Mudpuppy (an aquatic salamander) and the Eastern Spiny Softshell (an aquatic turtle more common to the west). Other rare species include the French Broad Crayfish, a North Carolina endemic found only in the French Broad and Horsepasture Rivers; and the Tennessee Heelsplitter mussel, a federal species of concern found in North Carolina only in the French Broad River watershed and a few rivers of the Hiwassee River basin.

Spring Creek is another important aquatic habitat found in the French Broad River watershed. Spring Creek flows into the French Broad River at Hot Springs. Approximately ten rare fish species have been found in this creek, though several now appear to be extirpated. Three (the Ohio Lamprey, the American Brook Lamprey and the Dusky Darter) are found nowhere else in North Carolina. Also notable are the Spotfin Chub (found in North Carolina only in the French Broad River watershed and the Little Tennessee River basin) and the Loggerhead Muskturtle (found in North Carolina only in the French Broad River watershed and the Hiwassee basin).

Nolichucky River Watershed

The Nolichucky and its three main tributaries, the North Toe, South Toe and the Cane Rivers, are home to a number of rare aquatic animals. The Wavy-rayed Lampmussel (a freshwater mussel) is found in the Nolichucky and Little Tennessee River watersheds only. The Cane River contains several rare animals: most notably, almost the entire state population of Sharphead Darter, Striped Shiner, Stonecat and Olive Darter.

The South Toe River supports the only extant North Carolina population of the Blotchside Darter. Several nearby bogs and marshes in the Celo area contain rare plants. The lower stretches of the North Toe and Nolichucky Rivers provide habitat for several noteworthy fish, including the Olive Darter, Logperch and Tangerine Darter, and the Appalachian Elktoe, a freshwater mussel.

Also noteworthy in the Nolichucky River watershed are the largely protected and intact forested slopes of the Black Mountains and the Roan Mountain Massif, both of which harbor a number of rare plants and animals and help ensure the water quality of the region.

Pigeon River Watershed

While the Pigeon River watershed harbors several rare aquatic species, including the Hellbender, Appalachian Elktoe, Sauger and Tangerine Darter, it does not match the diversity found in the other two watersheds of the French Broad River basin. Most notable features are the large, intact forested areas of the Great Smoky Mountains National Park and the Shining Rock Wilderness area.

2.7 Permitted Wastewater and Stormwater Discharge Facilities

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities that serve populations greater than 100,000 and stormwater discharges associated with certain

The primary pollutants associated with point source discharges are:

* oxygen-consuming wastes,
* nutrients,
* color, and
* toxic substances including chlorine, ammonia and metals

industrial activities. Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are issued under the NPDES program, which is delegated to DWQ by the Environmental Protection Agency.

2.7.1 Wastewater Discharges in the French Broad River Basin

There are 166 permitted wastewater discharges in the French Broad River basin. Only 16 of these dischargers are major dischargers. Table A-11 provides summary information by subbasin (numbers of facilities and permitted flows) regarding the discharges. The various types of dischargers characterized in the table are described in the inset box. A summary of all dischargers can be found in Appendix I.

Types of Wastewater Discharges

Major Facilities: Municipal Wastewater Treatment Plants with flows ≥1 MGD (million gallons per day); and some industrial facilities (depending on flow and potential impacts on public health and water quality).
Minor Facilities: Any facilities not meeting the definition of Major.
100% Domestic Waste: Facilities that only treat domestic-type waste (water from bathrooms, sinks, washers).
Municipal Facilities: Facilities that serve a municipality and can treat waste from homes and industries.
Nonmunicipal: Facilities with wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation. This category includes a variety of facilities such as schools, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

Figure A-10 shows the location of major and minor permitted wastewater discharges within the basin. The number of triangles on the map depicting major discharges do not correspond exactly to the number of major facilities listed in Table A-11, since some major facilities have more than one outfall point. Each outfall point received its own triangle.

2.7.2 Stormwater Discharges in the French Broad River Basin

Amendments were made to the Clean Water Act in 1990 pertaining to permit requirements for stormwater discharges associated with industrial activities and municipal storm sewer systems serving populations of 100,000 or more (called Phase I). In November 1999, a second phase of the NPDES stormwater program went into effect. Phase II requires smaller municipalities in urbanized areas to develop stormwater programs. DWQ administers these regulations in North Carolina through the state stormwater program. The goal of the DWQ stormwater discharge permitting regulations is to prevent pollution via stormwater runoff by controlling the source(s) of pollutants.

The municipal permitting requirements are designed to lead to the formation of comprehensive stormwater management programs for municipal areas. There were no municipalities in the French Broad River basin large enough to require a stormwater discharge permit under Phase I. For a current list of local governments that will be required to obtain an NPDES stormwater permit under Phase II, refer to Section A, Chapter 4, Part 4.3.3.

Table A-11 Summary of NPDES Dischargers and Permitted Flows for the French Broad River Basin

Facility Categories	Subbasin							
	01	02	03	04	05	06	07	TOTAL
Total Facilities	15	83	8	11	21	23	2	166
Total Permitted Flow (MGD)	33.529	55.8627	0.228	0.9779	37.3576	13.158	0.8177	141.9309
Major Discharges	3	6	0	0	3	4	0	16
Total Permitted Flow (MGD)	33.0	53.75	0.0	0.0	36.9	10.99	0.0	134.64
Minor Discharges	12	77	8	11	18	19	2	150
Total Permitted Flow (MGD)	0.529	2.1127	0.0228	0.9779	0.4576	2.168	0.8177	7.0857
100% Domestic Waste	10	63	7	8	20	10	1	120
Total Permitted Flow (MGD)	2.984	1.4317	0.048	0.5754	1.4576	0.188	0.0177	6.7024
Municipal Facilities	2	2	0	3	3	3	1	14
Total Permitted Flow (MGD)	2.59	43.2	0.0	0.905	7.21	0.995	0.8	55.7
Nonmunicipal Facilities	13	81	8	8	18	20	1	152
Total Permitted Flow (MGD)	30.939	12.6627	0.0228	0.0729	30.1476	12.163	0.0177	86.0257

Table A-12 Summary of Individual NPDES Stormwater Permits in the French Broad River Basin

Permit #	Facility Name	Receiving Stream	Subbasin	County
NCS000179	BASF Corporation	Hominy Creek & UT	04-03-02	Buncombe
NCS000209	Branford Wire Manufacturing	Mud Creek	04-03-02	Henderson
NCS000234	Arden Services, Inc.	Powell Creek	04-03-02	Buncombe
NCS000105	Blue Ridge Paper Products	Pigeon River, Bowen Branch & Beaverdam	04-03-05	Haywood
NCS000340	Vigoro Industries, Inc. - Haywood	Waynesville storm sewer system into Richland Creek	04-03-05	Haywood
NCS000093	Outboard Marine Corporation	English Creek	04-03-06	Mitchell
NCS000202	United States Gypsum	Toe River	04-03-06	Mitchell

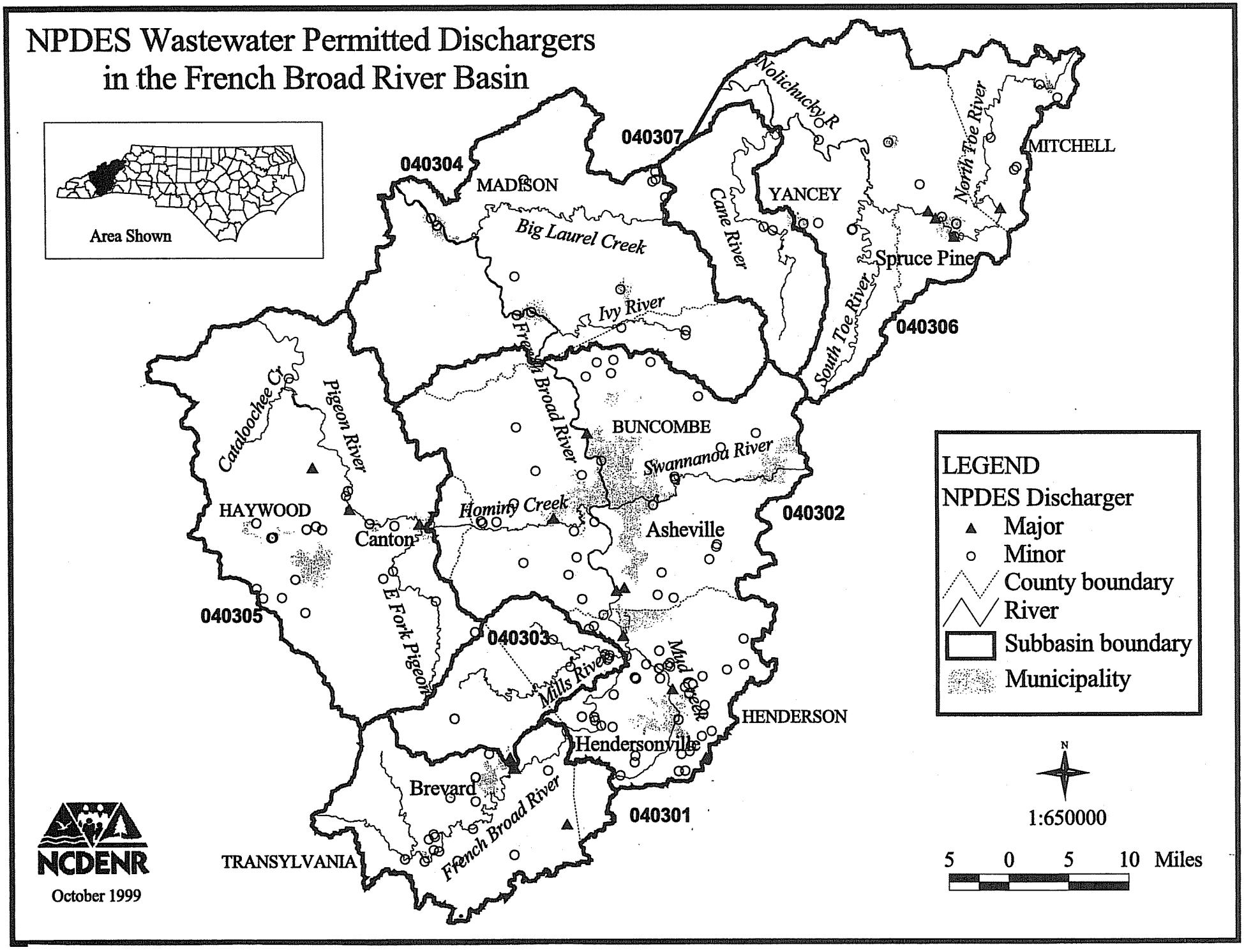


Figure A-10 Location of NPDES Permitted Dischargers in the French Broad River Basin

Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Stormwater permits are granted in the form of general permits (which cover a wide variety of more common activities) or individual permits. Excluding construction general permits, there are 154 general stormwater permits and 7 individual stormwater permits issued within the river basin. Individual permit holders are presented in Table A-12.

EPA Stormwater Rules

Phase I – December 1990

- Requires a NPDES permit for municipal storm sewer systems serving populations of 100,000 or more.
- Requires a NPDES stormwater permit for eleven categories of industry.
- Requires a NPDES stormwater permit for construction sites that are 5 acres or more.

Phase II – November 1999

- Requires a NPDES permit for municipal storm sewer systems serving populations under 100,000 that are located in urbanized areas.
- Provides incentives to industrial facilities covered under Phase I for protecting operations from stormwater exposure.
- Requires a NPDES stormwater permit for construction sites that are 1-5 acres.

The primary concern with runoff from industrial facilities is the contamination of stormwater from contact with exposed materials. Poor housekeeping can lead to significant contributions of sediment and other water quality pollutants. To address these issues, each NPDES stormwater permitted facility must develop a Stormwater Pollution Prevention Plan (SPPP) that addresses the facility's potential impacts on water quality. Facilities identified as having significant potential to impact water quality are also required to conduct analytical monitoring to characterize pollutants in stormwater discharges under individual NPDES stormwater permits.

The state stormwater management rules (15A NCAC 2H .1000) regulate development activities in 20 coastal counties and on land statewide that drain to Outstanding Resource Waters (ORW) and/or High Quality Waters (HQW). Under this program, development is permitted as either low density or high density. Low density limits the impervious, or built upon, area and allows natural infiltration and attenuation of stormwater runoff. High density requires installation and maintenance of a structural best management practice to control and treat stormwater runoff from the site.

2.8 Animal Operations

In 1992, the Environmental Management Commission adopted a rule modification establishing procedures for managing and reusing animal wastes from intensive livestock operations. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve animal populations of at least the following size: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. Within the past five years there have been several additional pieces of legislation enacted that affect animal operations in North Carolina.

Table A-13 summarizes, by subbasin, the number of registered livestock operations, total animals, total acres in operation, and total steady state live weight as of September 1998. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

Steady State Live Weight (SSLW) is the result, in pounds, after a conversion factor has been applied to the number (head count) of swine, cattle or poultry on a farm. The conversion factors, which come from the Natural Resource Conservation Service (NRCS) guidelines, vary depending on the type of animals on the farm and the type of operation (for example, there are five types of hog farms). Since the amount of waste produced varies by hog size, SSLW is the best way to compare the sizes of the farms.

The NC Department of Agriculture provided information on animal capacity by subbasin (Table A-14). Total swine capacity represents only 1 percent of the state total. The two subbasins that had large numbers of swine significantly decreased their numbers between 1994 and 1998. Basinwide, the numbers of swine have decreased by about 61 percent. Only about 3 percent of the state's total capacity for dairy animals are within the basin. The numbers of dairy animals have also significantly decreased (41%). The basin contains less than 1 percent of the state total capacity for poultry.

Table A-13 Registered Animal Operations in the French Broad River Basin (as of 9/98)

Subbasin	Swine			Cattle		
	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight
04-03-01	0	0	0	0	0	0
04-03-02	1	2,000	283,400	10	3,630	5,082,000
04-03-03	0	0	0	2	425	595,000
04-03-04	0	0	0	0	0	0
04-03-05	0	0	0	8	1,180	1,586,000
04-03-06	0	0	0	0	0	0
04-03-07	0	0	0	0	0	0
Totals	1	2,000	283,400	20	5,235	7,263,000

Table A-14 Estimated Populations of Swine (1998, 1994 and 1990), Dairy (1998 and 1994) and Poultry (1998 and 1994) in the French Broad River Basin

Subbasin	Total Swine Capacity			Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	1990	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
04-03-01	260	219	275	19	0	0	0	700	700	0
04-03-02	690	1,180	1,468	-42	1,216	2,965	-59	600	600	0
04-03-03	14	6	0	133	285	269	6	0	0	0
04-03-04	95	105	204	-10	332	332	0	0	0	0
04-03-05	255	1,905	1,292	-87	1,337	1,696	-21	0	0	0
04-03-06	10	4	13	150	0	3	-100	0	0	0
04-03-07	0	0	0	0	110	303	-64	0	0	0
TOTALS	1,324	3,419	3,252	-61	3,280	5,568	-41	1,300	1,300	0
% of State Total	<1%	<1%	<1%		3%	4%		<1%	<1%	

Source : NC Department of Agriculture, Veterinary Division

2.9 Water Use and Minimum Streamflow

2.9.1 Local Water Supply Planning

The North Carolina General Assembly mandated a local and state water supply planning process under North Carolina General Statute 143-355(l) and (m) to assure that communities have an adequate supply of water for future needs. Under this statute all units of local government that provide or plan to provide public water supply service are required to prepare a Local Water Supply Plan (LWSP) and to update that plan at least every five years. The information presented in a LWSP is an assessment of a water system's present and future water needs and its ability to meet those needs. The current LWSPs are based on 1992 data. Plans are being updated this year (1999) based on 1997 water supply and water use information.

Twenty-three systems that use water from the French Broad River basin provided an average of 39 million gallons per day (MGD) to 204,396 persons in 1992 (Table A-15). Projections of future needs show that these systems expect their service populations to increase by 74 percent to 356,567 persons by the year 2020. Average daily water use for these systems is expected to increase to 56 MGD by the year 2020. This information represents systems submitting a LWSP and does not reflect the needs of the many public water systems in this basin that are not required to prepare a local plan because they are not operated by a unit of local government. The information is self-reported and has not been field verified. However, plans have been reviewed by staff engineers for consistency and reasonableness. More information is available for these and other systems across the state that submitted a Local Water Supply Plan from the Division of Water Resources website at: http://www.dwr.ehnr.state.nc.us/home.htm.

Table A-15 Population and Water Use Information Contained in Local Water Supply Plans in the French Broad River Basin

County	System	Population			Average Daily Water Use (MGD)		
		1992	2000	2020	1992	use2000	use2020
Avery	Newland	645	850	950	0.113	0.143	0.157
Buncombe	Asheville	99000	127100	190900	21.5	25.0	31.0
Buncombe	Biltmore Forest	1321	1401	1601	0.205	0.217	0.248
Buncombe	Black Mountain	5750	6226	7599	0.57	0.594	0.663
Buncombe	Montreat	637	700	800	0.14	0.15	0.17
Buncombe	Weaverville	3300	3907	5911	0.429	0.508	0.768
Buncombe	Woodfin	7000	7523	8138	0.998	1.058	1.136
Haywood	Canton	7000	7140	7500	1.435	1.668	1.9
Haywood	Clyde	1350	1497	1938	0.158	0.175	0.226
Haywood	Junaluska SD	3550	3900	4700	0.275	0.299	0.363
Haywood	Maggie Valley SD	5510	6456	9593	0.915	1.072	1.595
Haywood	Waynesville	10150	10760	12440	3.21	3.56	3.7
Henderson	Hendersonville	40000	46866	76795	5.567	5.628	9.273
Henderson	Laurel Park	1100	1572	1818	0.11	0.16	0.18
Madison	Mars Hill	2950	3460	5140	0.253	0.341	0.677
Madison	Marshall	809	802	776	0.119	0.119	0.12
McDowell	Little Switzerland CWA	270	300	360	0.011	0.012	0.014
Mitchell	Bakersville	340	340	340	0.088	0.088	0.088
Mitchell	Spruce Pine	3304	3260	3002	0.993	1.02	1.085
Polk	Saluda	565	678	758	0.11	0.139	0.152
Transylvania	Brevard	7600	10086	13075	0.99	1.31	1.69
Transylvania	Rosman	445	500	520	0.044	0.055	0.066
Yancey	Burnsville	1800	1874	1913	0.321	0.394	0.41
Total		204,396	247,198	356,567	38.554	43.71	55.681

Source: NC Division of Water Resources Local Water Supply Plans

2.9.2 Minimum Streamflow

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. The Division of Water Resources (DWR), in conjunction with the Wildlife Resources Commission, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources issues the permits. DWR has been involved in several minimum streamflow projects in this basin (Table A-16 and Table A-17).

Table A-16 Minimum Instream Flow Projects for Hydroelectric Dams in the French Broad River Basin

HYDROELECTRIC DAMS					
Hydropower Dam	**Location**	**Ownership**	**Bypass Reach**	**Drainage Area (sq. mi.)**	**Min. Release (cu.ft/sec)**
French Broad River Hydroelectric Dams: Craggy, Capitola and Redmon					
Craggy	downstream of Beaverdam Creek confluence	Metropolitan Sewer District	3200 feet	966	460 July through January 860 remainder of year
Capitola	upstream of Marshall, NC	French Broad Electric Membership Corporation	1000 feet	1332	None*
Redmon	downstream of Marshall, NC	Carolina Power and Light Company	None	1343	None*
Other Dams					
Ivy River	2.2 miles upstream of the mouth	Madison Hydropower Partners	None		16
Little River		Cascade Power Company	1016 feet	40	10
Walters Dam	Pigeon River confluence with Big Creek on the NC-TN border	Carolina Power and Light Company	12 miles	455	**
Richland Creek	impounds Lake Junaluska	Lake Junaluska Assembly	None	63.6	None*

Source: NC Division of Water Resources

Notes:

* Even though there is no minimum flow, the project must still operate in a run-of-river mode; i.e., instantaneous inflow equals instantaneous outflow. A noncompliant project can alter noticeably the streamflow.

** A minimum flow of 100 cfs is required one mile below the powerhouse at Brown's Bridge in Tennessee. Scheduled recreational releases are also required.

No minimum release will be required in the bypassed natural channel until water quality and biological criteria are met. In lieu of a minimum flow, the utility will contribute funds to the Pigeon River Fund. In exchange for contributions to the Fund, DENR will not seek a minimum release from the dam for 10 years. When water quality and biological criteria are met, the minimum release into the bypassed channel will be 30 cfs during May and June and 20 cfs during the remainder of the year.

Table A-17 Minimum Instream Flow Studies for Water Supply Impoundments in the French Broad River Basin

WATER SUPPLY IMPOUNDMENTS/WITHDRAWALS		
Dam	**Study Cooperators**	**Purpose of Study**
Davidson River - Cedar Rock Creek	NC Wildlife Resources Commission and US Forest Service	The Commission's Pisgah Fish Hatchery relies on these streams to fill raceways. The study will assist in determining a flow management strategy during low flow periods.
Jonathan Creek	NC Wildlife Resources Commission and Town of Maggie Valley	Study is for a proposed water treatment plant expansion from 1.5 to 3.0 MGD. All parties agreed on an 8 cfs minimum flow below the intake and the installation of a monitoring gage.
Ivy River	NC Wildlife Resources Commission and Town of Weaverville	A proposed withdrawal of 1.5 MGD was determined not to have a significant impact on downstream flows.
Mills River	NC Wildlife Resources Commission, Asheville-Buncombe County Water Authority and Henderson County	Discussions on a proposed water withdrawal on Mills River. The project includes a 5 MGD capacity WTP, 10 MGD (15.5 cfs) capacity intake, 50 million gallon raw water storage facility, and 2-10 MGD raw water pump stations. Further expansion of the facility will draw from the French Broad River. The resource agencies determined that, since the withdrawal is within 150 feet of confluence with the French Broad River, no instream flow study would be required.
Mills River	NC Wildlife Resources Commission and City of Hendersonville	The city is allowed to withdraw 12 MGD (18.5 cfs) without restriction, but withdrawals up to a maximum of 24 MGD (37 cfs) will require a minimum flow of 30 cfs.
North Fork Mills River - Bradley Creek	NC Wildlife Resources Commission, US Forest Service and City of Hendersonville	All parties agreed upon an 8 cfs release below each of the water supply impoundments with gages to monitor the releases.
Reems Creek - Sugarcamp Fork	NC Wildlife Resources Commission and Woodfin Sanitary Water and Sewer District	Discussions regarding a minimum flow release from the Woodfin Reservoir. The reservoir is located on Sugarcamp Fork very near the confluence with Reems Creek. The Division supports a tiered release from the reservoir with a maximum release no greater than 0.8 cfs and the development of a reservoir management plan.

Source: NC Division of Water Resources

2.9.3 Interbasin Transfers

The Division of Water Resources (DWR) is responsible for the registration and certification of interbasin transfers. The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina* and filed in the Office of the Secretary of State on April 16, 1991.

Table A-18 lists interbasin transfers in the French Broad River basin. The transfer amounts shown are 1992 average daily amounts in million gallons per day (MGD) based on 1992 Local Water Supply Plans and registered withdrawal/transfer information. All three of the transfers shown involve the City of Hendersonville, which has service areas in both the French Broad and Broad River basins. The first transfer involves a small unquantified consumptive loss (examples: septic systems, lawn irrigation). The second transfer would only occur during emergency water purchases from the City of Asheville. The third transfer is a bulk sale to the Town of Saluda. Currently, there are no interbasin transfer certificate holders in the French Broad River basin.

Under a provision of Senate Bill 1299 (ratified by the General Assembly on September 23, 1988), all local water systems are now required to report existing and anticipated interbasin transfers as part of the Local Water Supply Planning process. This information will be available for future updates of this management plan and will allow an assessment of cumulative impacts.

Table A-18 Interbasin Transfers in the French Broad River Basin

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Net Transfer[1] (MGD)
Hendersonville	Hendersonville	French Broad	Broad	Unknown (out)
Asheville	Hendersonville	French Broad	Broad	Emergency (Out)
Hendersonville	Saluda	French Broad	Broad	0.10 (out)

Source: NC Division of Water Resources

[1] Transfer amounts are based on average daily water use reported in 1992 Local Water Supply Plans. "Unknown" refers to undocumented consumptive losses. "Emergency" refers to an existing emergency connection between two public water systems.

Water Withdrawal Registrations

Prior to 1999, North Carolina General Statute 143-215.22H required all persons who withdraw or transfer one million gallons or more of surface or groundwater on any day, to register with the Division of Water Resources (DWR). Beginning in 1999, withdrawals and transfers greater than 100,000 gallons per day are to be registered with DWR. Table A-19 lists the parties that have registered withdrawals in the French Broad River basin as of January 1, 1999.

Table A-19 Water Withdrawal Registration in the French Broad River Basin

County	Facility #	Capacity (MGD)	Facility
Avery	06-002	2.63	Unimin
Buncombe	11-003	14.00	BASF Corporation
Buncombe	11-004	1.50	BASF Corporation
Buncombe	11-009	0.00	Vulcan Materials Company
Buncombe	11-007	1.73	Vulcan Materials Company
Buncombe	11-008	0.00	Vulcan Materials Company
Buncombe	11-005	316.00	Carolina Power & Light Company
Buncombe	11-006	7.20	Carolina Power & Light Company
Buncombe	11-011	1166.40	Metro Sewerage District of Buncombe County
Buncombe	11-010	0.00	Metro Sewerage District of Buncombe County
Haywood	44-005	1.00	Blue Ridge Paper Products
Haywood	44-006	60.00	Blue Ridge Paper Products
Haywood	44-003	1.00	Carolina Power & Light Company
Haywood	44-004	1256.00	Carolina Power & Light Company
Haywood	44-010	3.60	Little East Fork Trout Farm
Henderson	45-001	4.00	Cranston Print Works Company
Henderson	45-003	1.00	Vulcan Materials Company
Henderson	45-004	5.00	NCSU Mountain Horticulture Crop Res. Station
Madison	57-001	139.30	French Broad EMC
Madison	57-002	1.15	Spring Creek Trout Farm
Madison	57-003	0.69	Little Creek Trout Farm
Madison	57-004	1.40	Franklin Trout Farm
Madison	57-005	1.20	Fox Trout Farm
Madison	57-006	1.20	Fox Trout Farm
Mitchell	61-004	4.00	The Feldspar Corporation
Mitchell	61-003	4.20	Unimin
Mitchell	61-005	1.15	Roan Mountain Trout Farm
Transylvania	88-004	35.00	P.H. Glatfelter Company Ecusta Division
Transylvania	88-003	22.00	P.H. Glatfelter Company Ecusta Division
Transylvania	88-011	4.03	E.I. Dupont Denemours & Company
Transylvania	88-002	80.70	Cascade Power Company
Transylvania	88-005	10.80	NC Wildlife Resources Commission
Transylvania	88-007	1.50	Gourmet Mountain Trout of Western NC, Inc.
Transylvania	88-008	1.00	Sewah Trout Farm
Transylvania	88-009	0.86	High Valley Trout Farm
Transylvania	88-009	8.65	Headwater Trout Farm
Transylvania	88-010	7.00	Trigo Trout Farm
Transylvania	88-012	1.50	Cawtrell Creek Trout Farm
Transylvania	88-013	7.00	Cashiers Valley Trout Farm
	Total Capacity	**3175.39**	**MGD**

Source: NC Division of Water Resources

Chapter 3 -
Summary of Water Quality Information for the French Broad River Basin

3.1 General Sources of Pollution

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. With proper management of wastes and land use activities, these impacts can be minimized. Pollutants that enter waters fall into two general categories: *point sources* and *nonpoint sources*.

Point Sources

- Piped discharges from municipal wastewater treatment plants
- Industrial facilities
- Small package treatment plants
- Large urban and industrial stormwater systems
- Residential straightpiping

Point sources are typically piped discharges and are controlled through regulatory programs administered by the state. All regulated point source discharges in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state.

Nonpoint sources

- Stormwater runoff
- Timber Harvesting
- Agricultural lands
- Rural residential development
- Failing septic systems
- Mining

Nonpoint sources are from a broad range of land use activities. Nonpoint source pollutants are typically carried to waters by rainfall, runoff or snowmelt. Sediment and nutrients are most often associated with nonpoint source pollution. Other pollutants associated with nonpoint source pollution include fecal coliform bacteria, heavy metals, oil and grease, and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given the diffuse nature of nonpoint source pollution, it is difficult and resource intensive to quantify nonpoint contributions to water quality degradation in a given watershed. While nonpoint source pollution control often relies on voluntary actions, the state has many programs designed to reduce nonpoint source pollution.

Every person living in or visiting a watershed contributes to impacts on water quality. Therefore, each individual should be aware of these contributions and take actions to reduce them.

While any one activity may not have a dramatic effect on water quality, the cumulative effect of land use activities in a watershed can have a severe and long-lasting impact.

3.2 Description of Surface Water Classifications and Standards

Program Overview

North Carolina's Water Quality Standards program adopted classifications and water quality standards for all the state's river basins by 1963. The program remains consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters, and the protection of unique and special pristine waters with outstanding resource values.

Statewide Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water (Table A-20). In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. A full description of the state's primary and supplemental classifications is available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina.* Information on this subject is also available at DWQ's web site: http://h2o.enr.state.nc.us/wqhome.html.

Statewide Water Quality Standards

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in the waterbody to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are discussed briefly below. The standards for C and SC waters establish the basic protection level for all state surface waters. With the exception of Sw, all of the other primary and supplemental classifications have more stringent standards than for C and SC, and therefore, require higher levels of protection.

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish, or rare and endangered aquatic species. These waters may be rated as HQW or ORW.

Table A-20 Primary and Supplemental Surface Water Classifications
(Primary classifications beginning with an "S" are assigned to saltwaters)

PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS	
Class	**Best Uses**
C and SC	Aquatic life propagation/protection and secondary recreation.
B and SB	Primary recreation and Class C uses.
SA	Waters classified for commercial shellfish harvesting.
WS	*Water Supply watershed.* There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.
SUPPLEMENTAL CLASSIFICATIONS	
Class	**Best Uses**
Sw	*Swamp Waters*: Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen.
HQW	*High Quality Waters*: Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies.
ORW	*Outstanding Resource Waters*: Unique and special surface waters that are unimpacted by pollution and have some outstanding resource values.
NSW	*Nutrient Sensitive Waters*: Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.

High Quality Waters

Special HQW protection management strategies are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater discharge facilities and facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan in accordance with rules established by the NC Sedimentation Control Commission or approved local erosion and sedimentation control program, and which

Criteria for HQW Classification

- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native and special native trout waters or primary nursery areas by the Wildlife Resources Commission.
- Waters designated as primary nursery areas by the Division of Marine Fisheries.
- Critical habitat areas designated by the Wildlife Resources Commission or the Department of Agriculture.
- Waters classified by DWQ as WS-I, WS-II and SA are HQW by definition, but these waters are not specifically assigned the HQW classification because the standards for WS-I, WS-II and SA waters are at least as stringent as those for waters classified HQW.

drain to and are within one mile of HQWs, are required to control runoff from the development using either a low density or high density option. In addition, the Division of Land Resources requires more stringent sedimentation controls for land-disturbing projects within one mile and draining to HQWs.

Outstanding Resource Waters

A small percentage of North Carolina's surface waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

The ORW rule defines outstanding resource values as:

- outstanding fisheries resource;
- a high level of water-based recreation;
- a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
- being within a state or national park or forest; or
- having special ecological or scientific significance.

The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to North Carolina ORWs are set forth in 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted, and stormwater controls for most new developments are required. In some circumstances, the unique characteristics of the waters and resources that are to be protected require that a specialized (or customized) ORW management strategy be developed.

Classifications and Standards in the French Broad River Basin

The waters of the French Broad River basin have a variety of surface water quality classifications applied to them. Water Supply watersheds range from WS-I to WS-IV. Water supply watersheds, Outstanding Resource Waters and High Quality Waters are presented in Figure A-11.

Classification and standards for the entire basin can be found in a separate document titled *Classifications and Water Quality Standards Assigned to the Waters of the French Broad River Basin* available by calling the Planning Branch of DWQ at (919) 733-5083. They can also be accessed through DWQ's Water Quality Section web site: http://h2o.enr.state.nc.us/wqhome.html.

Pending and Recent Reclassifications in the French Broad River Basin

Rough Creek in Haywood County was approved for reclassification in October 1999 from a WS-I to a WS-I Trout and ORW. Rules will become effective on August 1, 2000.

The French Broad River mainstem from Transylvania County to the NC/TN state line (approximately 115 river miles) is proposed for reclassification from Class C and WS-IV to Class B and WS-IV waters. The following headwaters to the French Broad River are also included in this reclassification proposal: the North, West, East and Middle Forks of the French Broad. Portions of these waters are supplementally classified as Trout waters and High Quality Waters. The reclassification would maintain these classifications and upgrade the primary classification from Class C to Class B. The Davidson River from its source to Hwy 64 and Bent

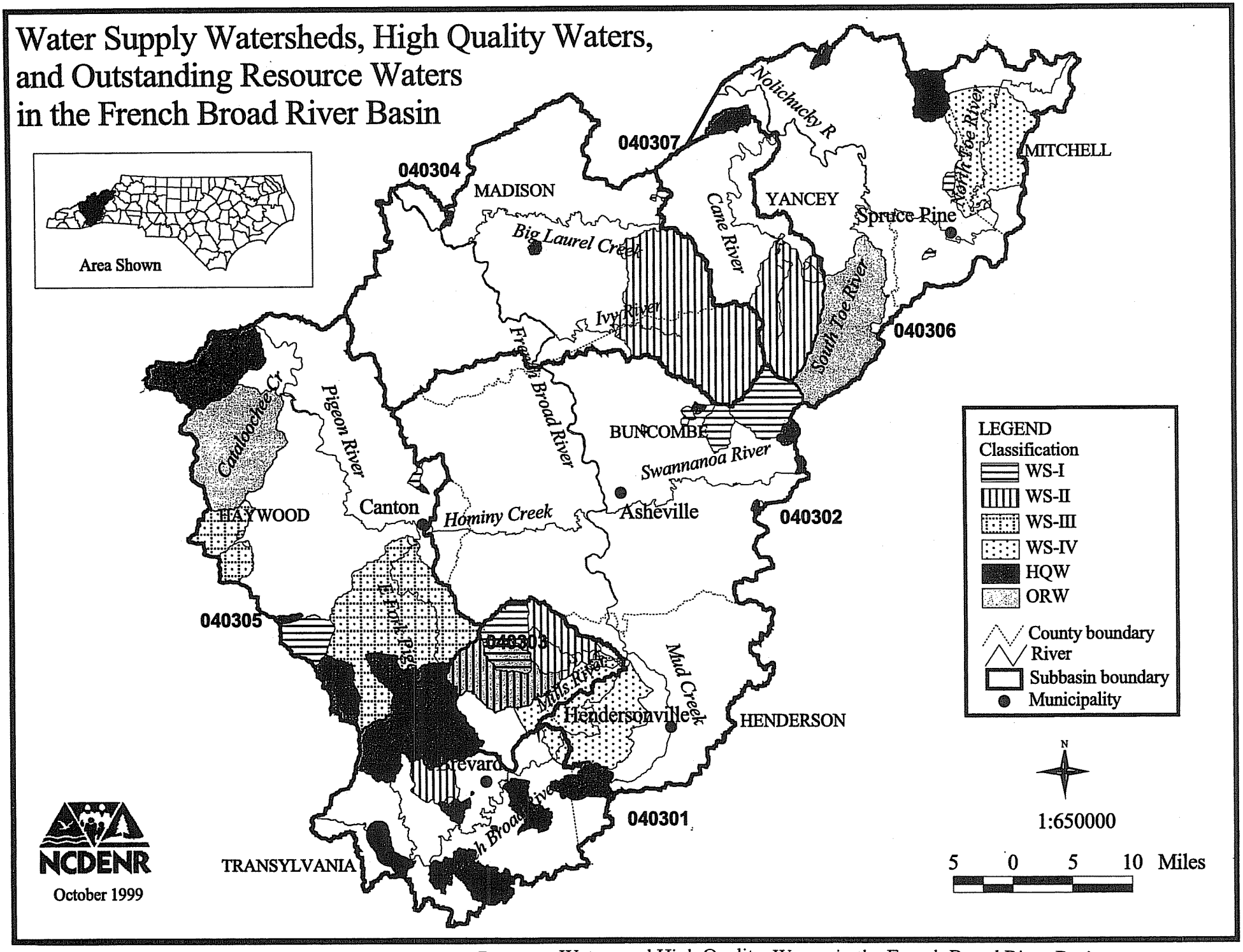


Figure A-11 Water Supply Watersheds, Outstanding Resource Waters and High Quality Waters in the French Broad River Basin

Creek below Lake Powhatan are also included in the reclassification project. The Davidson River has several classifications, depending on the stream segment. These classifications include the primary classification of Class C and Class B, as well as supplemental classifications of Trout and HQW or ORW. The reclassification would upgrade the Class C segments to Class B. Bent Creek also has segments with a Class C or Class B primary classification as well as a Trout water supplemental classification. The primary classification for Bent Creek would be upgraded to Class B. The entire reclassification area would encompass approximately 160 stream miles.

The Nolichucky River mainstem (approximately 9 river miles) from the confluence of the North Toe River and the Cane River to the TN state line are proposed for reclassification from Class C to Class B waters. The North Toe River from Toecane to the Nolichucky River (approximately 14 river miles) is also included in the proposal.

DWQ believes that the high recreational usage of all the above-mentioned waters for rafting, boating, swimming and other activities warrants the proposed reclassification to Class B for protection of these uses. Water quality standards for fecal coliform bacteria must be met for Class B waters. Sampling studies show that fecal coliform levels have decreased in the French Broad and Nolichucky Rivers since the 1970s, primarily due to sewer line improvements, regulations for concentrated animal feeding operations and tougher enforcement of NPDES permits. Public hearings will be held on these reclassification proposals by 2001.

3.3 DWQ Water Quality Monitoring Programs in the French Broad River Basin

DWQ collects a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the French Broad River basin for that program. A more complete discussion on biological and chemical monitoring within the basin can be found in the *French Broad River Basinwide Assessment Report* (DENR, November 1998).

DWQ monitoring programs for the French Broad River Basin include:

- benthic macroinvertebrates (Section 3.3.1)
- fish assessments (Section 3.3.2)
- aquatic toxicity monitoring (Section 3.3.3)
- lakes assessment (Section 3.3.4)
- ambient monitoring system (Section 3.3.5)

3.3.1 Benthic Macroinvertebrates

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification rating to each benthic sample based on the number of different species present in the pollution-intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies); or commonly referred to as EPTs. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. The ratings fall into five categories ranging from Poor to Excellent.

Overview of Benthic Macroinvertebrate Data

Appendix A-II lists all the benthic macroinvertebrate collections in the French Broad River basin between 1983 and 1997, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Benthic macroinvertebrates have been collected at 199 sites in the French Broad River basin since 1983, with seventy of these sites sampled during the 1997 basinwide surveys or special studies. For the 1997 collections, the following bioclassifications were found: Excellent – 24 (34%), Good – 15 (21%), Good-Fair – 19 (27%), Fair – 6 (9%) and Poor – 6 (9%). The upper mainstem of the French Broad River and tributaries (subbasin 04-03-02) is the only subbasin where the majority of sites received a Fair or Poor rating. The distribution of water quality ratings is very similar for both the 1997 collection and all collections since 1983. The benthos sampling may slightly overestimate the proportion of Fair and Poor sites, as DWQ special studies often have the greatest sampling intensity (number of sites/stream) in areas with severe water quality problems. Individual sites, however, often show distinct long-term changes in water quality. Table A-21 provides a summary of benthic macroinvertebrate samplings since 1983 (by subbasin) for the French Broad River basin.

Table A-21 Summary of Biological Ratings for Benthic Macroinvertebrate Samplings in the French Broad River Basin (1983 –1997)

Subbasin 04-03-01 to 04-03-07	Excellent	Good	Good-Fair	Fair	Poor
Headwaters: 01	10	10	4	4	1
Upper Mainstem & tribs (Asheville): 02	8	5	17	15	18
Davidson/Mills River: 03	10	1	3	1	0
Lower Mainstem & tribs: 04	8	12	7	1	0
Pigeon River: 05	24	3	6	4	1
Nolichucky/Toe River: 06	8	7	4	3	1
Cane River: 07	1	2	0	0	0
Total (#)	69	40	41	28	21
Total (%)	35%	20%	21%	14%	11%

Changes in water quality were evaluated at 44 sites in the French Broad River basin. The majority of sites show no changes in water quality other than flow-related bioclassification changes (Table A-22). Positive changes were primarily related to improvements in wastewater treatment, including sites on the Pigeon River, Richland Creek, Jonathans Creek, French Broad River, Swannanoa River, North Toe River, Nolichucky River and Cane River. Negative changes

were associated with agricultural areas, including the Mills River, South Hominy Creek and the Ivy River area. For greater detail, refer to specific subbasin chapters of this plan.

Table A-22 Changes in Water Quality Using Benthic Macroinvertebrate Samples

Subbasin 04-03-01 to 04-03-07	# Trend Sites	5-year trend			Long-term (>5 years) trend		
		None	+	-	None	+	-
Headwaters: 01	4	4	0	0	3	0	0
Upper Mainstem & tribs (Asheville): 02	10	8	2	0	3	3	0
Davidson/Mills River: 03	3	2	0	1	1	0	0
Lower Mainstem & tribs: 04	7	3	1	3	1	0	0
Pigeon River: 05	12	8	4	0	3	5	0
Nolichucky/Toe River: 06	6	4	1	1	2	2	0
Cane River: 07	2	1	1	0	0	1	0
Total	44	30	9	5	13	11	0

3.3.2 Fish Assessments

Overview of Fish Community Assessment Data

During the 1990s, stream fish community data were collected and analyzed by DWQ using several versions of the North Carolina Index of Biotic Integrity (NCIBI) from the French Broad River basin (NCDEHNR, 1994), from the Pigeon River by Carolina Power & Light Company (Crutchfield and Tracy, 1996) and Champion International (EA 1995), and in 1997, from the entire French Broad River basin by the Tennessee Valley Authority (McDonough and Saylor, pers. comm.). In 1997, 29 sites, representing all seven of the subbasins, were sampled and evaluated using the NCIBI.

NCIBI scores are provided in this report, but NCIBI classes are not listed and the data are not used for use support evaluations. One primary reason for this is that the present metrics are not applicable to trout streams. A survey of mountain reference streams in September 1998 found that none of the streams sampled could achieve the Excellent NCIBI class expected at such sites. A review of the present metrics will be concluded, and metrics will be modified to allow reference sites to reflect an Excellent NCIBI class. Fish community samples can still be used to identify streams where the community is altered due to degradation of water quality or habitat. Additional information on the use of the NCIBI for fish community assessments can be found in Appendix II and Section A, Chapter 3, Part 3.5.2.

Overview of Fish Tissue Sampling Data

Fish tissue samples were collected at 11 stations within the French Broad drainage from 1992 to 1997. DWQ fish tissue surveys were conducted as part of DWQ basinwide assessments and as part of a special study along the Pigeon River in 1996. Annual monitoring of fish tissue for dioxins in the Pigeon River is also performed by Blue Ridge Paper Products and Carolina Power

and Light. This monitoring is required as part of Blue Ridge Paper Products' NPDES permit and as a condition of the FERC license for Carolina Power and Light.

Nearly all fish samples collected from 1992 to 1997 that contained metals pollutants were at levels below FDA and EPA criteria.

Dioxin concentrations in fish collected from the Pigeon River and Walters Lake have declined since the early 1990s, although levels for certain species have fluctuated depending on sample season, station and the size of the fish collected. Dioxin concentrations in sportfishes (redbreast sunfish, rock bass, crappie, largemouth bass and smallmouth bass) have remained non-detectable or well below the NC limit for issuing a consumption advisory (3.0 ppt). Dioxin levels in carp have decreased as much as 80% downstream of the paper mill but remain above the NC limit in Walters Lake. For further information, refer to Section B, Chapter 5.

Currently, there is a limited-consumption advisory for carp and catfish species (bullhead species, channel catfish and flathead catfish) in effect for the Pigeon River between Canton, NC and the North Carolina-Tennessee state line, including Walters Lake. This advisory was revised by the State Health Director from a complete to a limited-consumption advisory in September 1994 due to declining dioxin levels. Additionally, there is a precautionary (limited) fish consumption advisory for carp, catfish species and redbreast sunfish in effect for the Pigeon River within the State of Tennessee from the state line downstream to the confluence with the French Broad River.

3.3.3 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit. Other facilities may be tested by DWQ's Aquatic Toxicology Laboratory.

The Aquatic Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge. A summary of compliance for the French Broad River basin from 1986 through 1997 is presented in Table A-23.

Table A-23 Summary of Compliance with Aquatic Toxicity in the French Broad River Basin

Year	Number of Facilities	Number of Tests**	% Meeting Permit Limit*
1987	8	70	91
1988	11	82	83
1989	15	162	88
1990	15	168	85
1991	17	208	87
1992	23	241	87
1993	26	289	93
1994	26	304	88
1995	33	340	91
1996	40	404	87
1997	43	460	96

* This number was calculated by determining whether a facility was meeting its ultimate permit limit during the given time period, regardless of any SOCs in force. Facilities were not included in any given year unless data was available for the full year.

** "Number of Tests" is not the actual number of tests performed, but the number of opportunities for limit compliance evaluation. Assumptions were made about compliance for months where no monitoring took place based on data previous to that month. Facilities compliant in a given month were assumed to be in compliance during months following until the next actual monitoring event. This same policy was applied to facilities in noncompliance.

3.3.4 Lakes Assessment Program

Six lakes in the French Broad River basin were sampled as part of the Lakes Assessment Program since 1993. These lakes, by river subbasin, are presented below.

Subbasin 04-03-02

Lake Julian
Lake Burnett
Beetree Reservoir

Subbasin 04-03-05

Allen Creek Reservoir
Lake Junaluska
Waterville (Waters) Lake

Each lake is individually discussed in the appropriate subbasin chapter. Figure A-12 shows the most recent North Carolina Trophic State Index (NCTSI) scores for the seven lakes of the French Broad River basin. Three of these lakes (Lake Burnett, Beetree Reservoir and Lake Junaluska) were sampled by DWQ in 1997. Lake Julian and Waterville Lake were most recently sampled by Carolina Power & Light Company in 1996 and 1995, respectively. Allen Creek Reservoir was last sampled in 1993, while Busbee Reservoir was sampled in 1990 and that data was presented in the first basin assessment report. More information on the NCTSI methodology can be found in Appendix II.

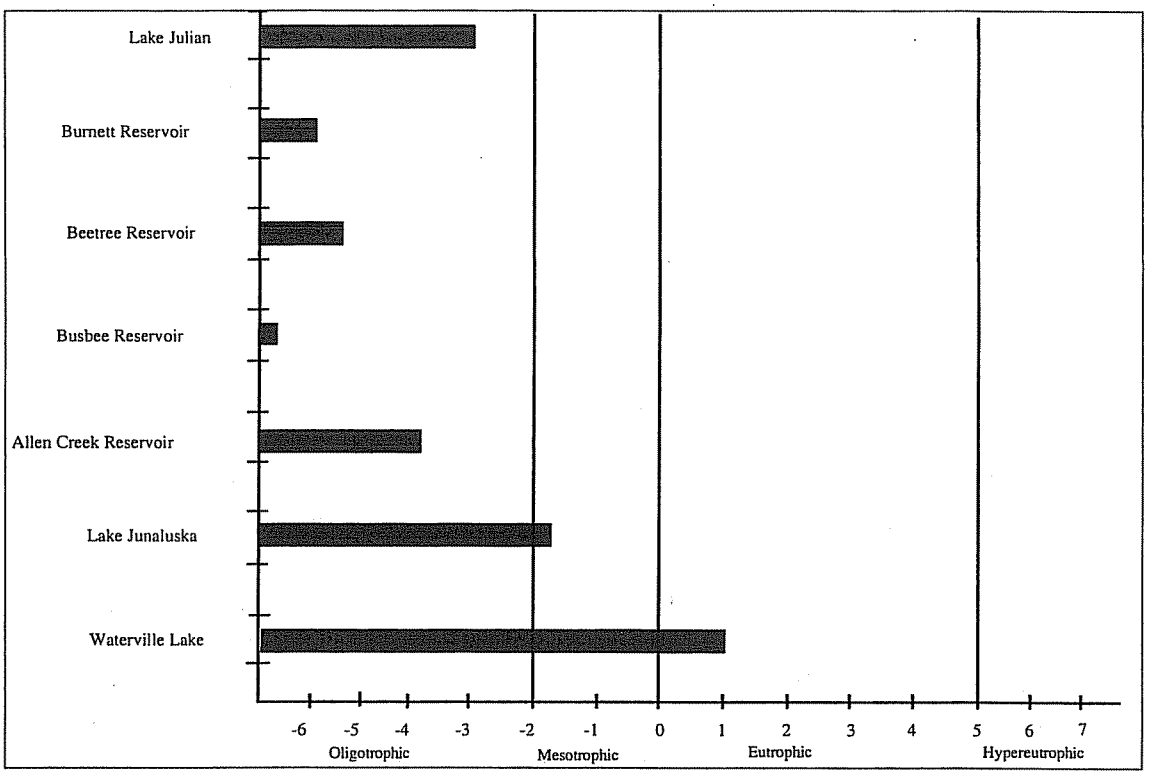


Figure A-12 NCTSI Scores for Lakes in the French Broad Basin

3.3.5 Ambient Monitoring System Program

Ambient monitoring stations for the basin are listed in Table A-24. For this discussion the basin has been segregated into three major drainages: French Broad River, Pigeon River and Nolichucky River. Mainstem stations are listed first followed by tributary stations. There are a total of 28 stations in the basin (17 mainstem and 11 tributary). All stations appear on individual subbasin maps in Section B.

Several general observations can be made about monitored water quality parameters in the French Broad River basin. As is characteristic with most larger basins, the cumulative effects of land-disturbing activities and development create an upstream to downstream increase in pollutant load.

Along the mainstem of the French Broad River, the patterns of increasing load can be seen in levels of conductivity and nutrient parameters. Metals (Al, Fe, Mn) similarly demonstrate a downstream increasing trend frequently associated with loads of clay soils. Mainstem stations E2730000, E4280000, E4770000 and E5120000 all had 10% or more of the samples with fecal coliform concentrations greater than 200 colonies/100ml.

Table A-24 Ambient Monitoring System Stations within the French Broad River Basin

STORET #	Station Name	County	Subbasin
E5410000	West Fork Pigeon River upstream Lake Logan near Hazelwood	Haywood	040305
E5495000	Pigeon River at Hwy 215 near Canton	Haywood	040305
E5600000	Pigeon River at SR 1624 near Clyde	Haywood	040305
E6480000	Pigeon River at SR 1338 near Hepco	Haywood	040305
E6500000	Pigeon River at Waterville	Cocke, TN	040305
E6110000	Richland Creek at SR 1184 near Waynesville	Haywood	040305
E6300000	Jonathans Creek at Hwy 276 at Cove Creek	Haywood	040305
E6450000	Cataloochee Creek at SR 1395 near Cataloochee	Haywood	040305
E0150000	French Broad River at Hwy 178 at Rosman	Transylvania	040301
E1270000	French Broad River at SR 1503 at Blantyre	Transylvania	040302
E2730000	French Broad River at Hwy 280 near Skyland	Buncombe	040302
E4280000	French Broad River at SR 1348 at Asheville	Buncombe	040302
E4770000	French Broad River at SR 1634 at Alexander	Buncombe	040302
E5120000	French Broad River at Marshall	Madison	040304
E0850000	Davidson River at Hwy 64 near Brevard	Transylvania	040303
E1130000	Little River above High Falls near Cedar Mountain	Transylvania	040301
E1470000	Bradley Creek at USFS Road off SR 1345 near Yellow Gap	Henderson	040303
E1490000	Mills River near Mills River	Henderson	040303
E2120000	Mud Creek at SR 1508 near Hilgart	Henderson	040302
E3520000	Hominy Creek at SR 3413 near Asheville	Buncombe	040302
E4030000	Beetree Creek near Swannanoa	Buncombe	040302
E4170000	Swannanoa River at Biltmore Avenue bridge at Biltmore	Buncombe	040302
E7000000	North Toe River at Hwy 19E near Ingalls	Avery	040306
E8100000	North Toe River at SR 1162 at Penland	Mitchell	040306
E8150000	South Toe River near Deep Gap	Yancey	040306
E8200000	South Toe River at SR 1168 near Celo	Yancey	040306
E9800000	Cane River at SR 1417 near Sioux	Yancey	040307
E9990000	Nolichucky River at Poplar	Mitchell	040306

Among the French Broad tributaries, Mud Creek (which receives the discharges of the Hendersonville WWTP and General Electric) and Hominy Creek (which receives the discharge of BASF) both have elevated levels of total phosphorus and total nitrogen. These stations, as well as the one on the Swannanoa River, have exceedences of 200 colonies/100ml. The influence of development and land-disturbing activities are possibly reflected again by the coincidence of higher aluminum and iron values observed in these watersheds. The Davidson River, Little River, Mills River and Beetree Creek have relatively low nutrient levels, conductivity and fecal coliform counts.

The Pigeon River drainage has five ambient monitoring sites on the mainstem and four tributary stations. The mainstem stations have all maintained adequate dissolved oxygen levels, though slight decreases are seen at the Clyde and Waterville stations. The station at Clyde, downstream of the Town of Canton and the Blue Ridge Paper Products discharge, reflects the effects of these

nonpoint and point source inputs on water quality through increases in pH, conductance, nitrogen, phosphorus, fecal coliform bacteria and several metals parameters, particularly aluminum and manganese.

The Nolichucky River Drainage, including the North and South Toe Rivers and the Cane River, shows little influence of point or nonpoint source effects on monitored parameters with the exception of the North Toe as it passes through the area of Spruce Pine. Conductivity and flouride levels are measurably higher below the Town of Spruce Pine. Across measured parameters, the South Toe River appears to have very good water quality relative to other stations in the basin.

3.4 Other Water Quality Research

There are many water quality sampling programs being conducted throughout the French Broad River basin beyond DWQ sampling. Any available data from this research has been reviewed and included in DWQ analysis for developing biological ratings, use support determinations and the 303(d) list. These research efforts have also been used by DWQ to adjust biological and chemical sampling sites. In particular, DWQ has reviewed and considered information developed through the Volunteer Water Information Network (VWIN) as managed by the UNC-Asheville Environmental Quality Institute (see Section C, Chapter 1, Part 1.4.7) and the TVA. Other programs or research that developed data or information are presented in Section C or discussed in individual subbasin chapters in Section B.

3.5 Use Support Summary

3.5.1 Introduction to Use Support

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses is an important method of interpreting water quality data and assessing water quality. Use support assessments for the French Broad River basin are summarized in this section and presented in the appropriate subbasin chapters in Section B.

Use support ratings for streams and lakes:

- *fully supporting (FS)*
- *partially supporting (PS)*
- *not supporting (NS)*
- *not rated (NR)*

The use support ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are fully supported (FS), partially supported (PS) or not supported (NS). For instance, waters classified for fishing and water contact recreation (Class C) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of exceedence. Streams rated as either partially supporting or not supporting are considered *impaired.* Impaired waters are discussed in the separate subbasin chapters in Section B.

Impaired waters categories:

- Partially Supporting
- Not Supporting

An additional use support category, fully supporting but threatened (ST), was used in previous basinwide plans. In the past, ST was used to identify a water that was fully supporting but had some notable water quality problems. ST could represent constant, degrading or improving conditions. North Carolina's use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that are characterized by declining water quality. In addition, the US EPA requires the inclusion of ST waters on the 303(d) list in its proposed revision to the 303(d) list rules (Appendix IV). Due to the difference between US EPA's and North Carolina's definitions of ST, North Carolina no longer uses this term. Because North Carolina has used fully supporting but threatened as a subset of fully supporting (FS) waters, those waters formerly called ST are now rated FS. Waters that are fully supporting but have some notable water quality problems are discussed individually in the subbasin chapters (Section B).

Streams which had no data to determine their use support were listed as not rated (NR). For a more complete description of use support methodology, refer to Appendix III.

3.5.2 Revisions to Methodology Since 1992-1993 305(b) Report

Methodology for determining use support has been revised. As mentioned above, fully supporting but threatened (ST) is no longer used as a use support category. In the 1992-1993 305(b) Report, evaluated information (subjective information not based on actual monitoring) from older reports and workshops was included in the use support process. Streams rated using this information were considered to be rated on an evaluated basis. In the current use support process, this older, evaluated information has been discarded, and streams are now rated using only information from biological or physical/chemical monitoring (including current and older monitoring data). Streams are rated on a monitored basis if the data are less than five years old. Streams are rated on an evaluated basis under the following conditions:

- If the only existing data for a stream are more than five years old.
- If a stream is a tributary to a monitored segment of a stream rated fully supporting (FS) and it has land use similar to that of the monitored stream, the tributary will receive the same rating on an evaluated basis. If a stream is a tributary to a monitored segment rated partially supporting (PS) or not supporting (NS), the stream is considered not rated (NR).

These changes resulted in a reduction in streams rated on an evaluated basis.

The North Carolina Index of Biotic Integrity (NCIBI) is one of the tools that DWQ uses to summarize all classes of factors such as water and habitat quality, flow regime, and energy sources that influence the freshwater fish communities of wadeable streams across the state. Data from the 1997 fish community assessments were not used in the recent use support ratings for the French Broad River basin because of recent revisions to the criteria and metrics that constitute the Index. All metrics and criteria have been, and are continuing to be, revised based upon a better understanding of the fish communities in each river basin throughout the state. Studies are being conducted to:

1. Identify ecoregion Reference Sites and calibrate the Index based upon these sites.
2. Identify the temporal variability in the Index by sampling the fish communities at a selected group of streams several times during the year.
3. Identify the spatial variability in the Index by sampling the fish community in a stream at multiple reaches.
4. Identify the variability in the Index by sampling the fish communities at a selected group of streams known to be impacted by point and nonpoint sources.
5. Develop metrics and criteria that may allow future assessments of coldwater Blue Ridge trout streams.

Until these studies are completed, it would be premature to assign a "Final" bioclassification to the stream and apply a use support rating to the stream based on fish community sampling. Additional information on NCIBI for fish community assessments can be found in Appendix II.

3.5.3 Comparison of Use Support Ratings to Streams on the 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a priority. The waters in the French Broad River basin that are on this list are presented in the individual subbasin chapters in Section B. The waters presented in this basinwide plan represent those that will be submitted to EPA for approval in 2000. These waters are on the state's 303(d) list based on recent monitoring data. The actual 303(d) list for the French Broad River basin may be somewhat different than presented in this plan, depending on EPA approval.

Section 303(d) of the federal Clean Water Act requires states develop a 303(d) list of waters not meeting water quality standards or which have impaired uses. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not adequately been developed for specific impaired waters. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

Waters are placed on North Carolina's 303(d) list primarily due to a partially or not supporting use support rating. These use support ratings are based on biological and chemical data. When the state water quality criterion is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either biological ratings or water quality standards.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list since water quality

improvement has been attained. In other cases, the new data will show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality has improved.

In some cases, a waterbody appears on the 303(d) list, but has a fully supporting rating. There are two major reasons for this: 1) biological data show full use support, but chemical impairment continues; or 2) fish consumption advisories exist on the water. These waters will remain on the 303(d) list until the problem pollutant meets water quality standards or a TMDL is developed.

3.5.4 Use Support Ratings for the French Broad River Basin

A summary of current use support ratings for the French Broad River basin are presented in Table A-25. For further information and definition of monitored and evaluated streams, refer to Appendix A-III.

Table A-25 Use Support Summary Information for All Monitored and Evaluated Streams in the French Broad River Basin (1999)

		Monitored and Evaluated Streams*			Monitored Streams Only**	
		Miles	**%**		**Miles**	**%**
Fully Supporting		3190.9	77		812.2	90
Impaired		88.5	2			
	Partially Supporting	*50.6*	*1*		*50.1*	*6*
	Not Supporting	*37.9*	*1*		*37.9*	*4*
Not Rated		856.5	21			
Total		4135.9			900.2	

* = Percent based on total of all named and classified streams, both monitored and evaluated.
** = Percent based on total of all monitored streams.

Table A-26 shows the total number of stream miles and stream miles per each use support category for each subbasin. This table presents use support for both the monitored and evaluated streams in the basin. More detailed information on the monitored stream segments can be found in Appendix III. Color maps showing use support ratings for the basin are presented in Figure A-13 and A-14. Table A-27 shows a list of impaired waters in the basin.

Table A-26 Summary of Use Support Determinations by Subbasin for Monitored and Evaluated Freshwater Streams

French Broad Use Support Ratings in Miles (1999)					
Subbasin	**Fully Supporting**	**Partially Supporting**	**Not Supporting**	**Not Rated**	**Total**
04-03-01	338.2	1.6	0	103.7	443.5
04-03-02	554.5	35.1	33.3	354.5	977.7
04-03-03	222.4	1.9	4.6	4.3	233.2
04-03-04	728.7	2.6	0.0	30.7	762.0
04-03-05	612.1	9.4	0.0	155.6	777.1
04-03-06	555.7	0.0	0.0	166.5	722.2
04-03-07	179.3	0.0	0.0	40.9	220.2
TOTAL	3190.9	50.6	37.9	856.5	4135.9

Table A-27 Impaired Waters within the French Broad River Basin (as of 1999) •

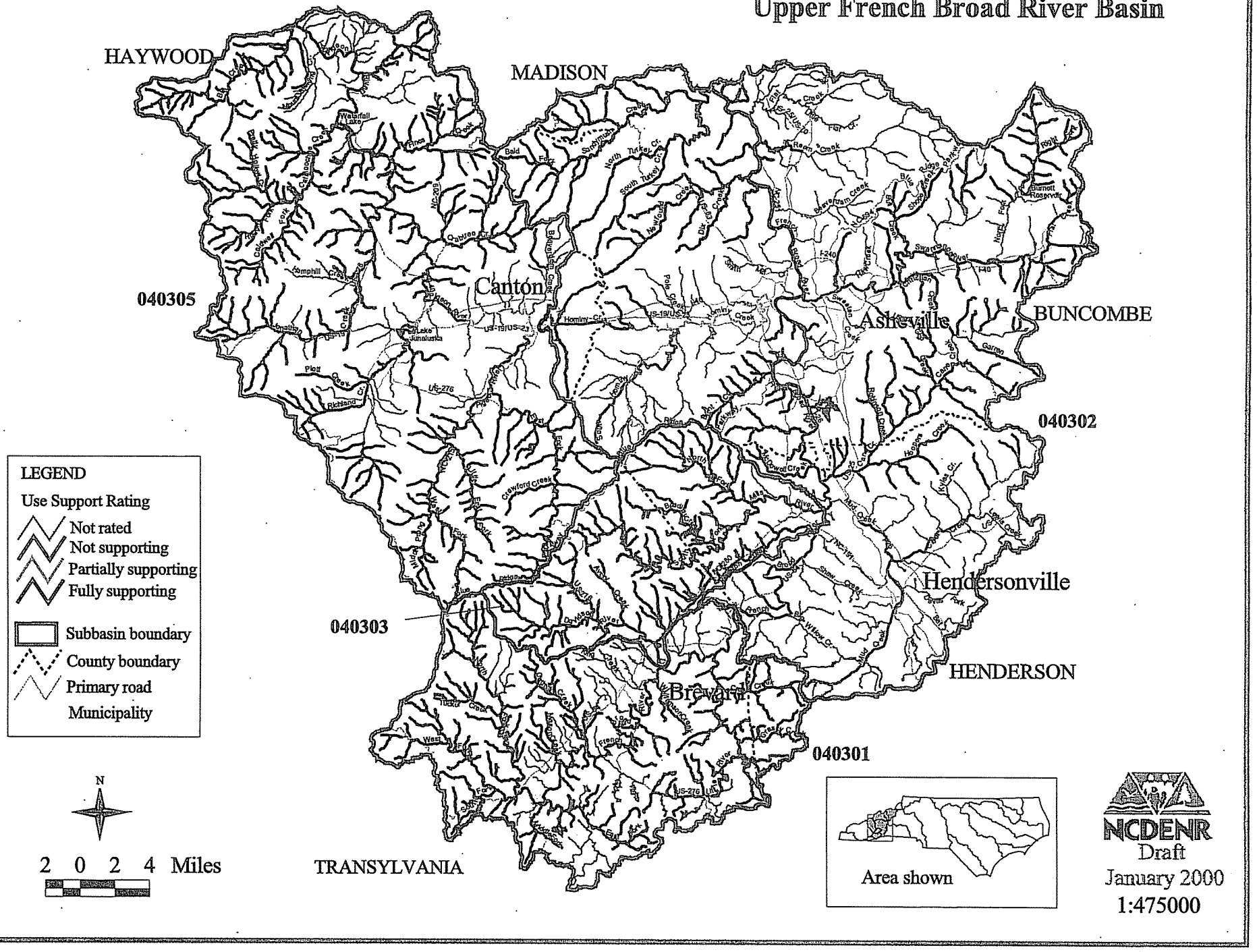
Subbasin	Chapter in Section B	Listed Water	Use Support Rating	Potential Sources*	Recommended Management Strategy
04-03-01	1	Peter Weaver Creek	PS	P	DWQ will resample this creek to obtain information for a management strategy. Holders of individual NPDES permits may be required to conduct upstream/downstream sampling or obtain an individual permit.
04-03-01	1	Morgan Mill Creek	PS	P	DWQ will resample this creek to obtain information for a management strategy. Holders of individual NPDES permits may be required to conduct upstream/downstream sampling or obtain an individual permit.
04-03-02	2	Gash Creek	NS	NP	Local actions are needed on NPS inventory.
04-03-02	2	Mill Pond Creek	PS	NP	DWQ will continue to monitor to better identify problem parameters.
04-03-02	2	Mud Creek	NS	NP P	Local restoration initiatives are underway, and DWQ will continue to monitor results.
04-03-02	2	Bat Fork Creek	PS	NP	DWQ will continue to monitor the creek and increase coordination with other agencies to address the various pollution sources.
04-03-02	2	Clear Creek	PS	NP	Local actions are needed to expand buffer and BMP implementation.
04-03-02	2	Hominy Creek	PS	NP	There is a need to increase the funding and implementation of chemical handling facilities.
04-03-02	2	South Hominy Creek	NS	NP	There is a need to increase the funding and implementation of chemical handling facilities.
04-03-02	2	Ross Creek	NS	NP	Local initiatives are underway, and DWQ will continue to monitor results.
04-03-03	3	Mills River	NS	NP	Local initiatives are underway, and DWQ will continue to monitor results.
04-03-03	3	Brandy Branch	PS	NP	Local projects aimed at identifying sources of pollution and necessary actions would be very useful to DWQ and various funding agencies. DWQ will continue to monitor Brandy Branch to better identify problem parameters.
04-03-04	4	Little Ivy Creek	PS	NP	Local restoration initiatives are underway, and DWQ will continue to monitor results.
04-03-05	5	Pigeon River	PS	NP P	DWQ will continue to monitor process improvements made at BRPP and work with the Joint Watershed Advisory Group. Local nonpoint source initiatives are needed.
04-03-05	5	Richland Creek	PS	NP	Local restoration initiatives are underway, and DWQ will continue to monitor results.

Key: NS = Not Supporting PS = Partially Supporting
NP = Nonpoint sources P = Point Sources

* = Only limited progress towards developing and implementing NPS strategies for these impaired waters can be expected without additional resources.

• = These waters are also on the 303(d) list, and a TMDL and/or management strategy will be developed to remove the water from the list.

Upper French Broad River Basin



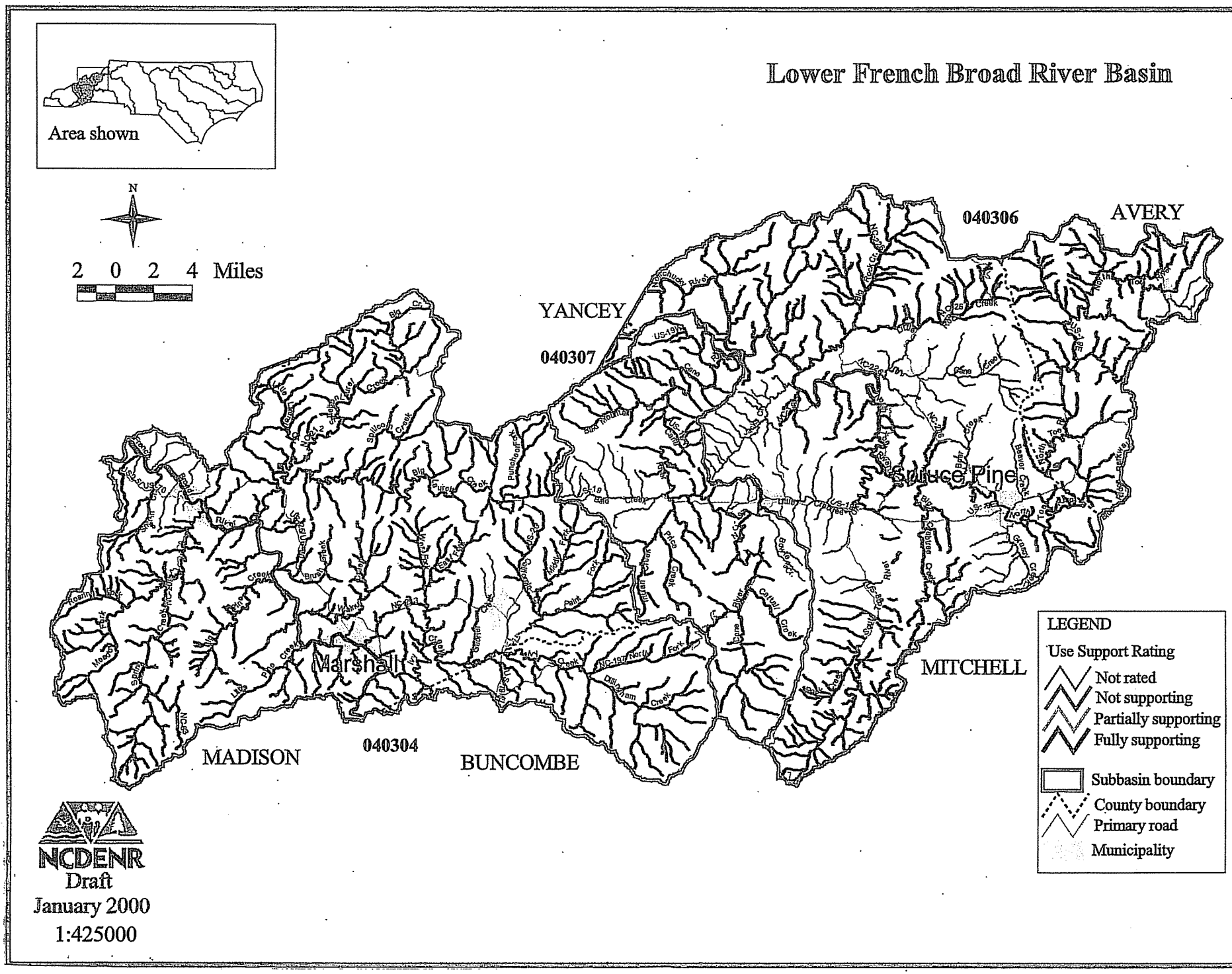


Figure A-14 Use Support Ratings for the Lower French Broad River Basin

Chapter 4 –
Water Quality Issues for the French Broad River Basin

4.1 Overview

This document includes a number of recommendations to address water quality issues in the French Broad River basin. Some of these recommendations are pertinent to more than one watershed or to the basin as a whole, while others are specific to a particular stream or area within a subbasin. A status of the more specific recommendations is reported within the subbasin chapters in Section B. This chapter discusses other water quality issues that relate to the entire French Broad River basin including bank erosion and sedimentation, loss of riparian vegetation, urban runoff and development, and livestock grazing.

4.2 Sedimentation

Soil erosion, transport and redeposition are among the most essential natural processes occurring in watersheds. However, land-disturbing activities such as the construction of roads and buildings, crop production, livestock grazing, and logging can accelerate erosion rates by causing more soil than usual to be detached and moved by water. If best management practices (BMPs) are not used effectively, accelerated erosion can strip the land of its topsoil, decreasing soil productivity, and causing sedimentation in streams and rivers (DLR, 1998).

Sedimentation is the process by which eroded soil is deposited into waters. Sediment that accumulates on the bottom of streams and rivers smothers fish habitat vital to reproduction and impacts aquatic insects that fish feed upon. Sediment filling rivers and streams decreases their storage volume and increases the frequency of floods. Suspended sediment increases the cost of treating municipal drinking water supplies (DLR, 1998).

Major Causes of Sedimentation in the French Broad River Basin

- Land clearing activities (construction and preparing land for crops and development)
- Streambank erosion
- Runoff from unpaved rural roads and eroding road grades

During 1998 basinwide monitoring, DWQ aquatic biologists reported streambank erosion and sedimentation in many streams in the French Broad River basin. Some streams are currently considered biologically impaired due to habitat degradation related in part to these impacts. Even in streams that are not listed as impaired, lower bioclassification ratings were assigned because of sedimentation.

4.2.1 Land Clearing Activities

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, substantial amounts of erosion can be prevented by planning to minimize the (1) amount and (2) time the land is exposed. Land clearing activities that contribute to sedimentation in the basin include: construction of homes and subdivisions as well as commercial and public buildings; plowing soil to plant crops; and road projects. DWQ's role in sediment control is to work cooperatively with those agencies that administer sediment control programs in order to maximize the effectiveness of the programs and protect water quality. Where programs are not effective, as evidenced by violation of instream water quality standards and where DWQ can identify a source, then appropriate enforcement action can be taken. Generally, this would entail requiring the landowner or responsible party to install acceptable BMPs.

Some Best Management Practices

Agriculture
- Using no till or conservation tillage practices
- Strip cropping, contour farming and use of terraces
- Taking land on the steepest terrain out of production

Construction
- Using phased grading/seeding plans
- Limiting time of exposure
- Planting temporary ground cover
- Using sediment basins and traps

Forestry
- Controlling runoff from logging roads and other areas
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit (refer to Part 2.7.2 of this section for more information). An erosion and sediment control plan must also be developed for these sites under the state's Sedimentation Pollution Control Act (SPCA) administered by the NC Division of Land Resources. Site disturbances of less than one acre are required to use BMPs, but a plan is not required.

For activities not subject to these rules, such as agriculture and forestry, sediment controls are carried out on a voluntary basis through programs administered by several different agencies. Forestry operations, however, must comply with nine performance standards to remain exempt from permitting requirements of the SPCA. The performance standards can be found in the document *Forest Practice Guidelines Related to Water Quality.*

4.2.2 Streambank Erosion and Loss of Riparian Vegetation

During 1998 basinwide sampling, DWQ biologists reported degradation of benthic and fish communities at numerous sites throughout the French Broad River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in rural and residential areas, as well as in urban watersheds (DENR-DWQ, November 1998).

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as rip-rap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a bank absorb the sun's heat and warm the water even more. Trout require higher levels of

dissolved oxygen available in coldwater. Trees, shrubs and other native vegetation cool the water by shading it. Straightening a stream, clearing streambank vegetation, and lining the banks with grass or rock severely impact the habitat that aquatic insects and fish need to survive (WNCT, 1999).

Livestock grazing with unlimited access to the stream channel and banks can cause severe streambank erosion resulting in degraded water quality. Although they often make up a small percentage of grazing areas by surface area, riparian zones (vegetated stream corridors) are particularly attractive to cattle that prefer the cooler environment and lush vegetation found beside rivers and streams. This concentration of livestock can result in increased sedimentation of streams due to "hoof shear", trampling of bank vegetation, and down-cutting by the destabilized stream. Despite livestock's preference for frequent water access, farm veterinarians have reported that cows are healthier when stream access is limited (USEPA, 1999).

Probably the best-known and most widely used category of BMPs is the retention of naturally vegetated buffer strips along streams. Streamside buffers serve many functions including nutrient filtering, bank stabilization, reduction of soil and land loss, moderating water temperature (which helps maintain higher levels of dissolved oxygen and hence a more suitable fish environment), and providing wildlife habitat and corridors for movement (EPA, 1999).

4.2.3 Unpaved Rural Roads and Eroding Road Grades

As is typical of settlement in mountainous areas, many roads in the French Broad River basin follow streams. The roads are often constructed on the streambank with very little (if any) vegetated buffer to filter sediment and other pollutants from surface runoff. Many of the steep road grades are actively eroding because of a lack of stabilization. Additionally, when road maintenance activities are conducted, there is often inadequate space for structural BMPs to be installed to control erosion from the land-disturbing activity.

Roads built to accommodate vehicles and equipment used to plant, tend and harvest timber in the basin also contribute to sediment runoff. These roads are generally unpaved and accelerate erosion unless they are maintained with stable drainage structures and foundations. In the mountainous areas of North Carolina, ordinary forest roads are known to lose as much as 200 tons of soil per acre of roadway during the first year following disturbance (DFR, September 1989).

4.2.4 New Rules Regarding Sediment Control

The Division of Land Resources (DLR) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced. For the past several years, there were inadequate staff to achieve the mission of the agency; however, in its 1999-2001 biennial budget, the NC General Assembly provided funding for 10 new positions in the Land Quality Section of DLR.

In February 1999, the NC Sedimentation Control Commission adopted significant changes for strengthening the Erosion and Sedimentation Control Program. The following rule changes were filed as temporary rules, subject to approval by the Rules Review Commission and the NC General Assembly:

- Allows state and local erosion and sediment control programs to require a pre-construction conference when one is deemed necessary.
- Reduces the number of days allowed for establishment of ground cover from 30 working days to 15 working days and from 120 calendar days to 90 calendar days. (Stabilization must now be complete in 15 working days or 90 calendar days, whichever period is shorter.)
- Provides that no person may initiate a land-disturbing activity until notifying the agency that issued the plan approval of the date the activity will begin.
- Allows assessment penalties for significant violations upon initial issuance of a Notice of Violation (NOV).

Additionally, during its 1999 session, the NC General Assembly passed House Bill 1098 to strengthen the Sediment Pollution Control Act of 1973 (SPCA). The bill made the following changes to the Act:

- Increases the maximum civil penalty for violating the SPCA from $500 to $5000 per day.
- Provides that a person may be assessed a civil penalty from the date a violation is detected if the deadline stated in the Notice of Violation is not met.
- Provides that approval of an erosion control plan is conditioned on compliance with federal and state water quality laws, regulations and rules.
- Provides that any erosion control plan that involves using ditches for the purpose of de-watering or lowering the water table must be forwarded to the Director of DWQ.
- Amends the General Statutes governing licensing of general contractors to provide that the State Licensing Board for General Contractors shall test applicants' knowledge of requirements of the SPCA and rules adopted pursuant to the Act.
- Removes a cap on the percentage of administrative costs that may be recovered through plan review fees.

In August 1999, the Sediment Control Commission initiated rule making to increase plan review fees to $40 per acre. In addition, the Commission voted to request that Governor Hunt use his authority to put into effect at an earlier date (before August 1, 2000) the rules adopted in February (DLR, September 1999). For information on North Carolina's Erosion and Sedimentation Control Program or to report erosion and sedimentation problems, visit the new website: http://www.dlr.enr.state.nc.us/ or you may call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

4.2.5 Recommendations

DWQ will continue to work cooperatively with DLR and other agencies that administer sediment control programs in order to maximize the effectiveness of the programs and to take appropriate enforcement action when necessary to protect or restore water quality. However, more voluntary implementation of BMPs is needed for activities that are not subject to these rules in order to substantially reduce the amount of widespread sedimentation present in the French Broad River basin. Public education is needed basinwide to educate landowners about the value of riparian vegetation and the impacts of sedimentation.

Funding is available for cost sharing with local governments that set up new erosion and sedimentation control programs or conduct their own training workshops. The Sediment Control Commission will provide 40% of the cost of starting a new local erosion and sedimentation control program for up to 18 months. Two municipalities or a municipality and county can develop a program together and split the match. It is recommended that local governments draft and implement local erosion and sedimentation control programs.

Funding is also available through numerous federal and state programs for farmers to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources for livestock, and fence animals out of streams. EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines these and other programs aimed at protecting water quality. A copy may be obtained by calling the National Center for Environmental Publications and Information at (800) 490-9198. Local contacts for various state and local agencies are listed in Appendix VI.

4.3 Urban Runoff

Runoff from built-up (developed) areas carries a wide variety of contaminants to streams including sediment, oil and grease from roads and parking lots, street litter, and pollutants from the atmosphere. Generally, there are also a larger number of point source discharges in these areas. Cumulative impacts from habitat and floodplain alterations, point and nonpoint source pollution can cause severe impairment to streams.

4.3.1 Rural Development

More than three-quarters of the land in western North Carolina has a slope in excess of 30%. Building site preparation and access are complicated by shallow bedrock, high erosion rates, soils that are subject to sliding, and lack of adequate sites for septic systems. Additionally, road grades of 12% or less are desirable. Unpaved roads with grades in excess of 12% erode easily and are difficult to maintain (WNCT, 1999). This terrain presents a kind of "no win" situation. Development could occur in the relatively flat stream and river valleys placing pressure on floodplains and riparian zones and displacing agricultural land uses. Alternatively, it could occur on the steep slopes causing acute problems in handling large amounts of erosion and sedimentation during construction and chronic problems with failing septic systems and eroding road grades. Development occurs in both situations in different portions of the French Broad River basin.

4.3.2 Urbanization

Urbanization often has greater hydrologic effects than any other land use, as native watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and yards. Urbanization results in increased surface runoff and correspondingly earlier and higher peak flows after storms. Flooding frequency is also increased. These effects are compounded when small streams are channelized (straightened) or piped and storm sewer systems are installed to increase transport of drainage waters downstream. Bank scour from these frequent high flow events tends to enlarge urban streams and increase

suspended sediment. Scouring also destroys the variety of habitat in streams leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

In and around municipalities in the French Broad River basin, DWQ biological assessments reveal that streams are being impacted and, in some cases, impaired because of urban stormwater runoff. Most of the impacts are in terms of habitat degradation (see Part 4.4 of this section), but runoff from developed and developing areas can also carry toxic pollutants to a stream.

The presence of intact riparian buffers and/or wetlands in urban areas can lessen these impacts and restoration of these watershed features should be considered where feasible; however, the amount of impervious cover should be limited as much as possible. Wide streets, huge cul-de-sacs, long driveways and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas.

4.3.3 Stormwater Regulations

DWQ administers a number of programs aimed at controlling stormwater runoff. These include: 1) programs for the control of development activities near High Quality Waters (HQW) and Outstanding Resource Waters (ORW) and activities within designated Water Supply (WS) watersheds; and 2) NPDES stormwater permit requirements for industrial activities and municipalities. For more detailed information on current and proposed stormwater rules, refer to Part 2.7.2 of this section.

Various types of activities with point source discharges of stormwater are required to be permitted under the Phase I NPDES stormwater program. These include industrial discharges related to manufacturing, processing and materials storage areas. Construction activities with greater than five acres of disturbance are also required to obtain an NPDES permit. All of those areas requiring coverage must develop Stormwater Pollution Prevention Plans (SPPP) to minimize and control pollutants discharged from their stormwater systems. Municipal areas with populations greater than 100,000 are also required to obtain Phase I NPDES stormwater permit and develop a stormwater program. There are no Phase I stormwater permits required in the French Broad River basin.

In November 1999, a second phase of the NPDES stormwater program was signed into law. Phase II of the NPDES stormwater program lowers the construction activity threshold to 1 or more acres of land disturbance and allows a permitting exemption for industrial facilities that do not have significant materials or activities exposed to stormwater. Phase II also pulls many small local governments into the NPDES stormwater program. In the French Broad River basin, an additional seven cities (Asheville, Biltmore Forest, Black Mountain, Fletcher, Montreat, Weaverville and Woodfin) and Buncombe County will be required to obtain an NPDES stormwater permit. Additional cities and counties may be added after a statewide stormwater program is finalized.

For more information on municipal NPDES stormwater programs, contact Jeanette Powell at (919) 733-5083 ext. 537. For industrial NPDES stormwater programs, contact Bill Mills at (919) 733-5083 ext. 548.

4.3.4 Recommendations

Proactive planning efforts at the local level are needed to assure that development is done in a manner that minimizes impacts to water quality. These planning efforts must find a balance among water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases as well as developing and enforcing environmental protection measures.

Planning Recommendations for New Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking and narrower slots).
- Place sidewalks on only one side of residential streets.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.
- Minimize floodplain development.
- Protect and restore wetland/bog areas.

These actions are critical to water quality management and the quality of life for the residents of the basin. These actions should include, but not be limited to:

- preservation of open spaces;
- provisions for controlled growth;
- development and enforcement of buffer ordinances and water supply watershed protection ordinances more stringent than state requirements;
- implementation of best management practices to reduce sediment to streams from urban development;
- stormwater runoff detention from urban developments;
- halt on floodplain development and protection of wetland areas;
- examination of zoning ordinances to ensure that they limit large, unnecessary parking lots, allow for vegetation and soil drainage systems, and build in green spaces in parking lots to limit and absorb runoff; and
- sustainable land use planning that considers long-term effects of development.

Phase II of the NPDES stormwater permitting program, promulgated by EPA and administered by DWQ, will help address stormwater runoff from additional municipal areas.

Public education is needed in the French Broad River basin in order for citizens to understand the value of urban planning and stormwater management. Action should be taken by county governments and municipalities in the basin to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development, refer to EPA's website: www.epa.gov/owow/watershed/wacademy/acad2000/protection.

4.4 Habitat Degradation

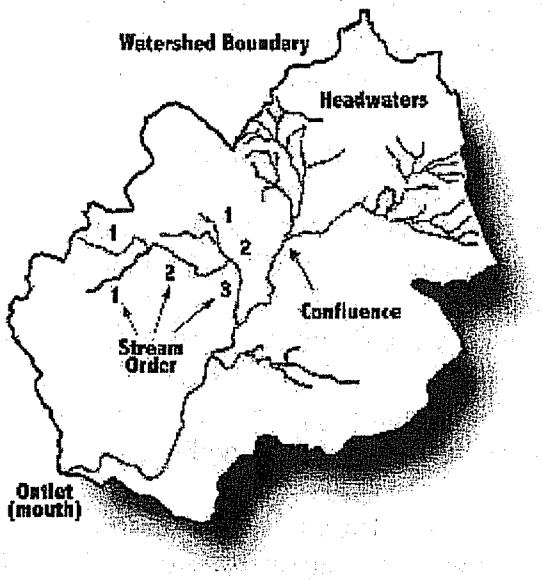
Instream habitat degradation is the result of various activities in a watershed that cover, wash away or remove habitat needed by macroinvertebrates and fish to survive and reproduce in a stream. Sedimentation is one type of instream habitat degradation and is discussed at length in Part 4.2 of this section. Determining the cause and quantifying amounts of habitat degradation is

very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream to a supporting rating. DWQ is working to develop a reliable habitat assessment methodology.

Although DWQ and other agencies are starting to address this issue, local efforts are needed to prevent further instream habitat degradation and to restore streams that have been impaired by activities that cause habitat degradation. As point sources become less of a source of water quality impairment, nonpoint sources that pollute water and cause habitat degradation will need to be addressed to further improve water quality in North Carolina's streams and rivers.

4.5 Protecting Headwaters

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. However, impairment of headwater streams can (and does) impact the larger stream or river.



Headwater areas are found from the mountains to the coast along all river systems and drain all of the land in a river basin. Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed.

For a more detailed description of watershed hydrology, please refer to EPA's Watershed Academy Website: http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

4.6 Priority Issues for the Next Five Years

4.6.1 Introduction

Clean water is crucial to the health, economic and ecologic well-being of the state. Tourism, water supplies, recreation and a high quality of life for residents are dependent on the water resources within any given river basin. Water quality problems are varied and complex. Inevitably, water quality impairment is due to human activities within the watershed. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge. Looking to the future, water quality in this basin will depend on the manner in which growth and development occur.

The long-range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the French Broad River basin's surface waters. In striving towards its mission, DWQ's highest priority near-term goals are to:

- identify and restore impaired waters in the basin;
- identify and protect high value resource waters and biological communities of special importance; and
- protect unimpaired waters while allowing for reasonable economic growth.

4.6.2 Strategies for Restoring and Protecting Impaired Waters

Impaired waters are those waters identified in Section A, Chapter 3 as partially supporting (PS) or not supporting (NS) their designated uses based on DWQ monitoring data. Table A-29 presents impaired waters in the French Broad River basin, the sources of impairment, summaries of the recommended management strategies, and location of further information in the basinwide plan.

These waters are impaired, at least in part, due to nonpoint sources (NPS) of pollution. The tasks of identifying nonpoint sources of pollution and developing management strategies for these impaired waterbodies is very resource intensive. Accomplishing these tasks is overwhelming, given the current limited resources of DWQ, other agencies (e.g., Division of Land Resources, Division of Soil and Water Conservation, Cooperative Extension Service, etc.) and local governments. Therefore, only limited progress towards restoring NPS impaired waters can be expected during this five-year cycle unless substantial resources are put toward solving NPS problems. Due to these restraints, this plan has no NPS management strategies for most of the streams with NPS problems.

DWQ plans to further evaluate the impaired waters in the French Broad River basin in conjunction with other NPS agencies and develop management strategies for a portion of these impaired waters for the next French Broad River Basinwide Water Quality Plan, in accordance with the requirements of Section 303(d) (see Section 4.6.3 below).

4.6.3 Addressing Waters on the State's 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a priority. The waters in the French Broad River basin that are on this list are presented in the individual subbasin descriptions in Section B. Refer to Appendix IV for 303(d) listing requirements.

Section 303(d) of the federal Clean Water Act requires states to develop a 303(d) list of waters not meeting water quality standards or which have impaired uses. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not adequately been developed for specific impaired waters. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

There are approximately 2,387 impaired stream miles on the 303(d) list in NC. The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters. This task will be accomplished through the basinwide planning process and schedule.

Section B

Water Quality Data and Information by Subbasin

Chapter 1 -
French Broad River Subbasin 04-03-01
Includes North and West Fork French Broad Headwaters

1.1 Water Quality Overview

Subbasin 04-03-01 at a Glance

Land and Water Area (sq. mi.)

Total area:	215
Land Area:	214
Water Area:	1

Population Statistics

1990 Est. Pop.:	17,853 people
Pop. Density:	83 persons/mi^2

Land Cover (%)

Forest/Wetland:	89%
Water:	<1%
Urban:	2%
Cultivated Crop:	3%
Pasture/ Managed Herbaceous:	6%

Use Support Summary

Freshwater Streams:

Fully Supporting:	338.2 miles
Partially Supporting:	1.6 miles
Not Supporting:	0.0 miles
Not Rated:	103.7 miles

The French Broad River originates at the confluence of the West and North Forks of the French Broad River near the Town of Rosman. The East Fork of the French Broad River also flows into the French Broad River near Rosman. These three large headwater tributaries of the upper French Broad River are generally high gradient streams capable of supporting viable trout populations. A map of this subbasin, including water quality sampling locations, is presented in Figure B-1. Biological ratings for these sample locations are presented in Table B-1.

Approximately one half of the land within this subbasin is within the Pisgah National Forest and Pisgah Game Lands, and therefore, protected from most land-disturbing activities. Below Rosman, the French Broad River is a much wider, lower gradient river, which meanders through a relatively undeveloped watershed to the Town of Brevard. Some agriculture and construction activities are present in this stretch of the river. Brevard is the largest urban area in the subbasin. Construction and development are becoming more intense along the upper French Broad River corridor in this subbasin.

Good to Excellent water quality conditions have been found at most locations in this subbasin, particularly mainstem reaches of the French Broad River and its large headwater tributaries. Water quality conditions have not changed significantly at these locations since the 1992 basinwide assessment.

Ambient water quality data are being collected at the French Broad River at Rosman and the Little River near High Falls. These data indicated good water quality, with few exceedences of water quality standards during this review period and no significant negative long-term trends in water quality data.

Benthic macroinvertebrate samples have been collected from 29 locations in this subbasin since 1983. These investigations have historically found Excellent or Good water quality conditions in the French Broad River near Rosman and large headwater tributary locations (West, North and East Forks of the French Broad River). These three tributaries and Catheys Creek are designated as High Quality Waters.

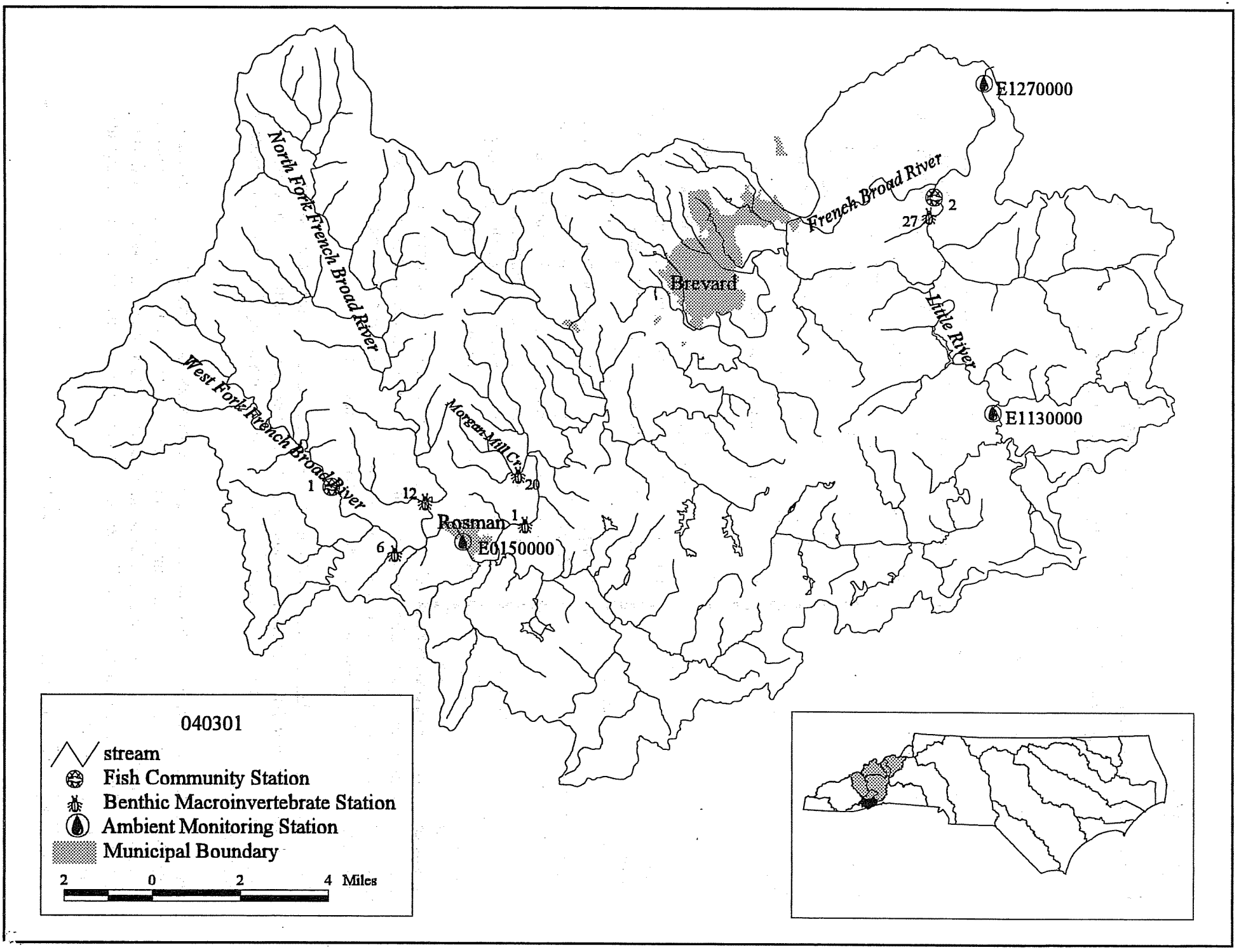


Figure B-1 Sampling Locations within Subbasin 04-03-01

Table B-1 Basinwide Biological Sites in French Broad River Subbasin 04-03-01 (1997)°

Site	Stream	County	Road	1997 Rating
Benthic Macroinvertebrates				
B-1	French Broad River	Transylvania	SR 1129	Excellent
B-6	West Fork French Broad River	Transylvania	US 64	Excellent
B-12	North Fork French Broad River	Transylvania	SR 1322	Excellent
B-27	Little River	Transylvania	SR 1533	Good-Fair
Fish Community				
F-1	West Fork French Broad River	Transylvania	SR 1309	Not Rated*
F-2	Little River	Transylvania	SR 1533	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25

There are 14 point source discharges in this subbasin, but only three have permitted discharge greater than 0.5 MGD. There are six wastewater treatment facilities in this subbasin currently monitoring effluent toxicity as part of their NPDES permit. All of these facilities are currently meeting permit limits. There are many permitted discharges from trout farms in this subbasin. Studies in 1990 showed these discharges had a moderate to severe impact on the macroinvertebrate community below the trout farms, but downstream recovery was noted.

The VWIN program, coordinated by UNCA, maintains ten water quality monitoring locations in Transylvania County (Maas et al., 1997). These data show that streams in Transylvania County are more acidic and have a low buffering capacity making them more vulnerable to acid deposition. Data from West Fork of the French Broad River resulted in elevated metal concentrations downstream of an industrial area. Nutrient values were high in the North Fork French Broad River, relative to other VWIN monitoring sites. The nutrient inputs appear to be primarily due to trout farm effluent and these effects will continue to be monitored.

For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

1.2 Prior Basinwide Plan Recommendations (1995) and Achievements

1.2.1 Impaired Waters

The 1995 French Broad River Basinwide Plan identified two stream segments in this subbasin as impaired: West Fork of French Broad and French Broad. Each of these is presented and discussed below.

West Fork of French Broad (0.5 miles below trout farms at SR 1306)

The 1995 basinwide plan identified one-half mile of the West Fork of French Broad below the Whitewater trout farm as partially supporting. The plan recommended that a special study of

trout farms should be conducted to determine if current permit conditions are adequate to protect water quality.

Status of Progress

This particular site was not resampled during this basin cycle; therefore, this one-half mile stream length will remain on the 303(d) list until further sampling is conducted (see Part 1.3.2 and Appendix IV). Monitoring conducted downstream at NC 64 indicated Excellent water quality at this lower site, and the stream is fully supporting at this lower location.

DWQ will conduct more intensive water quality sampling in the creek to determine if the stream is still impacted by trout farming activities. If the sampling indicates there is a need for more data, DWQ will work with the farmer to reduce impacts from trout farming or require the farm to obtain an individual NPDES permit, rather than the general permit that is currently required of most trout farms. The additional data will be used to develop a water quality model and will be used as the basis for developing a management strategy (see Part 1.3.2 below).

French Broad River (26.9 miles above SR 1503 at Blantyre)

This section of the French Broad River was listed in the 1995 basinwide plan as partially supporting due to fecal coliform bacteria from nonpoint sources. No specific point source strategies were developed. General recommendations were presented to address fecal coliform bacteria from nonpoint sources.

Status of Progress

No additional strategies were implemented. Based on more recent sampling, this section of the river is not currently impaired. Trout farms remain a concern during low flows, and DWQ will continue to work with the trout farmers to reduce impacts to water quality. Residential development also remains a concern, and efforts should be made to reduce the impact of construction activities on the river.

1.3 Current Priority Issues and Recommendations

1.3.1 Monitored Impaired Waters

Peter Weaver Creek (0.8 miles from Morgan Mill Creek to French Broad River) **and Morgan Mill Creek** (0.3 miles from trout farm (US 64) to Peter Weaver Creek)

Both of these creeks are partially supporting their uses and are on the state's year 2000 (not yet EPA approved) 303(d) list (see Part 1.3.2). Benthic macroinvertebrate samples were collected from Peter Weaver Creek at the junction of Morgan Mill Creek in 1997 at the request of the Asheville Regional Office because of potential problems with runoff from construction and discharge from a trout farm on Morgan Mill Creek. Much of the land use in the watershed is residential and pasture; however, the Morgan Mill trout farm discharges to the stream approximately 3/4 mile above the collection location. The sampling resulted in a Fair

bioclassification. The benthic sample composition suggested periods of low dissolved oxygen and high concentrations of fine particulate organic matter.

2000 Recommendation(s)

The first action that must be taken in both watersheds is to perform benthic macroinvertebrate surveys. The surveys would allow DWQ to determine if the water quality problems persist, and if the impacts are from the trout farm or other sources. If impairment is confirmed, DWQ proposes to implement a water quality monitoring program in the watershed to identify which pollutants are causing the problems. Such a program will strive to be comprehensive so that all sources may be addressed.

The program would include weekly or biweekly monitoring of several locations in the watershed for the following parameters: dissolved oxygen, ammonia, temperature, pH, turbidity, biological oxygen demand and total suspended solids. A time of travel study to identify sags in dissolved oxygen along the stream length may also be conducted. Additionally, a sediment oxygen demand study may be used to determine where the oxygen-consuming waste is located (in the sediment or water column). A toxic substance assessment may be warranted, as there are numerous potential sources of these substances in the watershed. Finally, the benthic community may be impacted by hydromodification (channelization and increased paved surfaces) and subsequent habitat degradation. These impacts may be assessed using a geomorphologic assessment.

Depending on the results of initial sampling, existing individual NPDES permit holders may be required to conduct upstream/downstream monitoring and general NPDES permit holders may be required to obtain individual NPDES permits.

1.3.2 303(d) Listed Waters

Segments of three streams are on the state's year 2000 (not yet EPA approved) 303(d) list for this subbasin. Refer to Appendix IV for more information on the state's 303(d) methodology and listing requirements. Management strategies for Morgan Mill and Peter Weaver Creeks are presented in Part 1.3.1 above. A one-half mile section of the West Fork of the French Broad River is on the 303(d) list for 2000 for resampling to assess its current water quality status (see Part 1.2.1 above).

1.3.3 Other Issues and Recommendations

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs and nonpoint source agency contacts, see Appendix VI.

The Little River from the Cascade Lake dam to the French Broad River (4.8 miles) was monitored by DWQ in both 1992 and 1997 for benthic macroinvertebrates. Both sample years showed some habitat degradation and effects of turbidity. The Little River watershed may be impacted by agricultural activities that accelerate erosion and instream habitat degradation. Agricultural BMPs are encouraged to reduce potential impacts. DWQ will notify local agencies of water quality concerns for this river and work with these various agencies to conduct further monitoring and assist agency personnel to locate sources of water quality protection funding sources.

Chapter 2 -
French Broad River Subbasin 04-03-02
Includes Mud Creek, Cane Creek, Hominy Creek, Swannanoa River, Sandymush Creek and Newfound Creek

2.1 Water Quality Overview

Subbasin 04-03-02 at a Glance

Land and Water Area (sq. mi.)

Total area:	806
Land area:	801
Water area:	5

Population Statistics

1990 Est. Pop.: 232,903 people
Pop. Density: 290 persons/mi^2

Land Cover (%)

Forest/Wetland:	74%
Surface Water:	1%
Urban:	3%
Cultivated Crop:	1%
Pasture/ Managed Herbaceous:	21%

Use Support Summary

Freshwater Streams:

Fully Supporting:	554.5 miles
Partially Supporting:	35.1 miles
Not Supporting:	33.3 miles
Not Rated:	354.5 miles

Lakes:

Lake Julian – Fully Supporting
Burnett Reservoir – Fully Supporting
Beetree Reservoir – Fully Supporting

This subbasin contains approximately 40 river miles of the French Broad River below the Henderson/Transylvania County line to the confluence of Sandymush Creek in Buncombe County. The French Broad River in this subbasin is a very wide river capable of supporting many species of warmwater gamefish. The urban areas of Asheville and Hendersonville are within this subbasin. The French Broad River, because of its proximity to these large urban areas, is a popular water-based recreational resource. Many of the tributaries have viable populations of brook trout. A map of this subbasin, including water quality sampling locations, is presented in Figure B-2. Biological ratings for these sample locations are presented in Table B-2.

Agriculture (apple orchards, corn, tomatoes and burley tobacco), dairy operations and urbanization affect the middle and lower French Broad River and some smaller tributaries. There are 83 permitted point source discharges in this subbasin, but only 6 of these facilities discharge more than 0.5 MGD.

Ambient water quality data are collected from eight monitoring locations in this subbasin with four of these locations on the mainstem of the French Broad River. These data show an increase in concentration for several water quality parameters from the upstream location at Blantyre through Buncombe County to the Alexander monitoring location. Median concentrations for conductivity, total phosphorus and ammonia nitrogen all increase downstream. However, there does not appear to be any significant changes over time in these parameters during this review period. Downstream increases in total suspended solids also were found at ambient monitoring locations at Rosman, Asheville and Marshall. Many of these observations are corroborated by data collected by the VWIN program (see below).

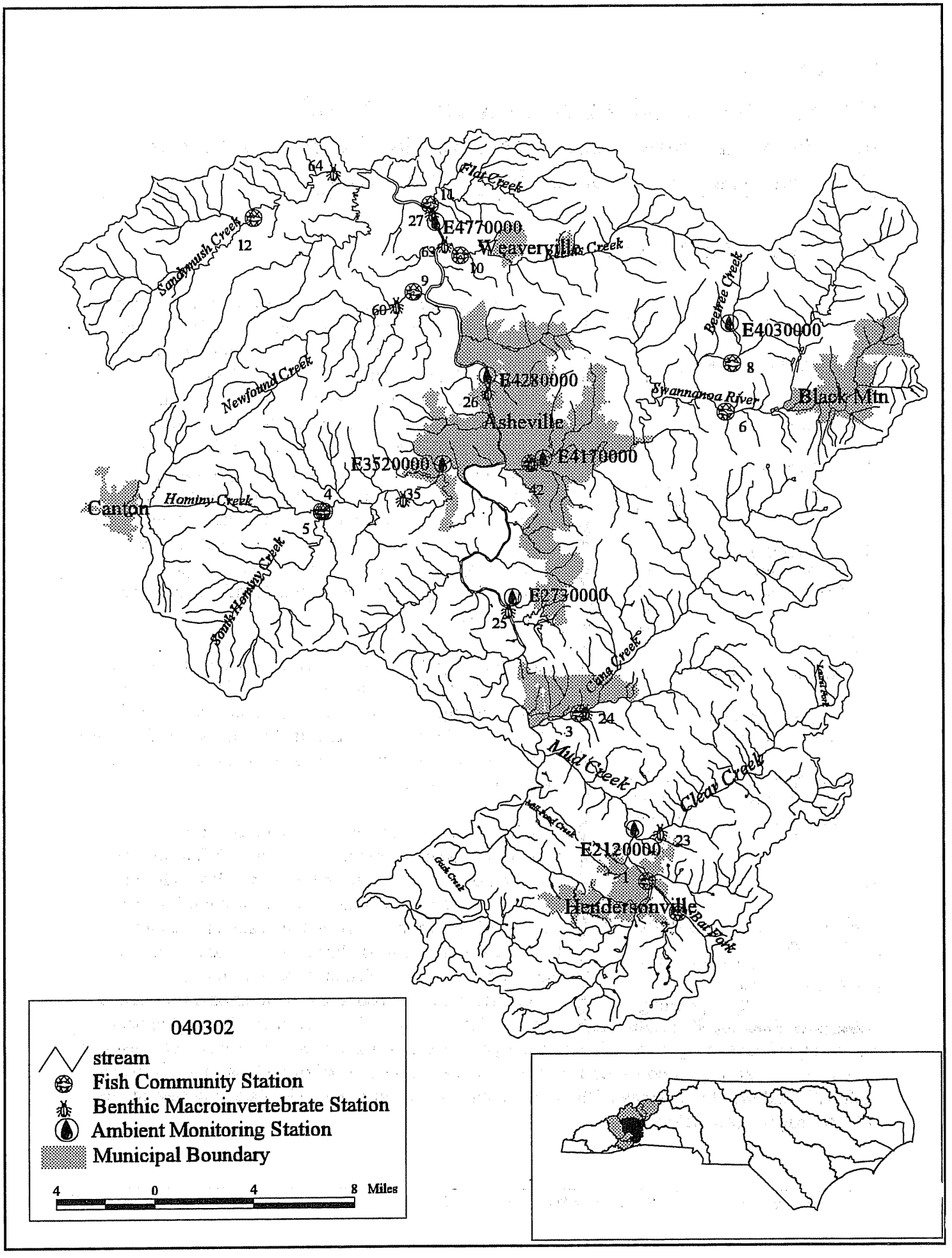


Figure B-2 Sampling Locations within Subbasin 04-03-02

Table B-2 Basinwide Biological Sites in French Broad River Subbasin 04-03-02 (1997)°

Site #	Stream	County	Road	Rating
Benthic Macroinvertebrates				
B-23	Clear Creek	Henderson	SR 1513	Poor
B-24	Cane Creek	Henderson	SR 1006	Good-Fair
B-25	French Broad River	Buncombe	NC 146	Good-Fair
B-26	French Broad River	Buncombe	SR 1348	Good
B-27	French Broad River	Buncombe	SR 1634	Good-Fair
B-35	Hominy Creek	Buncombe	SR 3412	Fair
B-42	Swannanoa River	Buncombe	US 25	Good-Fair
B-62	Newfound Creek	Buncombe	SR 1622	Good-Fair
B-63	Reems Creek	Buncombe	NC 251	Good
B-65	Sandymush Creek	Madison	SR 1114	Good
Fish Community				
F-1	Mud Creek	Henderson	SR 1647	Not Rated*
F-2	Bat Fork	Henderson	SR 1779	Not Rated*
F-3	Cane Creek	Henderson	US 25	Not Rated*
F-4	Hominy Creek	Buncombe	NC 151	Not Rated*
F-5	South Hominy Creek	Buncombe	NC 151	Not Rated*
F-6	Swannanoa River	Buncombe	SR 2435	Not Rated*
F-8	Beetree Creek	Buncombe	SR 2427	Not Rated*
F-9	Newfound Creek	Buncombe	SR 1641	Not Rated*
F-10	Reems Creek	Buncombe	NC 251	Not Rated*
F-11	Flat Creek	Buncombe	SR 1742	Not Rated*
F-12	Sandymush Creek	Madison	SR 1107	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25

The number of fecal coliform samples collected that exceed NC's water quality criterion (200 colonies/100ml) are fewer during this basinwide review period (1993-1997) than during the previous review period (1988-1993) at all ambient monitoring locations in this subbasin. Fecal coliform exceedences were higher at the Mud Creek location than at any other location in the subbasin.

Benthic macroinvertebrate samples were collected from 65 locations in this subbasin since 1983. Water quality conditions generally range from Good-Fair to Good in the French Broad River in this subbasin. Benthos samples conducted at 10 tributary basinwide locations during 1997 showed no change in bioclassification at Clear Creek, Cane Creek or the Swannanoa River near Biltmore, compared to the 1992 surveys. Improvements in bioclassifications were found at Hominy Creek (Poor to Fair), Newfound Creek (Fair or Poor to Good-Fair), and Reems Creek (Good-Fair to Good). Only Sandymush Creek had a lower bioclassification during the 1997 basinwide survey (Excellent to Good).

Fish community samples were collected from 11 tributary streams in this subbasin in 1997. In Beetree Creek, the fish communities appear to be responding to the lack of required minimum flow releases from Beetree Reservoir. In Newfound Creek and Sandymush Creek, the fish communities appear to be responding to sedimentation and habitat degradation.

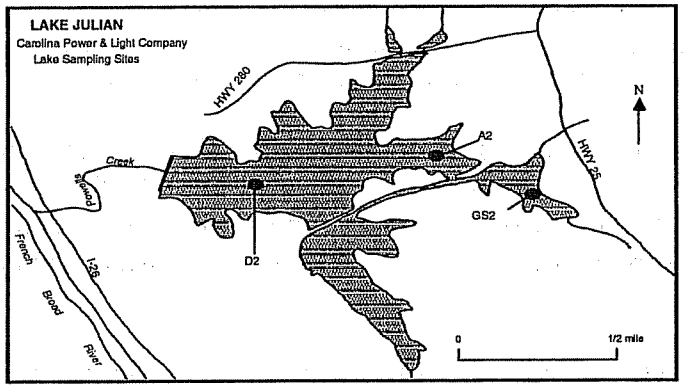
There are 19 wastewater treatment facilities in this subbasin that currently monitor effluent toxicity as part of their NPDES permit. General Electric began sending processed wastewater to the Hendersonville WWTP and is currently monitoring for groundwater and stormwater runoff.

The VWIN program (coordinated by UNCA) maintains 20 monitoring locations in Henderson County and 49 locations in Buncombe County. VWIN data from Henderson County show water quality problems at many sites in the Mud Creek watershed and the Cane Creek watershed (Maas et al., 1999). Numerous water quality problems are noted for Buncombe County streams. High turbidity and total suspended solids were recorded from Boylston, Little Willow, Sandymush, Newfound, Turkey and Hominy Creeks. Also, high conductivity levels were found in Reed, Flat and Sandymush Creeks (Maas et al., 1999).

Lake Julian Assessment

COUNTY:	Buncombe	**CLASSIFICATION:**	C
SURFACE AREA:	130 hectares (320 acres)	**MEAN DEPTH:**	66 feet (20 meters)
VOLUME:	2.60 x10^6 m^3	**WATERSHED:**	5 mi^2 (12 km^2)

Lake Julian was constructed in 1963 by the Carolina Power and Light Company (CP&L) to serve as a source of cooling water for the Asheville Steam Electric Plant. Located on Powell Creek, the lake is also used for boating and fishing. The watershed is primarily urban and residential.



Lake Julian was most recently monitored by CP&L in 1996. Comparison of water quality data collected by CP&L indicates that most chemistry characteristics of the lake have remained relatively unchanged since 1992 when it was last sampled by DWQ and was determined to be oligotrophic.

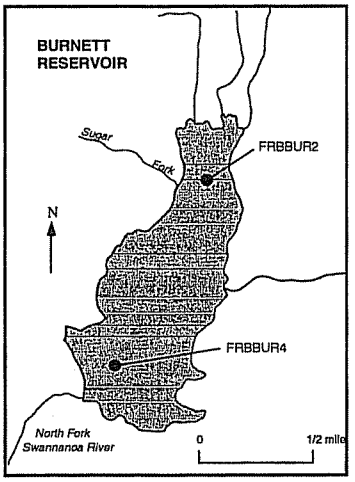
A special study of trace element concentrations in fish was conducted by CP&L during December 1995 in Lake Julian. This study showed, for the most part, that trace elements

(arsenic, copper, mercury, selenium and zinc) were comparable to background concentrations or slightly above background concentrations. Copper concentrations in fish liver (an indicator of bioconcentration) did not indicate any significant uptake of copper from reservoir waters. Concentrations of several key metals (arsenic, cadmium, mercury and selenium) were well below contaminant screening values recommended by the USEPA.

Burnett Reservoir Assessment

COUNTY:	Buncombe	**CLASSIFICATION:**	WS-I
SURFACE AREA:	134 hectares (330 acres)	**MEAN DEPTH:**	39 feet (12 meters)
VOLUME:	22.00 $x10^6 m^3$	**WATERSHED:**	2 mi^2 (6 km^2)

Burnett Reservoir was constructed in 1954 to provide drinking water for the City of Asheville. The North Fork Swannanoa River, Sugar Fork and several unnamed tributaries drain the forested watershed and flow into the lake. Burnett Reservoir was most recently monitored by DWQ in June, August and September 1997 and was found to be oligotrophic.

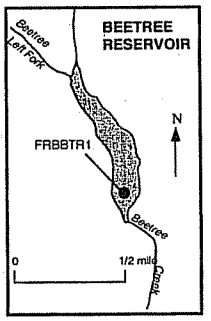


Beetree Reservoir Assessment

COUNTY:	Buncombe	**CLASSIFICATION:**	WS-I
SURFACE AREA:	22 hectares (55 acres)	**MEAN DEPTH:**	33 feet (10 meters)
VOLUME:	1.90 $x10^6 m^3$	**WATERSHED:**	8 mi^2 (20 km^2)

Beetree Reservoir was constructed in 1926 to serve as a water supply for the City of Asheville. Beetree Reservoir is not used for recreation, and access to the lake is limited. The watershed is owned by the City of Asheville and consists of undeveloped forested land.

Beetree Reservoir was most recently monitored by DWQ in June, August and September 1997. Beetree Reservoir is assumed to have been oligotrophic on the days it was sampled due to the low nutrient and chlorophyll *a* values observed.



For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

2.2 Prior Basinwide Plan Recommendations (1995) and Achievements

2.2.1 Impaired Waters

The 1995 French Broad River Basinwide Plan identified nine stream segments in this subbasin as impaired. Each of these segments is discussed below.

Mud Creek (15.2 miles above and below Henderson WWTP, from source to Byers Creek)

This section of Mud Creek was listed as not supporting due to turbidity and fecal coliform bacteria. New and expanding dischargers were required to meet advanced tertiary treatment with limits of 10 mg/l BOD_5 and 2 mg/l NH_3-N. Field-calibrated model results suggested that Hendersonville WWTP discharge should be relocated to the French Broad River. All other facilities were encouraged to connect onto the Hendersonville WWTP.

Status of Progress

Hendersonville plans to move its expanded discharge downstream in Mud Creek to the mouth of Clear Creek. This expansion includes more restrictive permit limits. All dischargers have hooked onto the Hendersonville WWTP. The creek is still considered to be impaired due to nonpoint source pollution and further discussion can be found in Part 2.3 below.

Bat Fork Creek (4.8 miles from source to Johnson Drainage Ditch)

This section of Bat Fork Creek was listed as not supporting due to both point and nonpoint source impacts. A field-calibrated model was conducted on Bat Fork Creek prior to the 1995 basinwide plan. The model did not indicate dissolved oxygen violations, but did indicate a BOD residual downstream. It was recommended that dischargers to the creek connect to city sewer. General Electric (GE) was scheduled to send its waste to the Hendersonville WWTP, which would remove a problematic discharge. Stormwater discharges from the GE site were to be monitored and limits would be developed as needed.

Status of Progress

GE's wastewater is now sent to Hendersonville WWTP with the exception of its groundwater and stormwater. Groundwater and stormwater monitoring are being conducted by GE and limits are being met. The creek is still considered to be impaired, and further discussion can be found in Part 2.3 below.

Clear Creek (6.3 miles from source to SR 1513)

This section of Clear Creek was listed as not supporting due to nonpoint sources of pollution. Studies were to be conducted to determine if pesticides from apple orchards were contributing to the impairment. A pesticide control program would be recommended if appropriate.

Status of Progress

A pesticide study was completed in 1994. Results of the study showed some low levels of pesticides present. This creek is still considered to be impaired and is discussed further in Part 2.3 below.

Hominy Creek (11.8 miles from NC 112 to French Broad River)

This length of Hominy Creek was listed as partially and not supporting due to both point and nonpoint sources of pollution. Toxicity limits for BASF were to be reevaluated at permit renewal and instream monitoring was recommended. Tomato farms and erosion were also cited as sources of impacts to this creek. DWQ anticipated conducting a field-calibrated model of the French Broad River in this area and more closely examining the impact of BASF on Hominy Creek.

Status of Progress

The BASF facility is in compliance with its NPDES discharge permit. DWQ did not conduct additional modeling of the French Broad River in this area and no longer anticipates conducting such modeling given current priorities. The lower portion of Hominy Creek is still impaired due to tomato farming and urban and nonurban development and is discussed further in Part 2.3 below.

French Broad River (9.6 miles from Blantyre to Alexander)

This section of the French Broad River was listed as partially supporting. A field-calibrated model was developed for the French Broad River between Ecusta and Hwy 64 in 1980. An updated model was planned for the revised basinwide plan, but the empirical model was to be used in the interim. Water quality impacts were noted below the Buncombe County MSD facility, and the facility was operating under a Judicial Order of Consent (JOC) due to anticipated construction-related compliance problems during expansion from a 25 MGD to a 40 MGD

facility. The WWTP's permit and compliance records were to be closely evaluated to determine future management strategies.

Status of Progress

The empirical model has been applied to this portion of the river. A field-calibrated model was not developed for the French Broad River and development of such a model is no longer planned given current DWQ priorities. This section of the French Broad River is no longer considered to be impaired based on recent DWQ monitoring data. However, there are notable impacts to the benthic macroinvertebrate community along the river and elevated turbidity at the state line sampling site.

The Buncombe County MSD facility completed facility upgrades in 1991 and is no longer under the Judicial Order of Consent. The facility routinely operates within compliance. Since 1990, MSD has spent approximately $124,000,000 on treatment facility upgrades and sewer system rehabilitation.

Swannanoa River (10.8 miles from SR 2416 to US 25)

This section of the Swannanoa River was listed as partially supporting. The primary concerns for this river were urban runoff and sedimentation. General management strategies for controlling sedimentation were presented.

Status of Progress

The river has been sampled at the US 25 location five times during summer months since 1985. Water quality conditions have varied during this time period, with conditions improving since 1988. The Swannanoa River is no longer considered to be impaired based on the most recent DWQ monitoring data. The trend in water quality improvement at this location parallels the trend at the ambient monitoring location on the French Broad River site approximately 5 miles below the confluence with the Swannanoa River.

DWQ believes that this segment of the river should continue to be a priority for sediment control due to the changing nature of the watershed from a rural to nonurban character. Therefore, DWQ recommends a strategy of monitoring the river to identify sources of sediment. Sediment controls should be enhanced and in accordance with regulations or ordinances. The implementation of best management practices and correction of existing sources of sediment would prevent this river from becoming impaired. Riverlink has received $532,400 to develop a detailed watershed management plan that, when implemented in full, will provide significant protection for the Swannanoa River. Riverlink is encouraging the participation of other groups to ensure the plan is implemented successfully.

Newfound Creek (10.2 miles from SR 1297 to SR 1622)

This length of Newfound Creek was previously listed as partially and not supporting. The primary concerns for this river were due to sedimentation, and general management strategies for controlling sedimentation were presented.

Status of Progress

Several segments of the Newfound Creek were previously rated as impaired, but are now no longer considered to be impaired based on recent data. There has been a great deal of effort focused on the Newfound Creek watershed, and these efforts have resulted in many improvements in the water quality of the creek. Several dairies in the watershed have closed, which has helped decrease bank destabilization associated with watering livestock out of the creek. Most of the remaining animal operations have certified waste systems. Despite these measurable improvements in water quality, the creek is still in need of continued restoration efforts. Sedimentation, turbidity and fecal coliform levels are notable problems for the creek. Nonurban development and agriculture remain sources of nonpoint pollution. To address remaining water quality problems in the creek, the Buncombe County Soil and Water Conservation District was awarded a Clean Water Management Trust Fund (CWMTF) grant (see Section C for more details). Newfound Creek, although not currently considered impaired, remains on the state's 303(d) list, and DWQ is proceeding with the development of a fecal coliform bacteria TMDL for Newfound Creek (See Appendix IV).

2.2.2 Other Recommendations

Gash Creek (3.7 miles from source to French Broad River)

The 1995 French Broad River Basinwide Plan did not identify Gash Creek as impaired; however, a recommendation was made to revise permit limits based on recent water quality modeling results using revised streamflow information. Permit limits were revised and a number of permits were rescinded prior to construction of the facility. A follow-up water quality survey was recommended to determine if there have been water quality improvements since the limits were revised.

Status of Progress

The NPDES discharge permit holders along the creek were either abandoned or consolidated into the Hendersonville WWTP. Follow-up monitoring has determined this section of the creek is impaired due to nonpoint source inputs. Gash Creek is discussed in Part 2.3 below.

2.3 Current Priority Issues and Recommendations

2.3.1 Monitored Impaired Waters

As noted in the previous basin plan, the greatest number of impaired stream segments in the French Broad River basin occurs in this subbasin. Segments of eight streams within this subbasin are rated as impaired based on the most recent data available. Each of these streams is presented and discussed below. These streams are also on the state's year 2000 (not yet EPA approved) 303(d) list (see Part 2.3.2).

Gash Creek (3.7 miles from source to French Broad River)

Gash Creek is listed as impaired (NS) due to nonurban development resulting in habitat degradation and the lack of biological community within the stream.

2000 Recommendation(s)

There is currently not enough information available to develop appropriate management strategies to restore Gash Creek. This creek is a good candidate for a NPS inventory, with particular focus on golf and construction activities. This type of watershed assessment could then be used to target resources toward correcting the water quality related impacts. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

Mill Pond Creek (3.6 miles from source to French Broad River)

Mill Pond Creek is listed as impaired (PS) due to nonpoint sources of pollution. A possible source of contamination is the Henderson County Stony Mountain Road landfill, which is located directly upstream of the sample site.

2000 Recommendation(s)

The Stony Mountain Road landfill is an unlined county landfill that was recently closed using approved techniques. The closure process includes capping the landfill and revegetating the area. The county must maintain post-closure activities that include well monitoring and assuring the stability of the area. County groundwater well sampling data does not show any contamination problems. However, the headwaters of Mill Pond Creek originate at the landfill and chemical sampling shows some impacts to the stream and biological sampling resulted in a Fair rating. The VWIN program samples Mill Pond Creek and notes consistently high conductivity levels (Maas et al., 2000) that may result from the landfill, a DOT storage site or upstream discharges.

DWQ will investigate and reduce the source of conductivity in the watershed while continuing to monitor this creek to better identify other problem parameters in order to develop an appropriate management strategy.

Mud Creek (18.4 miles from source to French Broad River)

Mud Creek is listed as impaired (NS) due to habitat degradation. Potential sources of impacts are both point (Hendersonville WWTP) and nonpoint (agriculture and urban to nonurban land uses). A special study of six sample sites was conducted in September 1997 to assess the overall watershed conditions. Four sites rated Poor and two sites rated Fair. Much of the land along Mud Creek is in row crops (tomatoes or corn) or pasture and hay. Mud Creek is the most developed watershed in Henderson County. Approximately 4-5 miles of the stream flows through the City of Hendersonville. Therefore, urban runoff is also of great concern for the water quality of the creek. The Hendersonville WWTP is potentially affecting only the upper sampling site just downstream of the facility.

2000 Recommendation(s)

The Hendersonville WWTP is currently operating under a Special Order by Consent (SOC) while the facility increases its flow capacity. The facility is currently meeting the effluent limits of the SOC, but is behind on the expansion construction schedule due to higher than anticipated contract bids. The city is looking for an additional $5 million in funding to meet the needs of the expansion. After the expansion is complete, the SOC will be removed and the facility will continue to be monitored to assure it is meeting all permit limits.

The DWQ Asheville Regional Office has issued Notice of Violations (NOVs) to operators of the Sexton Dairy for discharging without a permit. While this facility has improved some of its operations, there are still considerable improvements that should be made. Local agencies can assist with both technical assistance and funding opportunities to implement best management practices.

The Land of Sky Regional Council (LOS) and the DWQ have received grants to conduct work on the Mud Creek watershed. The LOS will assemble stakeholder groups and assist DWQ with a detailed strategy for implementation of actions to restore the creek. For more information on these grants, see Section C. Additional funding sources will be needed to bring full restoration to the creek, but it is anticipated that this planning phase could result in measurable water quality improvements upon implementation of the identified needed actions. Implementation of these grants will be concluded within this next five-year planning cycle.

Bat Fork Creek (4.8 miles from source to Johnson Drainage Ditch)

This section of Bat Fork Creek is impaired (PS) due to habitat degradation resulting from nonpoint source inputs from both agriculture as well as urban and nonurban development. The creek has notable sedimentation problems that affect the suitability of habitat for aquatic life.

2000 Recommendation(s)

Bat Fork Creek could benefit from local initiatives that might include the formation of a citizens group to conduct stream cleanup efforts, assess the watershed for specific pollution sources, and identify possible solutions to these nonpoint sources of pollution. Local agencies could pursue funding opportunities to reduce these sources and to implement a watershed-wide education effort. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

Clear Creek (11.7 miles from source to Lewis Creek)

The Clear Creek watershed (44 square miles) is a large tributary of Mud Creek. Clear Creek is impaired (PS) due to nonpoint sources of pollution. Habitat degradation is the cause of impairment, and pesticides associated with apple production along the creek may also be a cause of the impaired aquatic community. Land use is primarily forested and agriculture (apple orchards). Two special studies have been conducted to assess the effects of pesticide runoff from apple orchards. Some low levels of pesticides were found in the 1994 study, and these levels

may be having an impact on the aquatic life in the creek. The composition of the benthic macroinvertebrate community in the 1997 sampling suggests that instream toxicity, possibly from apple orchard runoff, is affecting the biology of the stream and leading to its impairment.

2000 Recommendation(s)

Farmers who disturb the vegetative cover along stream edges could increase the use of streamside buffers to protect streambanks from eroding. There is a long list of applicants for agricultural cost share funding, but a funding shortfall and the length of time to process the applications have been inadequate to address all applications. Many of the farmers in the watershed lease land, resulting in turnover of farmers and little incentive to install best management practices (BMPs). The expansion of buffers and BMPs would greatly enhance water quality in the creek. Funding and other resources should be directed towards the use of BMPs along Clear Creek. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

Hominy Creek (11.8 miles from NC 151 to French Broad River) **and**
South Hominy Creek (6.4 miles from source to Hominy Creek)

About 10 miles of the headwaters of Hominy Creek are not considered to be impaired, although there is sedimentation in the headwaters resulting in a notable habitat degradation and a decline in water quality. Straight piping is also suspected in the headwaters. The remainder of the creek is impaired (PS) due to nonpoint sources (urban and nonurban development and agriculture). Habitat degradation is a result of these nonpoint source inputs. Previous sampling for a water supply reclassification indicated pesticide contamination at two sampling stations. The DWQ Asheville Regional Office sampled those sites in June 1999. Results of this study were inconclusive. South Hominy Creek has declined in water quality since the last basinwide sampling from a Good-Fair to a Poor rating.

2000 Recommendation(s)

Tomato farms are a likely contributor of pesticides in any watershed where there is intensive tomato growing. Tomatoes must be sprayed every 6 days with a high-volume sprayer throughout the growing season (April – September) and are, therefore, usually located in bottomlands near a readily available water source. In general, tomato farmers lease land in these bottomland floodplains, so the incentive to invest in chemical handling facilities is reduced. These facilities can greatly increase the potential for containing chemical spills. There is a need to increase the funding and implementation of chemical handling facilities. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

Ross Creek (1.7 miles from I-240 to Swannanoa River)

This section of Ross Creek is impaired (NS) due to loss of habitat. Urban runoff, sediment and nutrients are related to this runoff. DWQ conducted sampling on two sites along Ross Creek in January 1999. The upper site was in an unimpaired section of the creek, but even this section

was impacted by residential development and cattle access to the creek. The 1.7 miles of impaired waters are located in a heavily urbanized area. The stream channel has been modified and straightened to allow for Tunnel Road. The banks have been riprapped to reduce erosion, but erosion is still evident in areas.

2000 Recommendation(s)

The impacts of urbanization on this creek are evident and long-term. Significant funding and effort will be required to undertake the projects needed to make measurable water quality improvements in Ross Creek. A management strategy or TMDL approach will be used under the 303(d) process (see Part 2.3.2) to address this impairment. DWQ will coordinate and collaborate with local agencies over the next basinwide cycle to make progress towards this end. The Land-of-Sky Regional Council has a project underway to increase stakeholder awareness of the stream and develop a restoration plan (see Section C, Chapter1). In addition, the Metropolitan Sewerage District of Buncombe County has acquired right-of-way to rehabilitate approximately one-half mile of existing sewer along Ross Creek near the Swannanoa River to the upper end of Kenilworth Lake.

2.3.2 303(d) Listed Waters

Several segments of streams are on the state's year 2000 (not yet approved) 303(d) list for this subbasin. These streams are currently impaired and discussed above (Part 2.3.1). Refer to Appendix IV for more information on the state's 303(d) methodology and listing requirements.

2.3.3 Other Issues and Recommendations

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs and nonpoint source agency contacts, see Appendix VI. DWQ will notify local agencies of water quality concerns for these creeks and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

The primarily agricultural watershed of Puncheon Camp Creek (2.6 miles from source to Clear Creek) is impacted by nonpoint sources of pollution resulting in habitat degradation. DWQ recommends local initiatives to implement agricultural BMPs in this watershed to reduce potential water quality degradation.

Cane Creek (12.4 miles from Ashworth Creek to the French Broad River) is affected by agricultural activities in the watershed that have resulted in habitat degradation. DWQ recommends local initiatives to implement agricultural BMPs in this watershed to reduce potential water quality degradation. To this end, RiverLink has conducted an assessment of the ecological health of the Buncombe County portion of the watershed. RiverLink will use this

information to prioritize efforts within high priority tributaries, initiate a watershed project, and seek partners interested in helping to improve and protect Can Creek. RiverLink hopes to continue the study downstream and include the Haywood County section of the watershed.

Although the Swannanoa River is not considered to be impaired, impacts to water quality are evident along the length of the river (see Part 2.2.1 above). The watershed of the river is being developed, and this urban to nonurban development is resulting in habitat degradation within the river. The VWIN program monitors several sites within the Swannanoa River watershed, as well as five sites on the Swannanoa River itself (Maas, et al., 1999). Data from this program note declines in water quality from upstream to downstream in the reach near Grassy Branch over the last couple of years. There is a need for land use planning within this watershed that will protect the future water quality of the river. Best management practices for all construction activities should be in place and monitored.

The Wetlands Restoration Program has prioritized watersheds within this subbasin for developing local watershed restoration strategies. For further information on this program, refer to Section C, Chapter 1, Part 1.3.

Chapter 3 -
French Broad River Subbasin 04-03-03
Includes Mills River and Davidson River

3.1 Water Quality Overview

Subbasin 04-03-03 at a Glance

Land and Water Area (sq. mi.)

Total area:	141
Land area:	141
Water area:	0

Population Statistics

1990 Est. Pop.:	7,530 people
Pop. Density:	53 persons/mi^2

Land Cover (%)

Forest/Wetland:	89%
Surface Water:	<1%
Urban:	<1%
Cultivated Crop:	2%
Pasture/ Managed Herbaceous:	8%

Use Support Summary

Freshwater Streams:

Fully Supporting:	222.4 miles
Partially Supporting:	1.9 miles
Not Supporting:	4.6 miles
Not Rated:	4.3 miles

Much of the land in this subbasin lies within the Pisgah National Forest or Pisgah Game Lands. There are no large urban areas within the subbasin, although some development exists along the major highways (NC 280 and NC 191). Much of the subbasin outside the national forest is in agricultural land use, especially dairies and row crops. This subbasin contains 8 permitted dischargers, but none with a permitted discharge greater than 0.2 MGD. A map of this subbasin, including water quality sampling locations, is presented in Figure B-3. Overall biological ratings are presented in Table B-3.

As a result of minimal development in the Pisgah National Forest, many of the streams in this area have an Excellent rating based on macroinvertebrate samples. Most of the South Fork Mills River watershed is classified ORW, and most of the Davidson River watershed is classified HQW. Excellent water quality has also been recorded in the North Fork Mills River and the upper part of the Mills River.

Ambient water chemistry samples from three sites on the Mills River, Bradley Creek and the Davidson River showed no water quality problems. These sites were characterized by slightly acidic pH (minimum values about 5.3), low nutrient values and very low conductivity.

Benthic macroinvertebrate samples have been collected at 15 sites in this subbasin since 1983, including four special studies. Five sites were sampled for benthic macroinvertebrates during basinwide collections in 1997. Benthic macroinvertebrate sampling found severe water quality problems in the lower part of the Mills River, downstream of pesticide mixing areas associated with tomato farming. This water quality problem constitutes the only decline in water quality observed in this subbasin.

For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

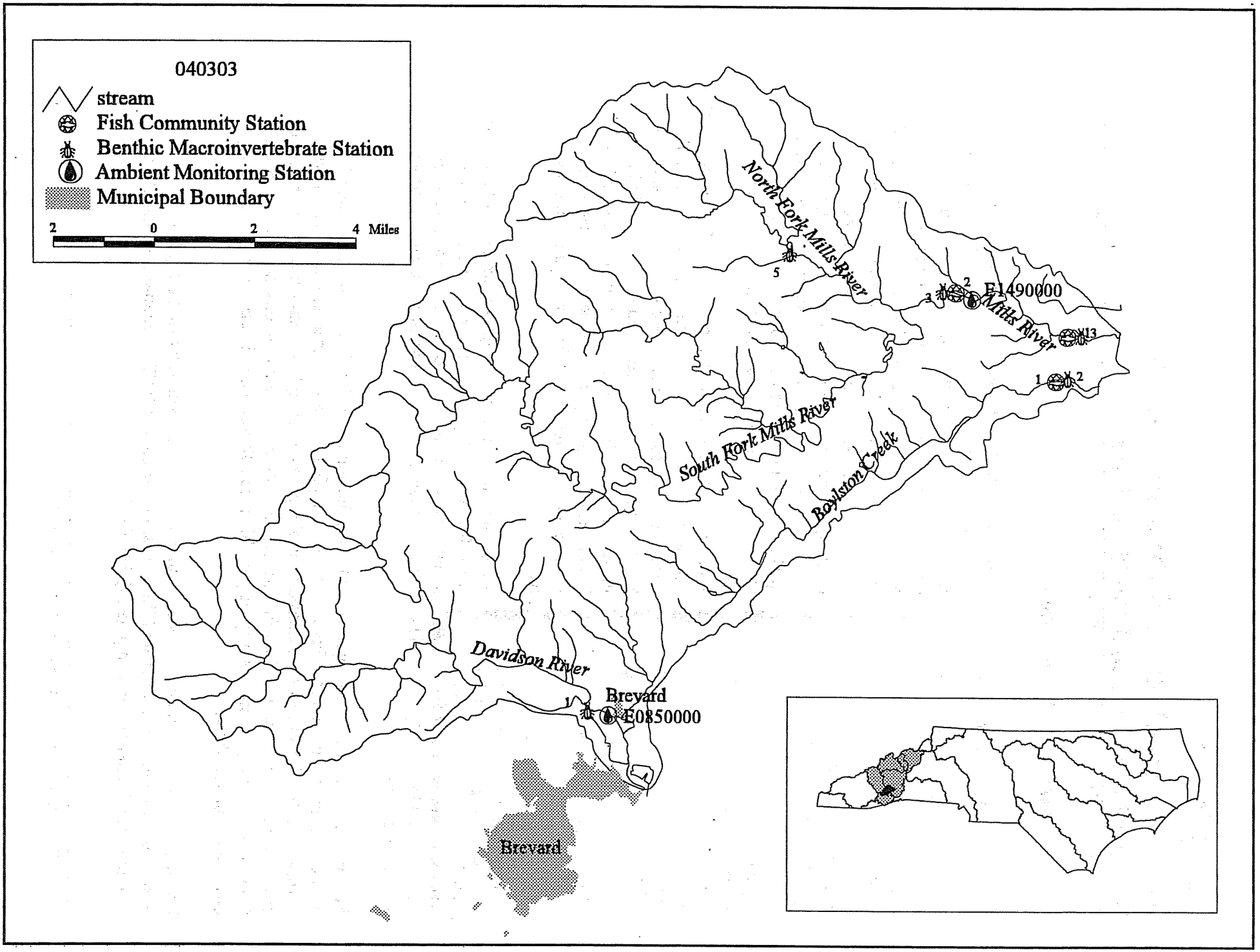


Figure B-3 Sampling Locations within Subbasin 04-03-03

Table B-3 Basinwide Biological Sites in French Broad River Subbasin 04-03-03 (1997)°

Site #	Stream	County	Road	Rating
Benthic Macroinvertebrates				
B-1	Davidson River	Transylvania	US 276	Excellent
B-2	Boylston Creek	Henderson	SR 1314	Good-Fair
B-3	Mills River	Henderson	SR 1337	Excellent
B-5	North Fork Mills	Henderson	ab Rocky Br	Excellent
B-13	Mills River	Henderson	SR 1353	Good-Fair
Fish Community				
F-1	Boylston Creek	Henderson	SR 1314	Not Rated*
F-2	Mills River	Henderson	SR 1337	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25

3.2 Prior Basinwide Plan Recommendations (1995) and Achievements

3.2.1 Impaired Waters

There were no streams identified as impaired in this subbasin in the 1995 French Broad River Basinwide Plan.

3.3 Current Priority Issues and Recommendations

Portions of the Mills River and all of Brandy Branch are considered to be impaired based on recent DWQ data (see Part 3.3.1). These waters are also on the state's year 2000 (not yet EPA approved) 303(d) list (see Part 3.3.2).

3.3.1 Monitored Impaired Waters

Mills River (4.6 miles from SR 1337 to the City of Hendersonville water supply intake, located 0.1 miles upstream of NC 191)

This section of the Mills River is rated as impaired (NS) due to impacts on the benthic macroinvertebrate community from agricultural nonpoint sources (tomato farms in particular) and possibly pesticides. Approximately one mile downstream, the Asheville-Buncombe Water Authority also withdraws water from the Mills River.

2000 Recommendation(s)

At the time of the 1995 French Broad River Basinwide Plan, Van Wingerden International was under a Special Order by Consent (SOC) due to excessive nutrients being discharged to a nearby pond with drainage to the Mills River. The SOC is a legal agreement between the state and the company that sets an enforceable time schedule for correcting problems at the facility. Van

Wingerden International has been making significant progress under the SOC agreement. Approximately 75% of the 35 acres of greenhouses are now on a recirculation system. The entire system is scheduled to be under recirculation, thereby eliminating the effluent from the greenhouses. A domestic waste NPDES permit will remain in effect for the operation.

The Mills River Partnership formed with various stakeholders to address pesticides in this watershed. A Clean Water Management Trust Fund grant was awarded to work with farmers to eliminate pesticide/herbicide chemical mixing and handling stations and move these away from the river. Some portion of this funding will also be used to restore buffers and provide streambank erosion control. See Section C, Chapter 1 for more information on this project. DWQ will rely on these local initiatives to address pesticide concerns and continue to monitor the river for improvements.

Brandy Branch (1.9 miles from source to Mills River)

This branch is listed as impaired (PS) due to nonpoint source pollution. This site was most recently sampled by DWQ in 1994. Brandy Branch is affected by both agricultural land use and residential activities, including the Mills River Village.

2000 Recommendation(s)

There is not enough information available to determine what efforts might be needed to restore Brandy Branch. A more in-depth study should be conducted to identify the land use activities or streambank problems that are causing degradation of this creek. There is currently not enough staff available at the state level to make this commitment. Local projects aimed at identifying sources of pollution and necessary actions would be very useful to DWQ and various funding agencies. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

3.3.2 303(d) Listed Waters

Segments of both the Mills River and Brandy Branch are on the state's year 2000 (not yet EPA approved) 303(d) list for this subbasin. These streams are currently impaired and discussed above (Part 2.3.1). Refer to Appendix IV for more information on the state's 303(d) methodology and listing requirements.

3.3.3 Other Issues and Recommendations

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs and nonpoint source agency contacts, see Appendix VI. DWQ will notify local agencies of water quality

concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

Withdrawals from the lower Davidson River are of interest to DWQ. Ecusta, a division of P.H. Glatfelter Inc., is located at the mouth of the Davidson River as it joins the French Broad. Ecusta is currently permitted to withdraw 27.5 MGD for water supply and processing from the lower Davidson River. The river, under 7Q10 conditions, may be impacted from this withdrawal. To minimize the impacts associated with the withdrawal under low flow conditions, Ecusta has initiated a recycling effort and reduced withdrawals to 20.5 MGD. Ecusta hopes to reduce withdrawals an additional 3-5 MGD. During very low flow conditions, Ecusta withdraws from the French Broad River as opposed to the lower Davidson River. DWQ will continue to monitor the Davidson River and assess any improvements to water quality resulting from this initiative.

Boylston Creek (12.1 miles from source to French Broad River) is impacted by both agricultural activities and nonurban development in the watershed. This creek could benefit from the development and implementation of appropriate BMPs for various land uses.

Chapter 4 -
French Broad River Subbasin 04-03-04
Includes Spring Creek, Ivy River, Little Ivy and Big Laurel Creek

4.1 Water Quality Overview

Subbasin 04-03-04 at a Glance

Land and Water Area (sq. mi.)

Total area:	496
Land area:	494
Water area:	2

Population Statistics

1990 Est. Pop.:	20,660 people
Pop. Density:	41 persons/mi^2

Land Cover (%)

Forest/Wetland:	85%
Surface Water:	<1%
Urban:	<1%
Cultivated Cropland:	<1%
Pasture/ Managed Herbaceous:	14%

Use Support Ratings

Freshwater Streams:

Fully Supporting:	728.7 miles
Partially Supporting:	2.6 miles
Not Supporting:	0.0 miles
Not Rated:	30.7 miles

This subbasin includes the lower section of the French Broad River in Madison County. The largest tributaries in the northern portion of the subbasin are Spring Creek, which is entirely within the Pisgah National Forest, and Big Laurel Creek, which creates the southern border of the Pisgah National Forest. In the southern section of the subbasin, there is development around the towns of Marshall and Mars Hill and agricultural activities. The largest tributary in this part of the subbasin is Ivy Creek (River). A map of this subbasin, including water quality sampling locations, is presented in Figure B-4. Overall biological ratings are presented in Table B-4.

Ambient water quality data is collected on the French Broad River at Marshall. Data do not indicate any significant changes since 1992.

Benthic macroinvertebrate samples have been collected at 28 sites in this subbasin since 1983. The French Broad River near Marshall has been sampled 9 times and received a rating of Good-Fair each time, with the exception of a Fair rating in 1987. In general, streams in the northern and western section of the subbasin (which are in the Pisgah National Forest) have been consistently rated Good or Excellent. Streams closer to Marshall in the Ivy Creek (River) watershed have declined from Good or Excellent ratings to Fair or Good-Fair ratings since 1992.

Three fish community samples were conducted in this subbasin. The entire length of Big Ivy Creek and Shelton Laurel Creek is designated as Hatchery Supported Trout Waters (NCWRC, 1997). Big Laurel Creek and Shelton Laurel Creek are also supplementally classified by DWQ as Trout Waters. Fisheries biologists observed large amounts of thick, filamentous green algae in Big Laurel Creek that was assumed to affect the fish community status.

There are 11 minor dischargers in this subbasin. Only the Marshall WWTP currently monitors effluent toxicity under its NPDES permit.

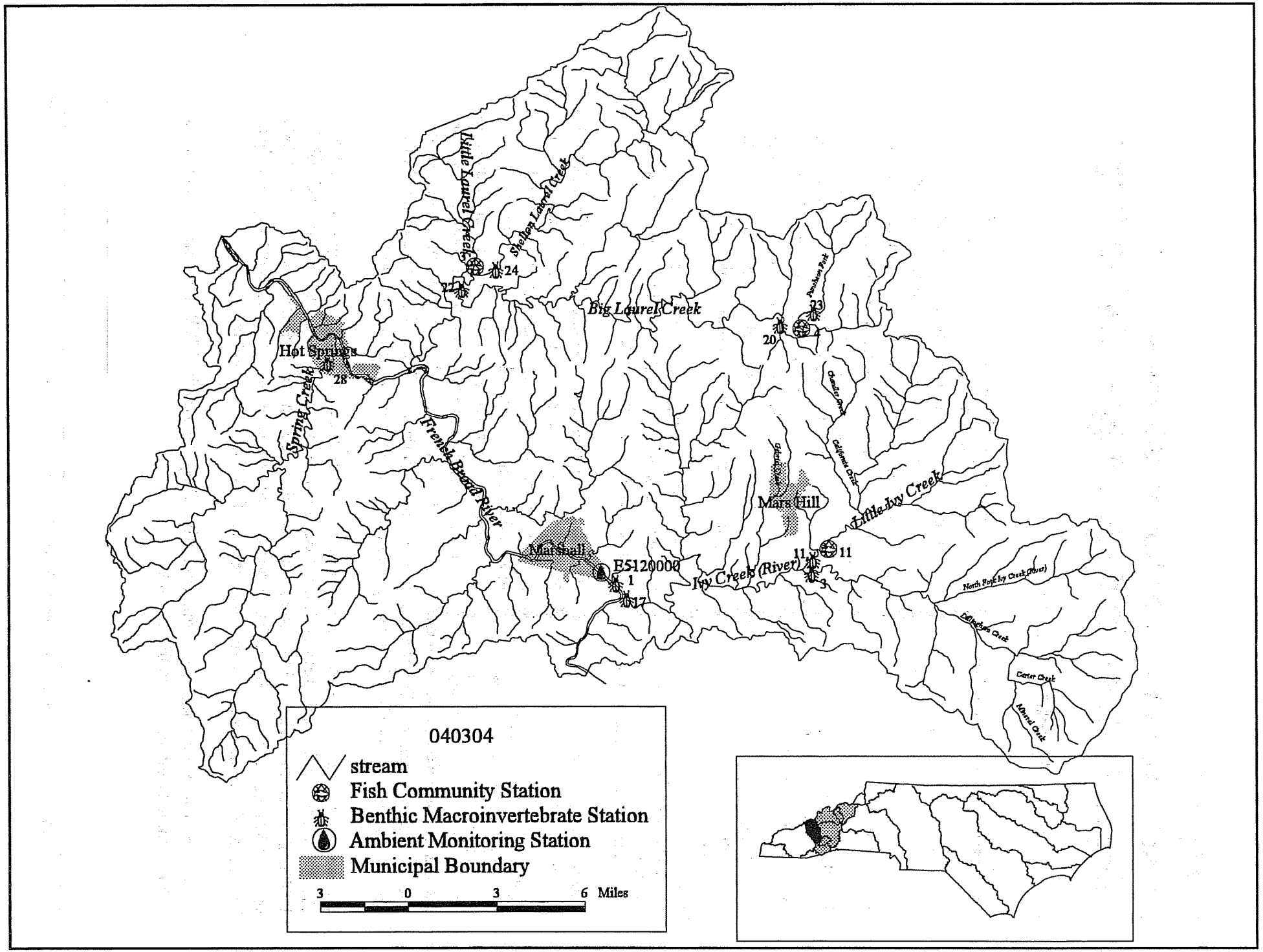


Figure B-4 Sampling Locations within Subbasin 04-03-04

Table B-4 Basinwide Biological Sites in French Broad River Subbasin 04-03-04 (1997)°

Site #	Stream	County	Road	Rating
Benthic Macroinvertebrates				
B-1	French Broad River	Madison	NC 213	Good-Fair
B-3	Ivy Creek (River)	Buncombe	SR 2150	Good-Fair
B-11	Little Ivy Creek	Madison	SR 1610	Fair
B-17	Ivy Creek (River)	Madison	US 25/70	Good-Fair
B-19	Big Laurel Creek	Madison	SR 1503	Good
B-22	Big Laurel Creek	Madison	NC 208	Excellent
B-23	Puncheon Fork	Madison	SR 1503	Good
B-24	Shelton Laurel Creek	Madison	NC 208/212	Good
B-28	Spring Creek	Madison	NC 209	Good
Fish Community				
F-1	Ivy Creek (River)	Buncombe	SR 2150	Not Rated*
F-3	Big Laurel Creek	Madison	NC 208	Not Rated*
F-4	Shelton Laurel Creek	Madison	NC 208	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25

For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

4.2 Prior Basinwide Plan Recommendations (1995) and Achievements

4.2.1 Impaired Waters

There were no streams identified as impaired in this subbasin in the 1995 French Broad River Basinwide Plan.

4.3 Current Priority Issues and Recommendations

A portion of the Little Ivy Creek (River) is the only river in this subbasin that is considered to be impaired and is discussed in Part 4.3.1. This length of the river is also on the state's year 2000 (not yet EPA approved) 303(d) list (see Part 4.3.2).

4.3.1 Monitored Impaired Waters

Little Ivy Creek (River) (2.6 miles from SR 1547 to Ivy Creek (River))

This 2.6-mile section of the Little Ivy River is impaired (PS) due to nonpoint source contributions from agriculture and nonurban development. The 2.1 miles of the Little Ivy River

headwaters above this impaired section of the river are also impacted by these same nonpoint sources of pollution, but are not rated as impaired.

2000 Recommendation(s)

A project is currently underway to implement best management practices in the Little Ivy River watershed to reduce fecal coliform bacteria (see Section C, Chapter 1). Some of the best management practices implemented will reduce erosion and runoff from pastureland, exclude livestock from riparian areas, and include installation of vegetated riparian buffers. In addition, straight piping is known to occur in the watershed, and the NC Division of Environmental Health Waste Discharge Elimination Program (WADE) is currently working to eliminate direct discharges in the watershed (see Section C, Chapter 1). DWQ will continue to monitor the creek to better identify sources of pollution.

4.3.2 303(d) Listed Waters

Segments of the Little Ivy Creek (River) are on the state's year 2000 (not yet EPA approved) 303(d) list for this subbasin. Little Ivy Creek (River) is currently impaired and discussed above (Part 4.3.1). Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

4.3.3 Other Issues and Recommendations

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs and nonpoint source agency contacts, see Appendix VI. DWQ will notify local agencies of water quality concerns for these creeks and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

The I-26 corridor construction through northern Buncombe County to the Tennessee state line has resulted in impacts to water quality in some of the tributaries in the vicinity of the construction project. Impacts to the aquatic life and habitat are related to the construction itself. The new corridor is about 75 percent complete. Once complete, there will likely be additional impacts due to stormwater runoff being rerouted to streams. Mitigation of the construction has just begun, so there is yet no measure of success for the BMPs installed. Evaluation of the effectiveness of BMPs will need to be completed to assure water quality protection. DWQ will continue to monitor streams in this area to assess water quality.

The VWIN program is also monitoring several stream sites in this area (Maas et al., 1999). VWIN monitoring has shown higher median conductivity levels than other major watersheds. California Creek, Middle Fork and Paint Fork, all main tributaries of Little Ivy Creek, show elevated levels of turbidity and total suspended solids. California Creek and Middle Fork also

have shown elevated metals concentrations. Nutrient concentrations are often elevated on California and Gabriel Creeks, and Middle and Paint Forks.

California Creek (3.8 miles from SR 1349 to Little Ivy Creek) was recently sampled by DWQ to assess impacts of I-26 construction in Madison County. This sample was taken prior to construction and will be used as a baseline of water quality in the creek. DWQ will continue to monitor water quality at this site. VWIN monitoring will also continue at this site.

Gabriel Creek (7.2 miles from NC 213 to Ivy Creek) is experiencing impacts from both agricultural activities and nonurban development. A watershed assessment to identify sources of impacts and actions needed to address them would be beneficial.

DWQ is currently conducting monitoring to assess the potential to reclassify the lower French Broad River in Madison County from a Class C to a Class B water (see Section A, Chapter 3, Part 3.2). The Class B rating would provide water quality protection for primary recreation in addition to Class C protection.

Chapter 5 -
French Broad River Subbasin 04-03-05
Includes Pigeon River, East and West Fork Pigeon River and Richland, Jonathans, Crabtree and Cataloochee Creeks

5.1 Water Quality Overview

Subbasin 04-03-05 at a Glance

Land and Water Area (sq. mi.)

Total area:	532
Land area:	531
Water area:	1

Population Statistics

1990 Est. Pop.:	43,746 people
Pop. Density:	82 person/mi^2

Land Cover (%)

Forest/Wetland:	84%
Surface Water:	<1%
Urban:	1%
Cultivated Crop:	<1%
Pasture/ Managed Herbaceous:	14%

Use Support Ratings

Freshwater Streams:

Fully Supporting:	612.1 miles
Partially Supporting:	9.4 miles
Not Supporting:	0.0 miles
Not Rated:	155.6 miles

Lakes:

Allen Creek Reservoir – Fully Supporting
Lake Junaluska – Fully Supporting
Walters Lake – Fully Supporting

This subbasin includes undeveloped land within the Great Smoky Mountains National Park, Pisgah National Forest, Pisgah Game Lands and the Shining Rock Wilderness area. The largest urban areas are Waynesville, Lake Junaluska, Clyde and Canton. A map of this subbasin, including water quality sampling locations, is presented in Figure B-5. Overall biological ratings are presented in Table B-5.

The Pigeon River near Canton has been intensively sampled since the 1960s, when very poor water quality was found below Champion Paper's (now Blue Ridge Paper Products) discharge to the Pigeon River near Canton. Studies by DWQ in 1978-1980 showed water quality improvements, but the river was still impaired. Consultants to Champion Paper conducted extensive studies of the Pigeon River and tributaries, most recently in 1995 (EA, 1996). CP&L biologists have studied the Pigeon River near Walters Lake. These investigations generally agree that water quality has improved in the river.

Water chemistry data collected at four ambient sites on the Pigeon River by DWQ show substantial improvements as evidenced by large declines over time in conductivity, fecal coliform bacteria and nutrient values for all sites downstream of the Blue Ridge Paper Products discharge. Some improvements can be seen even within the last 5 years, with conductivity dropping by about 50% at Clyde (the first site downstream of the discharge). Further discussion on the Pigeon River can be found in Part 5.2 and 5.3 below.

Benthic macroinvertebrates were collected from 38 sites in this subbasin, including 16 samples collected during 1997. These data indicated Good to Excellent water quality in many tributary streams. Cataloochee Creek and its tributaries have been designated as Outstanding Resource Waters, while the Middle Prong West Fork Pigeon River and its tributaries have been designated

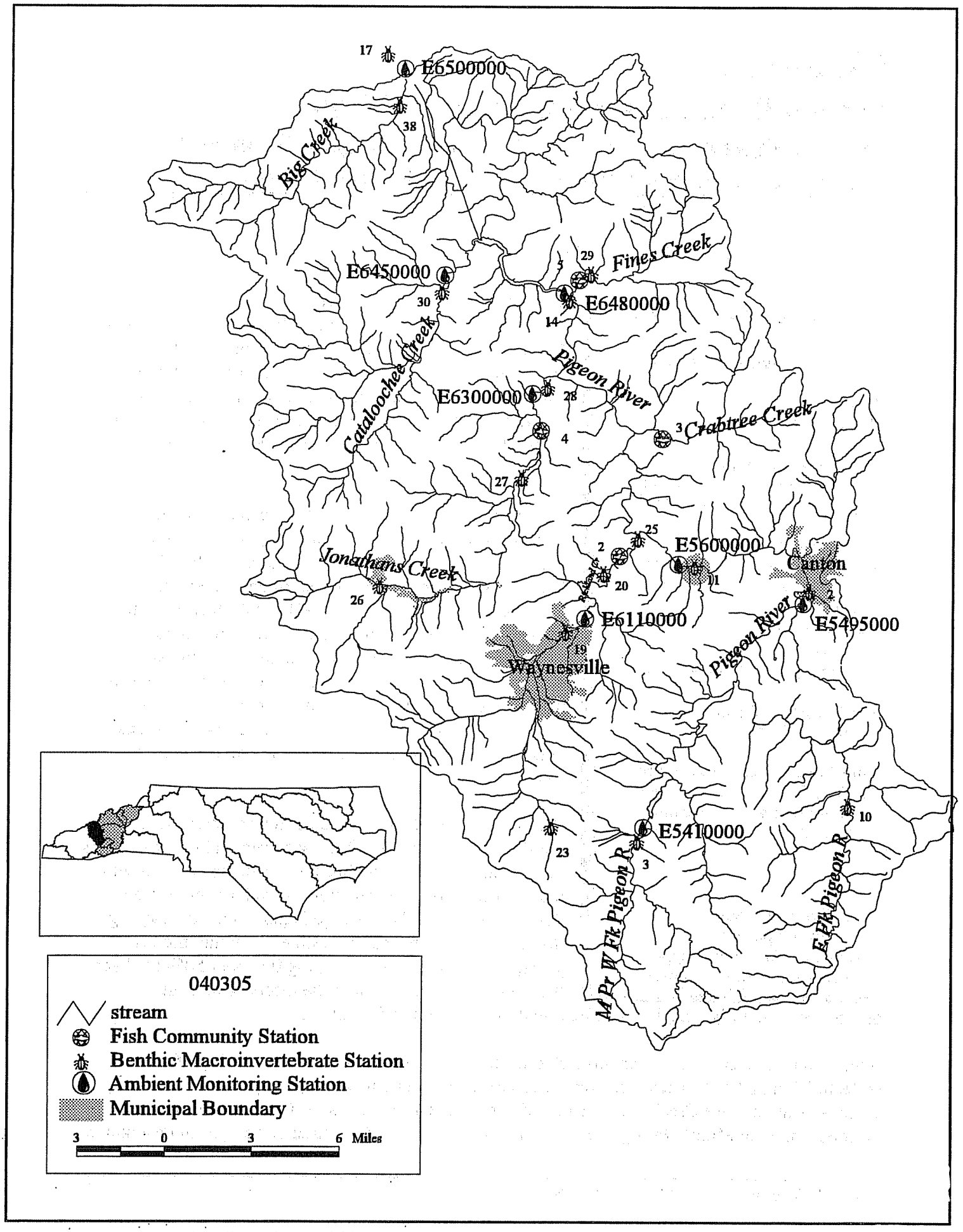


Figure B-5 Sampling Locations within Subbasin 04-03-05

Table B-5 Basinwide Biological Sites in French Broad River Subbasin 04-03-05 (1997)°

Site #	Stream	County	Road	Rating
Benthic Macroinvertebrates				
B-2	Pigeon River	Haywood	NC 215	Excellent
B-3	West Fork Pigeon River	Haywood	SR 1216	Excellent
B-10	East Fork Pigeon River	Haywood	US 276	Excellent
B-11	Pigeon River	Haywood	SR 1642, Clyde	Fair**
B-14	Pigeon River	Haywood	SR 1338, Hepco	Good-Fair
B-17	Pigeon River	Haywood	I-40, Waterville	Good
B-19	Richland Creek	Haywood	US 23 Business	Good-Fair
B-20	Richland Creek	Haywood	SR 1184	Good-Fair
B-23	Shiny Creek	Haywood	ab Allen Reservoir	Excellent
B-25	Richland Creek	Haywood	SR 1519	Fair
B-26	Jonathans Creek	Haywood	SR 1306	Excellent
B-27	Jonathans Creek	Haywood	SR 1322	Excellent
B-28	Jonathans Creek	Haywood	SR 1349	Excellent
B-29	Fines Creek	Haywood	SR 1355	Good-Fair
B-30	Cataloochee Creek	Haywood	SR 1395	Excellent
B-38	Big Creek	Haywood	in GSMNP	Excellent
Fish Community				
F-3	Richland Creek	Haywood	Walnut Trail	Not Rated*
F-4	Crabtree Creek	Haywood	NC 209	Not Rated*
F-5	Jonathans Creek	Haywood	US 276	Not Rated*
F-6	Fines Creek	Haywood	SR 1355	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25
** Based on December 1999 sampling data

High Quality Waters. Other waters designated Native and Special Native Trout Waters (and thus also HQW) include the upper portion of the Little East Fork Pigeon River and tributaries, the upper portion of East Fork Pigeon River and tributaries, and portions of Rough Creek and Rocky Branch. The Excellent rating given to Jonathans Creek could make it eligible for reclassification to HQW.

Richland Creek near Waynesville has shown signs of improving water quality in recent years. Degradation from nonpoint sources has been found in some of the smaller tributaries (Jonathans Creek and Fines Creek), although all Jonathans Creek sites received an Excellent rating in 1997. Jonathans Creek drains the Maggie Valley area, while Fines Creek flows through an agricultural area.

Fish sampling by both DWQ and TVA biologists produced low ratings for 8 of 10 sites in this subbasin. Some of these low ratings reflect the naturally low diversity of trout streams (Big Creek, East Fork Pigeon River) and were not rated. Highest scores were assigned to the West

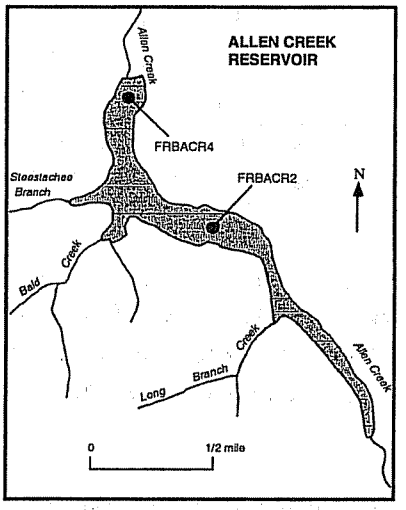
Fork Pigeon River and the Pigeon River above Canton. Streams draining agricultural watersheds (Crabtree Creek and Fines Creek) had low ratings. These sites suggested enrichment and Volunteer Water Information Network data have confirmed high nutrient levels in Fines Creek, as well as in nearby Rush Fork. Streams draining developed areas (Jonathans Creek and Richland Creek) also had low ratings, with Richland Creek more severely impacted.

There are over 20 dischargers in this subbasin, but only three facilities have a permitted flow greater than 0.5 MGD: Waynesville WWTP, Maggie Valley WWTP and Blue Ridge Paper Products. Four dischargers in this subbasin currently monitor effluent toxicity under conditions of the NPDES permits. Most facilities are passing toxicity tests, with occasional failures recorded for Blue Ridge Paper Products (single tests in 1995 and 1997) and Maggie Valley WWTP (2 tests in 1996).

Allen Creek Reservoir Assessment

COUNTY:	Haywood	**CLASSIFICATION:**	WS-I
SURFACE AREA:	49 hectares (120 acres)	**MEAN DEPTH:**	46 feet (14 meters)
VOLUME:	3.3 x$10^6 m^3$	**WATERSHED:**	13 mi^2 (34 km^2)

Allen Creek Reservoir is a small water supply reservoir with over 98 percent of its watershed owned by the Town of Waynesville. Most of the watershed is forested and undeveloped. Access to the lake is restricted to water treatment plant personnel.

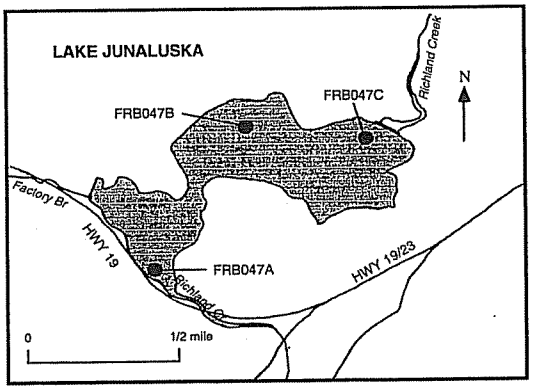


In 1991, Allen Creek was selected as one of 16 regional reference lakes. The purpose of this evaluation is to use this information in comparative evaluations of other lakes within the same general region. As part of that process, the lake was monitored three times each summer from 1991 to 1993. Allen Creek Reservoir was most recently sampled in 1993 and was found to be oligotrophic.

Lake Junaluska Assessment

COUNTY:	Haywood	**CLASSIFICATION:**	B
SURFACE AREA:	81 hectares (200 acres)	**MEAN DEPTH:**	20 feet (6 meters)
VOLUME:	4.50 x$10^6 m^3$	**WATERSHED:**	63 mi^2 (162 km^2)

The Lake Junaluska Assembly built Lake Junaluska in 1914. Mean hydraulic retention time of the lake is 13 days. The watershed is primarily forested with a few urban areas.

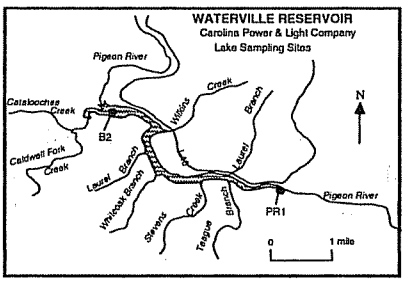


Lake Junaluska was most recently monitored by DWQ in June, August and September 1997 and was found to be oligotrophic in June and July and mesotrophic in August. DWQ has sampled this lake since 1981. Between 1981 to 1992, Lake Junaluska fluctuated between eutrophic and mesotrophic conditions. Lake Junaluska has had problems with sedimentation and eutrophication. An algae bloom was noted during July 1997, and a fish kill was reported a week prior to the sample date. Sedimentation has increased primarily because of residential and commercial growth in the watershed.

Waterville Lake (also known as Walters Lake) Assessment

COUNTY:	Haywood	**CLASSIFICATION:**	C
SURFACE AREA:	138 hectares (340 acres)	**MEAN DEPTH:**	76 feet (23 meters)
VOLUME:	31.60 x$10^6 m^3$	**WATERSHED:**	455 mi^2 (1178 km^2)

Waterville Lake, an impoundment of the Pigeon River, was built in the 1920s by Carolina Power and Light Company (CP&L) to produce hydroelectric power for Asheville and the surrounding area. The drainage area includes forest, agriculture and small urban/residential areas. Blue Ridge Paper Products (BRPP) is a major discharger into the headwaters of the lake.



Waterville Lake was most recently monitored by CP&L in 1995. Comparison of water quality data collected by CP&L indicates that most chemistry characteristics of the lake have improved since 1988, when monitoring of this reservoir was conducted in support of relicensure of the Walters Hydroelectric Plant. Waterville Lake was most recently monitored by DWQ in 1992, at which time the lake was determined to be eutrophic. Elevated total phosphorus and total organic nitrogen values contributed to the eutrophic conditions in the lake at that time.

For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

5.2 Prior Basinwide Plan Recommendations (1995) and Achievements

5.2.1 Impaired Waters

Portions of two streams were identified as impaired in this subbasin in the 1995 French Broad River Basinwide Plan: Pigeon River at Clyde to Waterville and Richland Creek. Each of these waters is discussed below.

Pigeon River (38.6 miles from Clyde to Waterville)

This length of the Pigeon River was listed as partially supporting due to dioxin contamination from the Champion Paper Mill (now called Blue Ridge Paper Products). Some portions were also listed due to elevated fecal coliform bacteria. After the 1992 biological sampling was conducted, many facility improvements were made to eliminate dioxin levels to the river. A field-calibrated model was recommended for the future once a long-term improvement to the paper mill effluent was observed.

Status of Progress

A mistake was made in the listing of an eight-mile stretch of the river from Hurricane Creek to the NC/TN state line. Champion's effluent by-passed this section of the river via a tunnel and these miles should not have been included in the total number of impaired stream miles. The Pigeon River has shown significant improvements due to process changes at the Blue Ridge Paper Products facility. There have been no detectable levels of dioxin in the mill's effluent since June 1989.

The majority of the river is no longer considered to be impaired. Therefore, field-calibrated modeling of the river is no longer a priority for DWQ. However, a seven-mile section of the river, just below the Canton water supply intake to Clyde, is still considered to be impaired and is discussed further in Part 5.3 below.

Richland Creek (2.4 miles from Bus US 23 to Lake Junaluska Dam to the Pigeon River)

Impacts from the wastewater effluent and stormwater runoff from the Dayco facility were noted, resulting in a partially supporting rating for the creek. Connection to municipal sewerage was recommended for new and expanding discharges to Factory Branch, a major tributary of Richland Creek.

Status of Progress

The Dayco facility has closed and is no longer having a significant impact on the creek. There is substantial urban and nonurban development in the watershed. This section of the creek is still considered to be impaired and is discussed further in Part 5.3 below.

Waterville (Walters) Lake (320 acres)

Waterville Lake (Walters Lake) was impaired due to organics and nutrients from the Champion Paper Mill (now Blue Ridge Paper Products) discharge 20.7 miles upstream. The lake also receives nonpoint source runoff from agricultural and urban areas. Lake water quality problems included algal blooms, chlorophyll *a* and dissolved oxygen violations. A nutrient budget was recommended to examine point and nonpoint sources of nutrients to the lake.

Status of Progress

A nutrient budget for the lake was not developed and will not be developed in the near future given current DWQ priorities. Use support methodology has changed since the last basinwide plan was completed. Based on current methods, the lake is considered to be supporting its uses. Monitoring by both DWQ and CP&L suggests recent improvements in water quality. However, there are still concerns about nutrients in the lake and dioxin levels in fish tissue. Dioxin concentrations in all species of fish collected from the lake have decreased since the early 1990s. However, dioxin levels in common carp remain above the North Carolina limit. A no-consumption advisory for catfish and carp remains in effect for the lake. Waterville Lake is on the state's 303(d) list due to the fish consumption advisory. DWQ is developing a TMDL (see Part 5.3.2) for dioxin in Waterville Lake.

5.2.2 Other Recommendations

Lake Junaluska has had chronic problems with sediment inputs from the surrounding watershed. As a result of these inputs, significant funds have been spent on periodically dredging the lake. DWQ assessed an enforcement action against the Lake Junaluska Assembly in November 1998 after the lake was mistakenly drained lower than was intended. A plume of sediment from the lake bottom flowed down the entire length of lower Richland Creek to the Pigeon River, burying

fish and habitat. These actions will likely have a long-term impact on the water quality of lower Richland Creek and the Pigeon River.

A progressive program to implement nonpoint source pollution controls was recommended to reduce the nutrient and sediment loading and the need for future dredging. Such a program will need to be developed and implemented at the local level. An initiative by the Haywood Waterways Association is underway to inventory nonpoint sources of pollution (see Section C, Chapter 1). The local support of recommendations produced by this study is critical to correcting the water quality of Lake Junaluska.

5.3 Current Priority Issues and Recommendations

One segment of both the Pigeon River and Richland Creek is listed as impaired based on recent DWQ monitoring data. Both of these waters are presented and discussed below in Part 5.3.1. These waters are also on the state's year 2000 (not yet EPA approved) 303(d) list (see Part 5.3.2).

5.3.1 Monitored Impaired Waters

Pigeon River (7.0 miles from Canton water supply intake to Clyde at SR 1642)

This section of the Pigeon River is listed as impaired (PS) due to both point source impacts from the Champion International facility (now Blue Ridge Paper Products) and nonpoint sources.

2000 Recommendation(s)

Water quality conditions in the Pigeon River have improved tremendously since the early 1990s. The 1995 basinwide plan reported the length of the Pigeon River from Clyde to Waterville (38.6 miles) as impaired. A Good rating for benthic samples at the state line was found in 1994 and 1997. The most recent benthic sampling provides evidence that the 7.0-mile stretch of the Pigeon River from the Town of Canton water supply intake to the Town of Clyde is still impaired.

The Pigeon River near Clyde at SR 1642 has been sampled ten times since 1984. There have been eight summer collections and two winter collections. This site consistently received Poor ratings from 1984 to 1989, but improved to Fair in 1992. The 1997 summer macroinvertebrate collection resulted in a Good-Fair rating; however, the benthic community was still dominated by pollution tolerant organisms. The benthic community makeup also indicated some toxic effects at this site. The 1997 summer sampling was very borderline between Good-Fair and Fair, so DWQ biologists conducted another sampling at this site in December 1999 to see if the sample results were stable. This winter sampling resulted in a Fair rating. The benthic community at this site was dominated by tolerant species, and no intolerant species were found. Fish sampling by TVA biologists in the Pigeon River in 1990, 1995 and 1997 has shown some limited recovery over time below BRPP discharge. However, the fish community below the plant was assigned Fair or Poor ratings in 1995-1997. Given the history of this sample site for benthic community, and considering TVA fish community data, DWQ will rate this stream segment as impaired and commit to conducting additional sampling during the summer months

to further assess recovery. The river has improved dramatically over the last 15 years, but clearly there are still impacts from Blue Ridge Paper Products (BRPP).

DWQ analyzed mercury concentrations in fish tissue at five Pigeon River sites during 1996, but none of these samples had levels over FDA or EPA criteria. Annual fish tissue monitoring for dioxin in the Pigeon River is also performed by BRPP and Carolina Power and Light. This monitoring is required as part of the BRRP discharge permit issued by DWQ and as a condition of the FERC license for Carolina Power and Light.

The BRPP facility has made several improvements to manufacturing processes. BRPP has spent more than $330 million upgrading its manufacturing process since 1990. Another $30 million dollars was spent to implement BFR™, a proprietary technology that has also improved the quality of the mill's effluent. Additional process improvements have been ongoing. These improvements in wastewater treatment at the BRPP facility are associated with a gradual improvement in macroinvertebrate bioclassifications over the years.

By 1994, a modernization program was completed at the BRPP facility that included replacing chlorine as a bleaching agent to ensure dioxin would no longer be a by-product within the effluent. Therefore, the source of dioxin in the river has been eliminated by BRPP. Dioxin concentrations in fish collected from the Pigeon River and Walters Lake have generally declined since the early 1990s, although levels for certain species have fluctuated depending on sample season, station and the size of the fish collected. Dioxin concentrations in sportfishes (redbreast sunfish, rock bass, crappie, largemouth and smallmouth bass) have remained non-detectable or well below the North Carolina limit for issuing a consumption advisory (3.0 ppt). Dioxin levels in carp have decreased as much as 80% downstream of the BRPP facility, but remain above the North Carolina limit in Walters Lake (see Figures B-6 and B-7).

Currently, there is a limited-consumption advisory for common carp and catfish species (bullhead species, channel catfish and flathead catfish) in effect for the Pigeon River between Canton and the North Carolina-Tennessee state line, including Walters Lake. Due to declining dioxin levels, this advisory was revised by the State Health Director from a no-consumption to a limited-consumption advisory in September 1994. Additionally, there is a limited-consumption advisory for common carp, catfish species and redbreast sunfish in effect for the Pigeon River within the State of Tennessee from the North Carolina-Tennessee state line downstream to the confluence with the French Broad River. DWQ is developing a TMDL (see Part 5.3.2) for dioxins in Waterville Lake and the Pigeon River.

Figure B-6 Dioxin (TCDD) Concentrations in Carp Fillets from the Pigeon River (1990-1997)

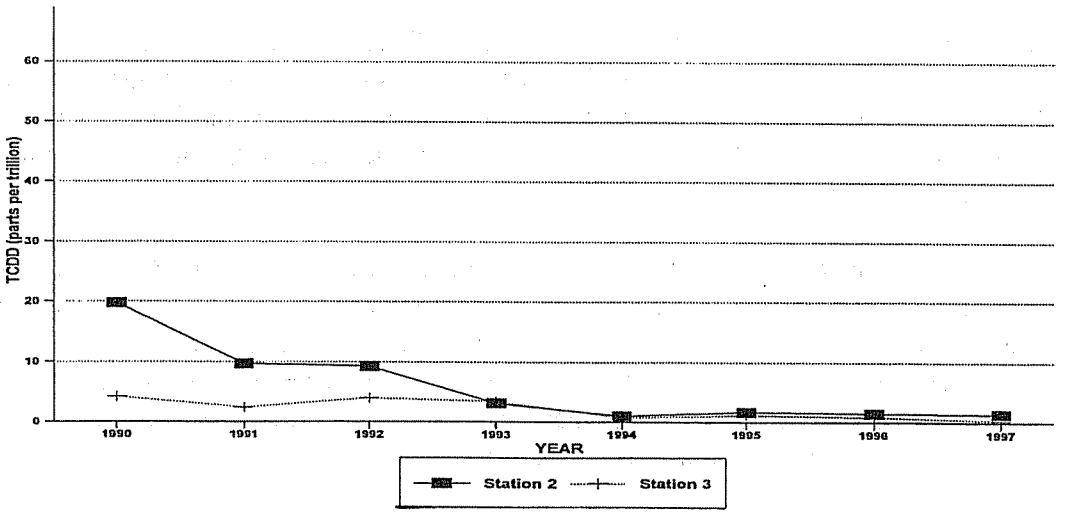
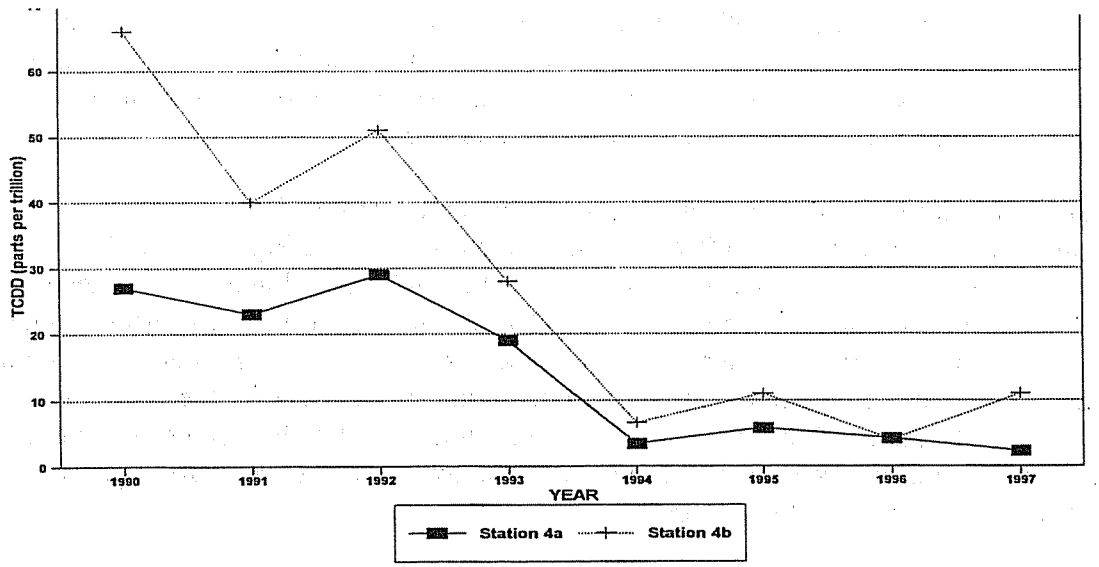


Figure B-7 Dioxin (TCDD) Concentrations in Carp Fillets Collected from Walters Lake (1990-1997)



A Settlement Agreement was reached in 1997 on a modified color variance and NPDES permit between EPA; the states of North Carolina and Tennessee; Cocke County and the City of Newport, TN; Tennessee Environmental Council; American Canoe Association and BRPP. The intent of the Agreement was to address the Pigeon River color issue without litigation. The parties involved in the ensuing discussions agreed to many measures to achieve color reduction over the life of the NPDES permit. In accordance with this agreement, BRPP began installing a full-scale Bleach Filtrate Recycle (BFR™) technology on the mill's pine line. Facility personnel also began to evaluate the potential for additional minimization of color and are reporting these

achieve a true color loading not to exceed an annual average load of 60,000 lbs/day, a monthly average true color of 69,000 lbs/day, and a maximum monthly color average of 50 true color units at the NC-TN state line (it was further agreed that the 50 color units should be met at Hepco). Further agreement was reached to target annual average color loading of 48,000-52,000 lbs/day by May 1, 2001.

A Technology Review Workgroup was formed to monitor BRPP's achievements. To date, this Workgroup has received reports on the following progress:

- The (BFR™) demonstration on the softwood fiber line has been installed with no problems.
- All of the BMP projects as required in the agreement were completed and are operational.
- Additional color reduction measures were completed and others are ongoing.
- Contingency plans for low flow periods were in place and operational.

As reported to the Workgroup in January 1999, monitoring confirms the daily average of color discharge is well below the limits set forth in the Agreement. The mill's end-of-pipe true color report shows the facility was discharging approximately 10,000 lbs/day of color below the limit required in the Agreement. The facility has reached the 2001 target for color loading. The color in the Pigeon River was below the limit at Hepco for the reporting period in 1998. The Workgroup, therefore, believes that BRPP is making substantial and continuous progress in reducing the amount of color generated and discharged to the Pigeon River and has met the conditions of the Agreement. Additional technologies are yet to be installed and further operational progress is anticipated. Figure B-8 illustrates BRPP's success in reducing color discharges to the Pigeon River since 1988, including monthly average performance for 1998.

Pursuant to the Agreement, North Carolina and Tennessee are required to establish a Joint Watershed Advisory Group to foster joint planning and public input on decisions affecting the Pigeon River. Each state will appoint three or four members to the committee and be co-chaired by each state. The Joint Watershed Advisory Group is expected to begin meeting in early 2000. DWQ will participate in the Watershed Advisory Group and will continue to monitor the river as additional improvements are made. In addition to the Joint Advisory Group, the mill has established a Community Advisory Committee composed of community leaders in Haywood County, Cocke County in Tennessee and the state of North Carolina.

Local initiatives are needed to address the nonpoint source impacts to the river from the towns of Canton and Clyde and outlying nonurban areas.

Richland Creek (2.4 miles from Lake Junaluska Dam to Pigeon River)

While the upper 15 miles of Richland Creek show impacts from agriculture and nonurban development, only the section below the Lake Junaluska Dam is currently rated impaired (PS). Agriculture and nonurban development is also affecting this section of the creek, resulting in biological impairment and habitat degradation. Erosion and the resulting sedimentation is problematic for the entire length of the creek and is heavily impacting water quality in Lake Junaluska.

2000 Recommendation(s)

The Pigeon River Fund has awarded a grant to the Haywood Waterways Association to conduct a nonpoint source inventory in the Pigeon River watershed (including the entire length of Richland Creek and Lake Junaluska) using infrared photography. The TVA is assisting with the interpretation of this information. A technical committee has formed to assist in the development of a Water Action Plan to address the pollution sources. For more information on this project, refer to Section C. DWQ will continue to monitor the creek and work with local initiatives to restore water quality.

5.3.2 303(d) Listed Waters

Segments of several streams and Waterville Lake are on the state's year 2000 (not yet EPA approved) 303(d) list for this subbasin. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements. Both the Pigeon River and Richland Creek are currently rated impaired and are therefore addressed above in Part 5.3.1. Hyatt Creek and Hurricane Creek were previously rated based on evaluated information. Use support methodology has been improved, and only monitored data are now used in use support determinations (see Appendix III). However, these streams are required to remain on the 303(d) list until sampling is conducted to assess current water quality conditions. DWQ will be developing a dioxin TMDL for Waterville Lake.

The Wetlands Restoration Program has prioritized watersheds within this subbasin for the development of local watershed restoration activities. For further information on this program, refer to Section C, Chapter 1, Part 1.3.

5.3.3 Other Issues and Recommendations

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs and nonpoint source agency contacts, see Appendix VI.

Fines Creek (10.4 miles from source to Pigeon River) is experiencing some notable impacts from agricultural activities as well as nonurban development. Siltation and nutrients have also been noted by the VWIN program (Maas et al., 1999). This watershed could benefit from implementation of BMPs directed towards these inputs. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

Rough Creek was approved by the Environmental Management Commission for a reclassification from WS-I to a WS-I Trout Outstanding Resource Water (see Section A, Chapter 3, Part 3.2 for more information).

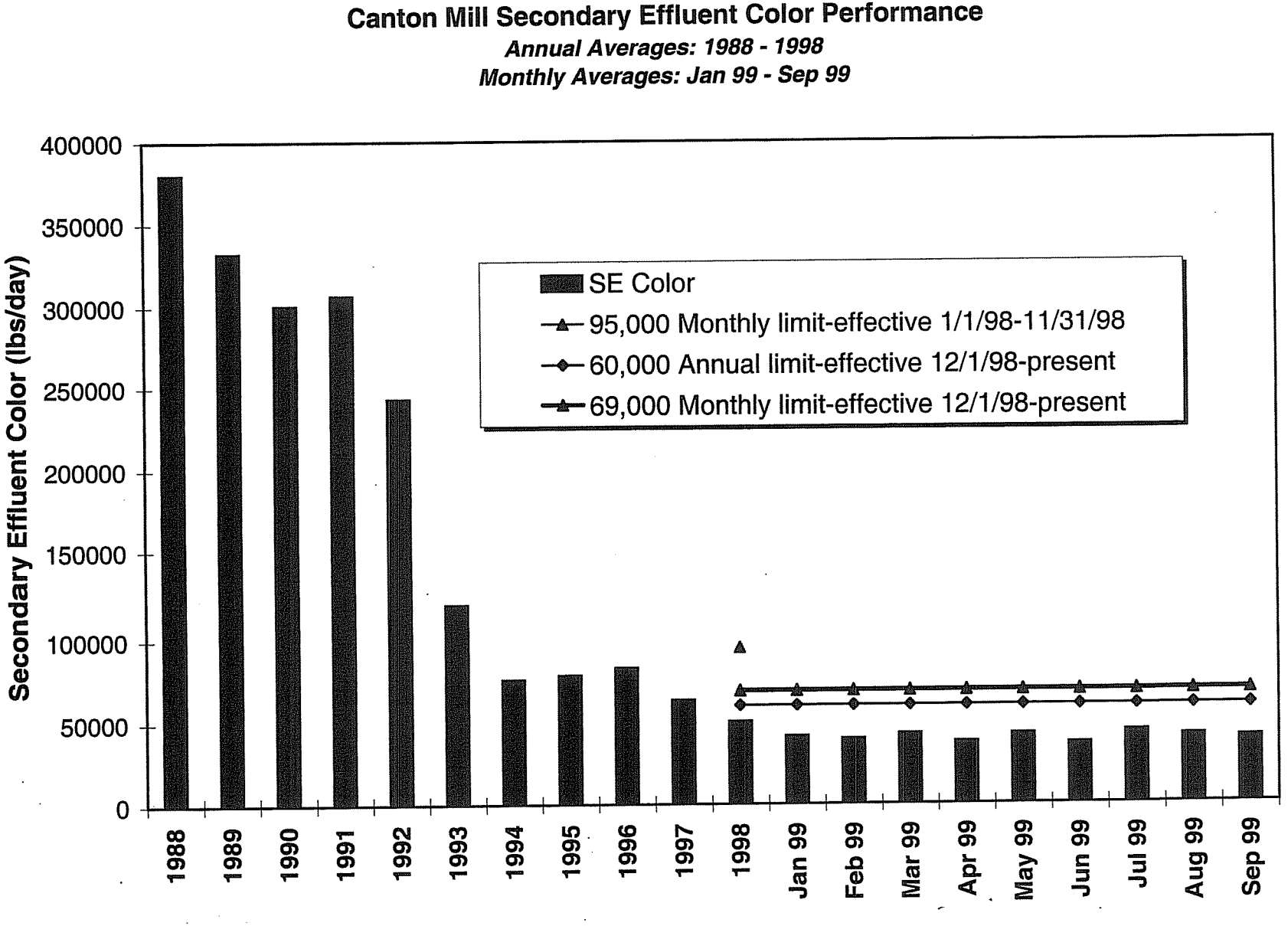


Figure B-8 Canton Mill Secondary Effluent Color Performance Source: Blue Ridge Paper Products

Chapter 6 -
French Broad River Subbasin 04-03-06
Includes North and South Toe Rivers and Nolichucky River

6.1 Water Quality Overview

Subbasin 04-03-06 at a Glance

Land and Water Area (sq. mi.)

Total area:	466
Land area:	465
Water area:	1

Population Statistics

1990 Est. Pop.:	29,806 people
Pop. Density:	64 persons/mi^2

Land Cover (%)

Forest/Wetland:	87%
Surface Water:	<1%
Urban:	<1%
Cultivated Crop:	<1%
Pasture/ Managed Herbaceous:	11%

Use Support Ratings

Freshwater Streams:

Fully Supporting:	555.7 miles
Partially Supporting:	0.0 miles
Not Supporting:	0.0 miles
Not Rated:	166.5 miles

Much of the land in this subbasin is within the Pisgah National Forest, although there is scattered agricultural and industrial activities throughout the subbasin. The largest community is the Town of Spruce Pine, near the Blue Ridge Parkway. A map of this subbasin, including water quality sampling locations, is presented in Figure B-9. Overall biological ratings are presented in Table B-6.

Ambient water quality data have been collected at five locations in this subbasin: two sites each on the North Toe River and the South Toe River, and one site on the Nolichucky River. The data does not indicate any concerns or significant changes since 1992.

Benthic macroinvertebrate samples have been collected at 23 sites in this subbasin since 1983. In the seven sites that were sampled in 1997, four sites were given an Excellent rating and three were rated Good. The Nolichucky River and two sites on the North Toe River have shown steady improvements in water quality since the mid-1980s. Only Big Rock Creek, a large tributary in northern Mitchell County had a decline in rating (from Excellent to Good). The site is in an area of agricultural land use, which may be affecting this site.

The South Toe River is classified as an Outstanding Resource Water (ORW). The Excellent ratings achieved at the Nolichucky River site in Yancey County and the North Toe River site in Avery County could make these waters draining to these sites eligible for reclassification to High Quality Waters (HQW).

Fish community data was collected from five sites in this subbasin in 1997. One site (Big Crabtree Creek) was also assessed with benthos; the other fish community collections were from sites that had not been previously assessed.

Of the 23 permitted dischargers in this subbasin, only 4 are major dischargers (>0.5 MGD). Six mining companies and the Spruce Pine WWTP currently monitor effluent toxicity under their NPDES permit.

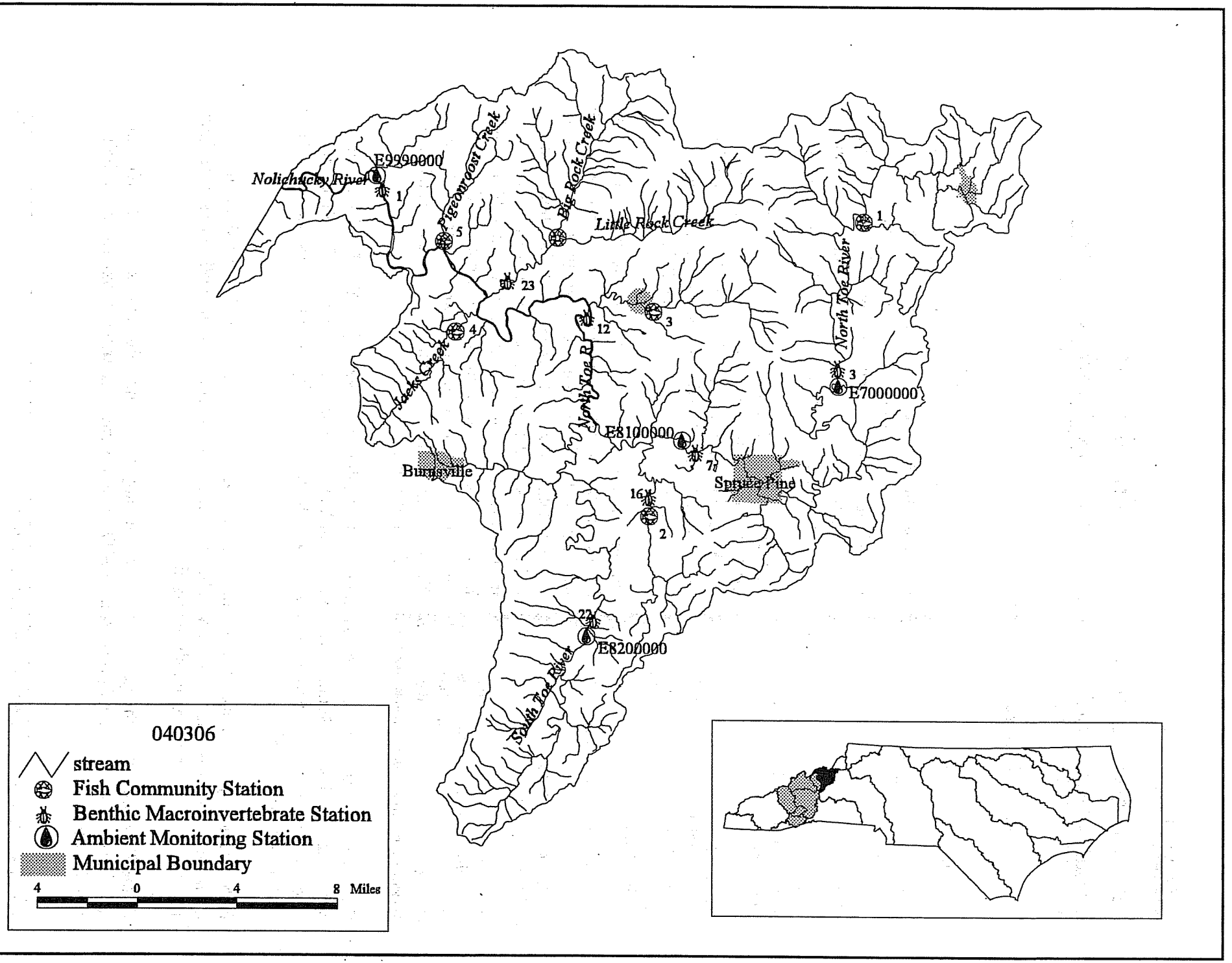


Figure B-9 Sampling Locations within Subbasin 04-03-06

Table B-6 Basinwide Biological Sites in French Broad River Subbasin 04-03-06 (1997)°

Site #	Stream	County	Road	Rating
Benthic Macroinvertebrates				
B-1	Nolichucky River	Yancey	SR 1321	Excellent
B-3	North Toe River	Avery	US 19E	Excellent
B-7	North Toe River	Mitchell	SR 1162	Good
B-12	North Toe River	Yancey	SR 1314	Good
B-16	Big Crabtree Creek	Mitchell	US 19E	Excellent
B-22	South Toe River	Yancey	SR 1167	Excellent
B-23	Big Rock Creek	Mitchell	NC 197	Good
Fish Community				
F-1	North Toe River	Avery	SR 1121	Not Rated*
F-2	Big Crabtree Creek	Mitchell	SR 1002	Not Rated*
F-3	Cane Creek	Mitchell	SR 1211	Not Rated*
F-4	Jacks Creek	Yancey	SR 1337	Not Rated*
F-5	Pigeonroost Creek	Mitchell	SR 1349	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25

For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

6.2 Prior Basinwide Plan Recommendations (1995) and Achievements

6.2.1 Impaired Waters

There were no streams identified as impaired in this subbasin in the 1995 French Broad River Basinwide Plan.

6.3 Current Priority Issues and Recommendations

6.3.1 Monitored Impaired Waters

There are no waters currently rated as impaired in this subbasin.

6.3.2 303(d) Listed Waters

Only Right Fork Cane Creek is on the state's year 2000 (not yet EPA approved) 303(d) list for this subbasin. Right Fork Cane Creek was previously rated based on evaluated information. Use support methodology has been improved, and only monitored data are now used in use support determinations (see Appendix III). However, this stream is required to remain on the 303(d) list

until sampling is conducted to assess current water quality conditions. Refer to Appendix IV for more information on the state's 303(d) methodology and listing requirements.

6.3.3 Other Issues and Recommendations

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs and nonpoint source agency contacts, see Appendix VI.

The North Toe River (32.5 miles from Grassy Creek to the South Toe River) has been sampled by DWQ since 1984. Prior to 1997, this site historically received a Poor to Good-Fair benthic rating. An improvement in the benthic macroinvertebrate community resulted in a Good bioclassification in 1997. This station may be affected by runoff from the Town of Spruce Pine and effluent from 5 dischargers, including 4 mine processors. Most of the failed discharger toxicity tests were during 1986 and 1987, the years with Fair bioclassifications. Since 1989, only occasional non-consecutive fails have occurred at the mine processors. The Spruce Pine WWTP has failed only one toxicity test (in 1996). Habitat degradation and turbidity are noted problem parameters for this stretch of the river. DWQ will continue to monitor the river to assess possible impacts from the mine processors. The implementation of urban BMPs around the Town of Spruce Pine is recommended to protect the river from future impacts of urban runoff. DWQ will notify local agencies of water quality concerns for this creek and work with these various agencies to conduct further monitoring and assist agency personnel with locating sources of water quality protection funding.

DWQ is conducting a special study of water quality on the Nolichucky River to determine if the river can be reclassified from a Class C water to a Class B water. The Class B classification is intended to protect the primary recreational value of this river in addition to the Class C protections. Refer to Section A, Chapter 3, Part 3.2 for more information.

Chapter 7 -
French Broad River Subbasin 04-03-07
Includes Cane River and its tributaries

7.1 Water Quality Overview

Subbasin 04-03-07 at a Glance

Land and Water Area (sq. mi.)

Total area:	153
Land area:	153
Water area:	0

Population Statistics

1990 Est. Pop.:	5,434 people
Pop. Density:	36 persons/mi^2

Land Cover (%)

Forest/Wetland:	87%
Surface Water:	<1%
Urban:	<1%
Cultivated Crop:	<1%
Pasture/ Managed Herbaceous:	12%

Use Support Ratings

Freshwater Streams:

Fully Supporting:	179.3 miles
Partially Supporting:	0.0 miles
Not Supporting:	0.0 miles
Not Rated:	40.9 miles

The southern section of this subbasin lies within the Pisgah National Forest, and the only area of concentrated development is around the Town of Burnsville. A map of this subbasin, including water quality sampling locations, is presented in Figure B-10. Overall biological ratings are presented in Table B-7.

Benthic macroinvertebrate samples have been collected from two locations (Cane River and Bald Mountain Creek) in this subbasin since 1992. Water quality in Cane River has steadily improved from Good-Fair (1983-85) to Excellent (1992-97). Even though there are biological data that indicate improving water quality at this site, the chemistry data do not indicate any significant changes at this site.

Fish community data were collected at Price Creek and Bald Mountain Creek in this subbasin in 1997. Price Creek and Bald Mountain Creek are supplementally classified as Trout Waters. The entire length of Bald Mountain Creek is also designated as Hatchery Supported Trout Waters (NCWRC, 1997).

If petitioned, the Excellent rating given to the Cane River site could make this river eligible for reclassification to High Quality Waters (HQW) or Outstanding Resource Waters (ORW).

There are two minor dischargers (<0.5 MGD) in this subbasin. Burnsville WWTP is the only facility in this subbasin that currently monitors effluent toxicity under its NPDES permit. There are no toxicity problems with this facility.

For more detailed information on water quality in this subbasin, refer to the *Basinwide Assessment Report – French Broad River Basin – November 1998,* available from the DWQ Environmental Sciences Branch at (919) 733-9960.

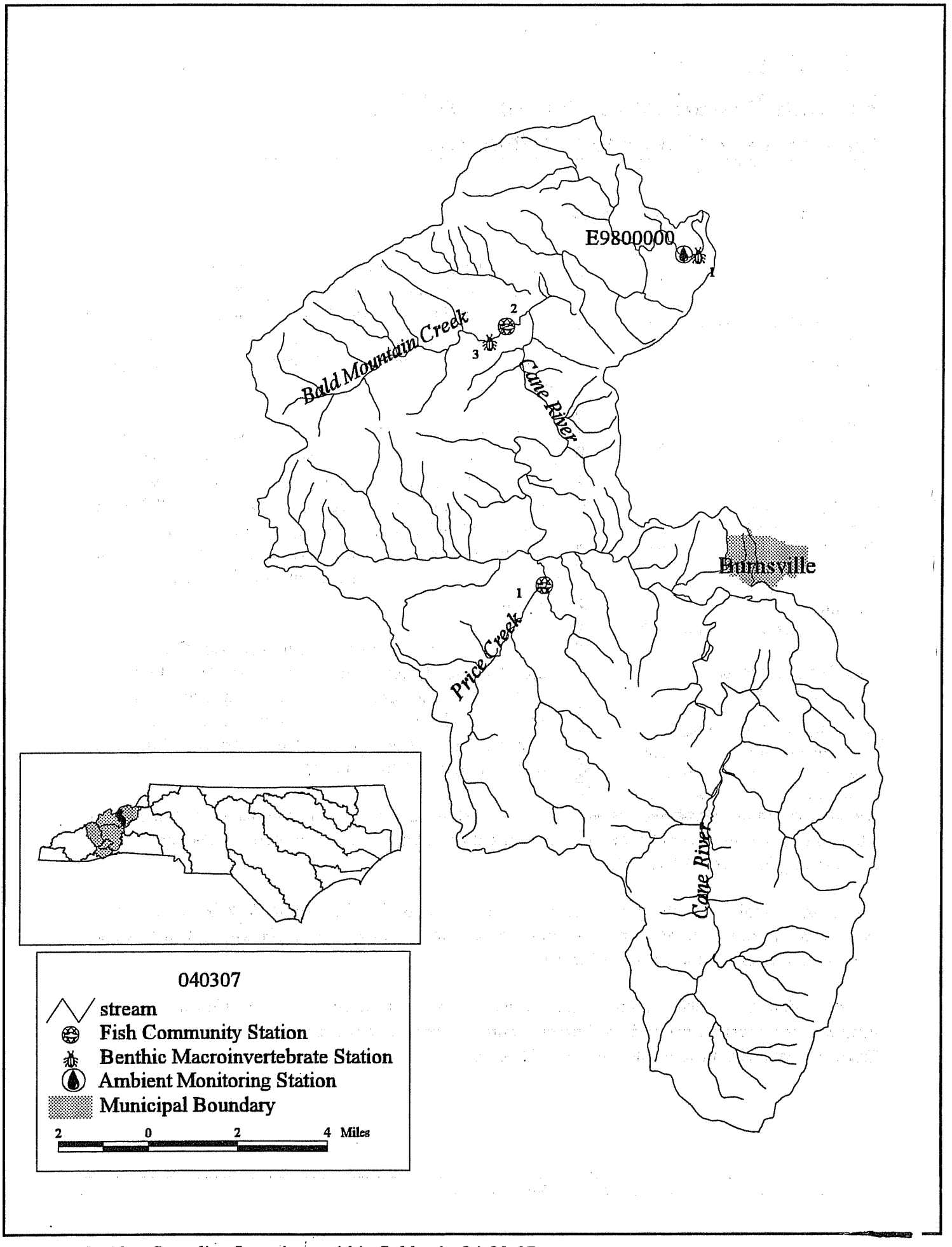


Figure B-10 Sampling Locations within Subbasin 04-03-07

Table B-7 Basinwide Biological Sites in French Broad River Subbasin 04-03-07 (1997)°

Site #	Stream	County	Road	Rating
Benthic Macroinvertebrates				
B-1	Cane River	Yancey	NC 19W	Excellent
B-3	Bald Mountain Creek	Yancey	SR 1408	Good
Fish Community				
F-1	Price Creek	Yancey	SR 1126	Not Rated*
F-2	Bald Mountain Creek	Yancey	SR 1408	Not Rated*

* Refer to Section A, Chapter 3 for more information on fish community ratings
° Locations of ambient monitoring stations can be found in Section A, Table A-25

7.2 Prior Basinwide Plan Recommendations (1995) and Achievements

7.2.1 Impaired Waters

There were no streams identified as impaired in this subbasin in the 1995 French Broad River Basinwide Plan.

7.3 Current Priority Issues and Recommendations

7.3.1 Monitored Impaired Waters

There are currently no waters listed as impaired in this subbasin based on the most recent DWQ monitoring data.

7.3.2 303(d) Listed Waters

Only Little Creek is on the state's year 2000 (not yet EPA approved) 303(d) list for this subbasin. Refer to Appendix IV for more information on the state's 303(d) methodology and listing requirements. Little Creek was previously rated based on evaluated information. Use support methodology has been improved, and only monitored data are now used in use support determinations (see Appendix III). However, this stream is required to remain on the 303(d) list until sampling is conducted to assess current water quality conditions.

Section C

Current and Future Water Quality Initiatives

Chapter 1 –
Current Water Quality Initiatives

1.1 Workshop Summaries

Two workshops were held in the French Broad River basin during 1999 on May 6 in Clyde and May 7 in Fletcher. A total of 60 people were in attendance at these workshops. The purpose of these workshops was to let people know about the upcoming update of the 1995 French Broad River Basinwide Plan and to seek input prior to updating the plan. The workshops help to ensure that major pubic concerns are presented. The basinwide plan attempts to address these issues where possible.

After hearing a general presentation by DWQ, workshop participants were asked to provide input on the following topics:

- What are the short-term and long-term issues for the French Broad River basin?
- What actions are needed to address these issues?

The discussion on these questions was very productive. Comments and responses were recorded during both workshops (see Appendix V). A general summary showing common ideas and viewpoints as expressed by participants is presented below.

The most frequently cited issues by the workshop attendees were:

- Sedimentation
- Urbanization and increased impervious surfaces
- Land use planning is needed, but local opposition will be difficult to overcome
- Water quality public education efforts are needed
- Nonpoint source control funding and actions are needed, as well as a stronger state NPS control program
- DOT road development is a concern

Participants most frequently cited the following actions to address water quality issues:

- Incentives for local governments to take responsibility (including grants or other funds)
- Land use planning and implementation of BMPs to protect streams (suggested for current rural land uses as well as new development)
- Protect and increase stream buffers
- Emphasize upgrades of wastewater facilities
- Educate public on how to make a difference

DWQ considered these comments while drafting the revised French Broad River Basinwide Water Quality Plan and will continue to use these comments to guide water quality activities in the French Broad River basin.

1.2 Federal Initiatives

1.2.1 Section 319 – Base Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration projects. Approximately one million dollars are available annually for demonstration and education projects across the state. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution. Information on the North Carolina 319 grant program, including application deadlines and requests for proposals, are available online at http://h2o.enr.state.nc.us/nps/bigpic.htm. Six projects in the French Broad River basin have been funded through the Section 319 base program. These projects are listed in Table C-1 and descriptions of the projects are included below or in Part 1.5.

Table C-1 Section 319 Projects in the French Broad River Basin

FY	Title	Approved Federal $	Non-Fed $	Total $	Reference in Plan
1994	Greenhouse Constructed Wetland Demonstration	19,500	13,000	32,500	Part 1.2.1
1995	North Toe River Christmas Tree BMP Demonstration	90,000	60,000	150,000	Part 1.5.3
1995	Allen Creek Land Acquisition	250,000	312,000	562,000	Part 1.5.2
1996	Water Quality Improvement Through Streambank Stabilization and Pasture Management	30,000	20,000	50,000	Part 1.2.1
1999	Mountain Nurseries Wetland Projects	11,815	7,880	19,695	Part 1.2.1
1999	Environmental Education and Nature Trail Revitalization	10,281	6,854	17,135	Part 1.2.1
2000	French Broad River Watershed Education Training Center	200,000	133,333	333,333	Part 1.5.2
319 Funding Total		**$ 611,596**	**$ 553,067**	**$ 1,164,663**	

Greenhouse Constructed Wetland Demonstration

This NC Cooperative Extension Service project demonstrated some best management practices that could be used to reduce pollutant sources and treat discharge water on-site. A series of constructed wetlands were used to attenuate discharge from the nursery and greenhouse area and prevent off-site movement of residual nutrients, pesticides and sediment to surface waters. In addition, the wetland design provides growers with an option to produce marketable wetland plants to offset the cost of BMP installation and maintenance.

Water Quality Improvement through Streambank Stabilization & Pasture Management

This NC Cooperative Extension Service project evaluated BMP systems for reducing NPS impacts on degraded streams at six sites in the mountains, piedmont and coastal plain. The focus

included the development and testing of better animal and crop management systems to provide maximum environmental protection and feed value to the producers. The BMPs demonstrated at the Brevard High School FFA Farm (Transylvania County) include livestock exclusion, riparian buffers, field buffers, cattle watering systems, stream crossings and streambank stabilization methods. In addition, the Brevard High School site includes a constructed wetland and outdoor teaching facility. Participation by the science and agricultural classes in water quality monitoring at the BMP sites is ongoing.

Mountain Nurseries Wetland Projects

The NC Cooperative Extension Service is working with two different nurseries which will collaborate to provide space for the development of demonstration filtration systems to show methods for filtering nutrient and pesticide runoff to local streams. One of the two demonstrations will involve the construction and demonstration of a man-made wetland. The second of the two demonstration sites will utilize this BMP for filtering nutrients and pesticide residues. Man-made wetlands and the use of wetland species have proven to be effective ways of providing sediment and nutrient runoff filtration. Educational Field Days will be implemented to share the information and results gathered from these demonstration projects and to encourage the implementation of similar systems at other nurseries.

Environmental Education and Nature Trail Revitalization (Transylvania County)

T.C. Henderson Elementary School has the unique opportunity to provide students with a demonstration of various techniques to protect water quality. The school campus is 16.81 acres with 6 acres of undisturbed forest. Due to the passage of a total school bond, the campus will undergo major renovation of the parking lot and playground. This will provide an excellent opportunity for students to study the impact these changes could have on the natural areas of the campus. An erosion control plan will be developed by the Transylvania Soil and Water Conservation District (SWCD) and implemented by contractors. Students will monitor sedimentation and study methods of controlling sediment loss. In addition, the Alice Tinesly Memorial Nature Trail, that surrounds the school within the forested area, will be enhanced considerably.

1.2.2 Section 319 – Incremental Program

Funding for implementation of the Federal Clean Water Action Plan Initiative, (often referred to as the Unified Watershed Assessment), is provided through the Section 319 Incremental Grant Program. These grant resources are to be allocated by the state for assessment and implementation in Hydrologic Units defined as "Needing Restoration" in the 1998 North Carolina Unified Watershed Assessment. This funding was first available for FY 1999 and continued funding of this program will be decided by Congress. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution. Information on the North Carolina 319 grant program, including application deadlines and requests for proposals, are available online at http://h2o.enr.state.nc.us/nps/bigpic.htm. Three projects in the French Broad River basin were funded during the first Section 319 Incremental Program allocation. These projects are listed in Table C-2 and presented in Part 1.5.

Table C-2 1999 Section 319 Incremental Funding

FY	Title	Approved Federal $	Non-Fed $	Total $	Reference in Plan
1999I	Newfound Creek Watershed NPS Control Project	416,250	277,500	693,750	Part 1.5.2
1999I	Little Ivy River Watershed BMP Implementation Project	380,000	692,750	1,072,750	Part 1.5.2
1999I	Upper French Broad Project	132,000	88,000	220,000	Part 1.5.2
319 Incremental Funding Total		**$ 928,250**	**$ 1,058,250**	**$ 1,986,500**	

1.2.3 USDA – NRCS Environmental Quality Improvement Program (EQIP)

Two areas within the French Broad River basin are included in the USDA – NRCS EQIP FY2000 Priority area budget. The Mountain Stream Restoration project includes Transylvania and Polk counties. In FY1999, $48,500 was distributed. The Ivy River in Madison County, where FY1999 contracts worth $49,000 were completed, is also included as a FY2000 priority area.

USDA – NRCS Environmental Quality Improvement Program (EQIP)

The EQIP program is a federal cost share program that in many states is not augmented by a state agricultural cost share program. For this reason, EQIP funds are allocated to priority areas where current available funding is identified as inadequate. Through applications, the NRCS districts are able to compete for EQIP incentive funding. A team of state agencies reviews new applications and reevaluates the performance of existing priority areas on an annual basis. Rankings are based upon performance (i.e., the value of contracts completed versus the amount of money allocated and environmental benefit). Initial allocations are based upon ranking and proposal requests. The NRCS administers the local signup, environmental benefits ratings, and contract administration.

Two areas within the French Broad River basin are included in the USDA – NRCS EQIP FY2000 Priority area budget. The Mountain Streambank Stabilization Priority area is located in the upper portions of the watershed including Henderson and Transylvania counties. The Ivy River Watershed Priority area is focused on implementation of treatments in the 31,000-acre watershed (see Table C-3). NRCS district contacts can be found in Appendix VI.

Table C-3 USDA-NRCS Environmental Quality Improvement Projects in the French Broad River Basin

Priority Area	Primary Resource Concern	Targeted Practices	Lead NRCS District	Final Allocation
Upper French Broad	Loss of riparian vegetation, sedimentation, erosion, streambank and shoreline degradation	Streambank and shoreline protection, critical area planting, riparian buffers, land smoothing	Henderson and Transylvania County	$48,467
French Broad	Animal waste, soil erosion, nutrient runoff	Field border, field strips, livestock exclusion, alternative watering source, nutrient management	Madison County	$49,178

1.3 State Initiatives

1.3.1 NC Wetlands Restoration Program

The North Carolina Wetlands Restoration Program (NCWRP) is a nonregulatory program responsible for implementing wetland and stream restoration projects throughout the state. The focus of the program is to improve water quality, flood prevention, fisheries, wildlife habitat and recreational opportunities. The NCWRP is not a grant program. Instead, the NCWRP funds wetland, stream and streamside (riparian) area projects directly through the Wetlands Restoration Fund.

Restoration sites are targeted through the use and development of the Basinwide Wetlands and Riparian Restoration Plans. These plans were developed, in part, using information compiled in DWQ's Basinwide Water Quality Plans. The Basinwide Wetlands and Riparian Restoration Plans are updated every five years on the same schedule as DWQ's Basinwide Water Quality Plans. As new data and information become available about water quality degradation issues in the French Broad River basin, priority subbasins identified in the NCWRP's plans, may be modified.

The NCWRP is also working to develop comprehensive Local Watershed Restoration Plans within the identified Priority Subbasins. These more locally-based plans will identify wetland areas, contiguous reaches of stream, and contiguous strips of buffer that, once restored, will provide significant water quality and other environmental benefits to watersheds. The NCWRP will coordinate with local community groups, local governments and others to develop and implement these plans.

The NCWRP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example, the NCWRP's efforts can complement projects funded through the Section 319 Program. Integrating wetlands or riparian area restoration components with 319 funded or proposed projects will often improve the overall water quality benefits of the project. The NCWRP actively seeks landowners within the French Broad River basin who have restorable wetland, riparian and stream sites.

For more information about participating in the NCWRP, please contact Crystal Braswell at (919) 733-5208 or visit the website at http://h2o.enr.state.nc.us/, then click on Wetlands Restoration Program.

1.3.2 Clean Water Management Trust Fund

The Clean Water Management Trust Fund (CWMTF) offers approximately $40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters, as well as establishing a network of riparian buffers and greenways. In the French Broad River basin, fourteen projects have been funded. The total amount of funds allocated to this basin through the CWMTF is $9,572,761. These projects are presented in Table C-4 and Part 1.5.

For more information on the CWMTF or these grants, call (252) 830-3222 or visit the website at www.cwmtf.net.

Table C-4 Clean Water Management Trust Fund Projects in the French Broad River Basin (as of 12/1999)

Name of Project	Purpose of Project	Grantee	Amount ($)	Reference in Plan
Newfound Creek Watershed Planning Project	Planning	Buncombe County SWCD	118,866	Part 1.5.2
Crawford's Creek Riparian Protection Project	Easements	Conservation Fund	1,148,000	Part 1.5.1
Beaver Lake Bird Sanctuary Stormwater Wetland	Stormwater	Elisha Mitchell Audubon Society	139,700	Part 1.5.2
FBR Voluntary Buffer Partnership	Planning	Land of Sky COG	110,000	Part 1.4.5
Straight Pipe Elimination Grant	Wastewater	Madison County DEH	903,000	Part 1.5.2
Little Ivy River Project	Coordinate Public Programs	Madison County SWCD	400,000	Part 1.5.2
Upper French Broad River Stream and Riparian Restoration Project	Restoration	NC Cooperative Extension Service	300,000	Part 1.5.2
Lake Logan Buffer Acquisition	Acquisition-Buffers	NC Wildlife Resources Commission	3,000,000	Part 1.5.1
South Fork Mills River Trail Restoration	Restoration	NC Trout Unlimited	25,000	Part 1.5.2
Mills River Watershed Protection and Restoration Project	Coordinate Public Programs	Regional Water Authority and Carolina Mountain Land Conservancy	730,000	Part 1.5.2
Asheville Motor Speedway Acquisition	Acquisition-Greenways	Riverlink	250,000	Part 1.5.2
Toe River Straight Pipe Elimination Grant	Wastewater	Toe River Health District	791,500	Part 1.5.3
Flat Rock Wastewater Collection System	Municipal Wastewater	Village of Flat Rock	551,695	Part 1.5.2
French Broad River Riparian Buffer Acquisition	Restoration	Land of Sky COG	605,000	Part 1.5.2
Allens Creek Land Acquisition	Acquisition-Buffers	City of Waynesville	500,000	Part 1.5.2

1.4 Local Initiatives

Several counties and municipalities within the French Broad River basin have ongoing programs that directly impact water quality. In addition, several county agencies and municipalities have received funding to conduct specific water quality projects within the basin. Most of these are included in Tables C-2 and C-3. Some county and municipal agencies have received FEMA grants to address riverfront areas that repeatedly flood. These projects, in addition to the numerous individual greenway projects being pursued by county, municipal and private groups, may well have a beneficial effect on water quality within the basin. The following is a description of several local groups active in water quality initiatives within the basin.

1.4.1 Land of Sky Regional Council

The Land of Sky Regional Council is the council of governments for a 4-county area including Buncombe, Henderson, Madison and Transylvania counties. The chief elected official from each county and the 15 municipalities comprise the Council board and govern the agency. Land of Sky's mission is to work with local, state and federal agencies and regional leaders to foster desirable economic, social and ecological conditions in the region. Council programs exist in multiple areas with those related to water quality discussed in this section of the plan.

The Land of Sky Regional Council can be reached at (828) 251-6622.

1.4.2 Pigeon River Fund

The Pigeon River Fund is a public-private partnership, established in 1994 by the State of North Carolina and Carolina Power and Light. The Fund is dedicated to improving water quality across Haywood, Buncombe and Madison counties. Disbursement of funding for eligible projects generally fall into one of the following categories: creation of buffers and increased access, pollution control, education of water quality issues and strengthening of organizations. The Fund has awarded 56 grants since spring 1996 to carry out its mission of improving water quality in the three-county Carolina Power and Light service area.

To obtain more information about the Pigeon River Fund and water quality projects, call (828) 254-4960.

1.4.3 Riverlink

Riverlink is a regional nonprofit organization that is spearheading the economic and environmental revitalization of the French Broad River and its tributaries as a place to live, work and play. Recognizing that growth is an inevitable process; Riverlink is interested in promoting growth in an environmentally sustainable fashion. To this end, Riverlink has sought grant opportunities to fund various water quality initiatives along the French Broad River and its tributaries.

Riverlink has identified "degraded" mountain wetland sites within Buncombe and Haywood counties and has prioritized these sites for restoration potential. A GIS methodology was

developed to address an assortment of conservation and land use planning issues. This study can be downloaded via RiverLink's website at www.riverlink.org.

Riverlink is involved in several other water quality activities including serving as a partner with the French Broad River Voluntary Buffer Partnership, raising funds and administering the VWIN program for several counties in the French Broad River basin, and the Swannanoa Watershed Nonpoint Source Control Project (all described below). Riverlink also actively supports greenway development within the basin and publishes a bimonthly newsletter that describes water quality issues throughout the French Broad River basin.

For more information about Riverlink, call (828) 252-8474 or visit www.riverlink.org.

1.4.4 Mills River Partnership

Participants -- Land of Sky Regional Council, USDA Forest Service, Henderson County SWCD, Henderson County NRCS, Regional Water Authority, City of Hendersonville, Carolina Mountain Land Conservancy
Funding – Clean Water Management Trust Fund, USDA Forest Service, Regional Water Authority, City of Hendersonville, Henderson County, Cross Creek Foundation and the Carolina Mountain Land Conservancy

The Mills River Partnership is comprised of various stakeholders who have partnered to improve water quality in the lower Mills River and Wash Creek while maintaining the outstanding quality of the other streams in the watershed. This partnership has initiated a project to work with landowners to maintain and enhance streamside buffers, acquire conservation easements, replace pesticide mixing areas with agrichemical handling facilities, and install sediment control measures. The Carolina Mountain Land Conservancy is offering assistance with conservation easements, as well as education of landowners regarding the various options for long-term protection of streamside buffers. In addition, the USDA Forest Service is addressing sediment control measures on unpaved roads and at creekside camping sites in the Pisgah National Forest that drain to Wash Creek. The Land of Sky Regional Council is working with local stakeholders to develop a comprehensive long-term plan for protecting water quality in the Mills River watershed. A survey of the Mills River is underway to identify high priority areas for buffer maintenance or enhancement. The NRCS and SWCD offices will work with farmers on the agricultural chemical handling facilities and buffer/streambank restoration elements of the project.

For more information about the Mills River Partnership and Project, call the Land of Sky Regional Council at (828) 251-6622.

1.4.5 French Broad River Voluntary Buffer Partnership

Participants -- Land of Sky Regional Council, TVA, local governments, landholders, private land trusts, state/federal resource management agencies
Funding – Clean Water Management Trust Fund and the Tennessee Valley Authority

This partnership was initiated by the Land of Sky Regional Council in December 1997 to develop a comprehensive plan for protection and restoration of riparian buffers along the main stem of the French Broad River. The project area extends 117 miles from the headwaters of the French Broad to the Tennessee border. A survey of the upper 52-mile priority area in Transylvania and Henderson counties (origin near Rosman to confluence with Mud Creek) was conducted in preparation of the comprehensive plan. The survey identified 75 sites with active streambank erosion and a total length of 4 miles of affected riverbank. Following the development of a "toolbox" of possible buffer protection/restoration options, two public meetings were held by the partnership to present landowners with possible stabilization/protection options. The Voluntary Buffer Partnership has received a $605,000 grant for the critical implementation phase of this project. These and future funds will be directed toward specific actions to stabilize, restore and protect targeted streambank and buffer areas along the mainstem of the upper 52 miles of the French Broad River.

1.4.6 Haywood Waterways Association

The Haywood Waterways Association is a nonprofit organization dedicated to improving and conserving the Pigeon River and its tributaries within Haywood County. The Association promotes water quality awareness among civic groups, public schools, businesses and landowners. Haywood Waterways Association has sponsored several water quality initiatives including greenways, information and work sessions, erosion control workshops and educational materials, and assistance with development of public school water quality curriculum and videos. Haywood Waterways Association has recently partnered with TVA to conduct an extensive nonpoint source inventory of Haywood County as described below. The HWA and the Soil and Water Conservation District recently received a Section 319 grant to develop a Watershed Assessment Plan and provide cost-share assistance to landowners to address water quality improvement needs on their land.

For more information about Haywood Waterways Association, contact Ron Moser at (828) 456-5195.

1.4.7 Volunteer Water Information Network Program (VWIN)

Participants-- Riverlink, Environmental Conservation Organization, Haywood Community College, Haywood Waterways Association, Sierra Club

Funding – Pigeon River Fund, Buncombe and Henderson counties, Cross Creek Foundation and various other groups. Riverlink and ECO administer the VWIN program in Buncombe and Henderson counties, respectively. Haywood Community College and Haywood Waterways Association administer the program in Haywood County, and the Sierra Club administers the program in Transylvania County.

The VWIN program is a water quality monitoring program initiated in 1990 with 27 sites in Buncombe County. Water samples are collected by trained volunteers, and samples are analyzed by a state certified laboratory at the University of North Carolina at Asheville's Environmental Quality Institute. Since 1990, the program has expanded to include 137 sites in the French Broad River basin, 12 of which are on the French Broad River proper.

In Transylvania, Henderson, Buncombe and Madison counties, all major tributaries and many minor tributaries are monitored, with most major tributaries having multiple monitoring sites. In Haywood County, there are two sites on the Pigeon River, with 16 sites on tributaries. VWIN has collected at least three years of monthly data for most sites and over six years of monthly data for many sites. Parameters monitored include major nutrients, turbidity, suspended solids, pH, alkalinity, conductivity and heavy metals such as zinc, copper and lead. Each county having monitoring stations has a coordinator to organize and train volunteers and ensure that all stations are monitored monthly.

For more information about the VWIN program, contact Marilyn Westphal at (828) 251-6823.

1.4.8 Environmental and Conservation Organization (ECO)

ECO is a nonprofit organization devoted to the conservation and preservation of Henderson County and its natural heritage. ECO addresses environmental community concerns through educational program development, recreational programs to encourage citizen environmental involvement, environmental service projects for the community, and encouragement of civic responsibility in economic and democratic processes that have environmental considerations. ECO has several ongoing water quality projects within Henderson County. Noteworthy is ECO's coordination of the Henderson County portion of the VWIN monitoring program, as well as coordination of the Henderson County Adopt-a-Stream Program and Henderson County's annual Big Sweep.

For more information about ECO, call (828) 692-0385.

1.4.9 Quality Forward

Quality Forward is a nonprofit organization that has been doing environmental work in Buncombe County since 1975. The River Improvement Program includes several components, including the Adopt-A-Stream program, the annual Big Sweep and Clean Streams Day volunteer clean-up efforts, and an environmental education program that teaches school and youth groups about water quality monitoring and benthic macroinvertebrate sampling. Quality Forward also coordinates the Swannanoa River Riparian Greenway Project, which is establishing riparian buffers, stormwater controls, and a walking trail along one mile of the Swannanoa River above Biltmore Village.

For more information about Quality Forward, call (828) 254-1776.

1.5 Current Initiatives by Major Watershed (Pigeon River, French Broad River and Nolichucky River)

1.5.1 Pigeon River and Tributaries

Storm Drain Stenciling Campaign
Participants -- Land of Sky Regional Council, County Coordinators of the Cooperative Extension Service
Funding – Pigeon River Fund

LOS Regional Council has established a public awareness campaign on urban storm drain pollution in the French Broad River and Pigeon River watersheds. This effort provides for the placement of "Don't Dump - Drains to River" signs on storm drains. Each of the five affected counties has a coordinator to distribute kits to interested groups and the LOS Regional Council acts as overall coordinator.

Haywood County Nonpoint Source Inventory Project
Participants-- Haywood Waterways Association, TVA, Haywood County SWCD
Funding – Pigeon River Fund

Haywood Waterways Association partnered with TVA to conduct a nonpoint source inventory of Haywood County using low elevation infrared photography and interpretation. TVA digitized multiple layers of GIS information obtained from photo interpretation. Nonpoint sources such as failing septic systems, eroding roads and streambanks, and animal access to streams were identified using aerial photography. This information is being used by TVA to apply a nutrient loading model to calculate a nutrient budget for the Haywood County portion of the Pigeon River watershed. This information will be used by the Haywood Waterways Association and the Haywood County Soil and Water Conservation District to develop and implement strategies for water quality improvements within this watershed. A watershed action plan will detail the inventory results and strategies.

Allen Creek Land Acquisition

The 8,400-acre Allen Creek watershed is designated as a WS–I watershed for the City of Waynesville. The city planned to acquire the remaining 627 acres of privately held land in the watershed. The city acquired 247 acres through a combination of monies from the city, the Clean Water Management Trust Fund and the Section 319 program.

Crawford's Creek Riparian Restoration Project

The Conservation Fund, with CWMTF funding, has acquired nearly seven miles of buffer easements in the Crawford Creek watershed, a High Quality Water.

Lake Logan Acquisition

The CWMTF contributed funds to the Wildlife Resources Commission to acquire a 4,374-acre tract adjacent to Lake Logan. Riparian buffers of 500 feet on the mainstem and 300 feet on tributaries of the West Fork Pigeon River will be protected by conservation easements. The land acquisition will protect approximately 28 miles and 1,200 acres of riparian buffer.

1.5.2 French Broad River and Tributaries

Ross Creek Urban Watershed Restoration Project
Participants-- Land of Sky Regional Council
Funding – Pigeon River Fund and federal 205(j) grant

Ross Creek, an urban watershed of approximately 3 square miles, lies predominately within the City of Asheville. The stream is impaired by urban stormwater pollution (see Section B, Chapter 2). LOS Regional Council obtained funding to increase stakeholder awareness of this stream's urban nature, as well as to develop a restoration plan for Ross Creek. Since initial funding of this project, the following activities have been conducted: intensive stream monitoring, a stream cleanup day, placing of curb "Don't Dump" markers on Ross Creek storm drains, three stakeholder meetings, and preliminary identification of locations for stream restoration projects. Future funded activities include continued education/participation of stakeholders and the development of a restoration plan for Ross Creek.

Mud Creek Watershed Project
Participants-- Land of Sky Regional Council, NC Division of Water Quality

Mud Creek is an impaired watershed within which are multiple land uses including agriculture and nonurban development along the headwaters and tributary streams, and urban development along the lower portions (see Section B, Chapter 2). LOS Regional Council received funding to assemble and educate the various stakeholders about water quality issues within the watershed and to assist with the development of a restoration and management plan for Mud Creek. DWQ also received a grant from the Clean Water Management Trust Fund to conduct an in-depth assessment of water quality impacts and sources for the Mud Creek watershed. DWQ and LOS Regional Council plan to work cooperatively in the assessment of issues, development of a restoration and management plan, and ultimately stakeholder ownership of management strategies that will result in water quality improvements within the Mud Creek watershed.

Storm Drain Stenciling Campaign
Participants -- Land of Sky Regional Council, County Coordinators from the Environmental and Conservation Organization, Cooperative Extension Service and Quality Forward
Funding – Pigeon River Fund

LOS Regional Council has established a public awareness campaign on urban storm drain pollution in the French Broad River and Pigeon River watersheds. This effort provides for the placement of "Don't Dump - Drains to River" signs on storm drains. Each of the five affected counties has a coordinator to distribute kits to interested groups and the LOS Regional Council acts as overall coordinator.

Bent Creek Watershed Project/Wesley Branch Wetlands Restoration Project
Participants-- Riverlink, USFS, NC Arboretum, Buncombe County, NC Wetlands Restoration Program

Working cooperatively with the US Forest Service and the North Carolina Arboretum, Riverlink has conducted a preliminary assessment of the Bent Creek watershed. The effort includes stream assessment, identification of potential water quality threats and possible projects. This study identified the Wesley Branch tributary as one in need of wetlands enhancement and protection. In addition, Buncombe County owns a 10-acre riparian wetland within the watershed. Riverlink is working in conjunction with the North Carolina Wetlands Restoration Program and Buncombe County to enhance and restore this area for water quality benefits, as well as for future educational programs at the North Carolina Arboretum.

Cane Creek Water Quality Project
Participants-- Riverlink

Riverlink is evaluating the existing and historic environmental conditions of the Cane Creek watershed in Buncombe County to provide baseline information that will be used to address ecosystem restoration and maintenance. This evaluation process will focus on the ecological, hydrological and water quality changes in Cane Creek. A model will be developed and used to identify and prioritize protection and restoration projects.

Swannanoa River Nonpoint Source Control Project
Participants – RiverLink, Swannanoa River Watershed Committee
Funding Source – Section 319

RiverLink, in conjunction with several public and private agencies, has secured $542,400 to conduct a water quality improvement project in the Swannanoa River watershed. These funds will allow for conducting a nonpoint source assessment of the Swannanoa River watershed, hire a fulltime technical/engineer position for three years to design BMPs, and to implement $250,000 of residential and urban nonpoint source controls.

The Swannanoa River Watershed Committee includes stakeholders from a variety of public and private agencies along with industrial and agricultural entities within the Swannanoa River watershed. This committee will assist with project management and be responsible for helping develop a watershed management plan and priorities.

Newfound Creek Watershed NPS Control Project
Participants -- Buncombe County Soil and Water Conservation District
Funding Source – Clean Water Management Fund, Section 319, NRCS and Pigeon River Fund

The 22,250-acre Newfound Creek Watershed in northwest Buncombe County is comprised of Newfound Creek, Morgan Branch, Brooks Branch, Round Hill Branch, Gouches Branch, Sluder Branch, Parker Branch, Dix Creek and several unnamed tributaries. Newfound Creek is listed in North Carolina's 1998 303(d) list with sediment, turbidity and fecal coliform bacteria as the problem parameters. The District has received funding to develop a management strategy for

these sources. The watershed has been integrated into a GIS system and, with assistance from TVA, infrared aerial photography is currently being digitized to identify nonpoint sources.

The watershed project will address all nonpoint sources in the watershed. Project personnel will provide landowners with the tools they need to help improve and preserve water quality through education, demonstration, information and cost sharing.

Other activities within the watershed include the installation of best management practices at 10 sites (9 via the NC Agricultural Cost Share Program and one via EQIP) as well as the installation of watershed boundary signs by the NC Department of Transportation for public awareness.

Little Ivy River Watershed BMP Implementation Project
Participants -- Madison County SWCD, Madison County Health Department, NC Division of Environmental Health
Funding – CWMTF, Section 319, NRCS, NCDOT I-26 Section A-10 Mitigation

Little Ivy River Watershed is located in the southeast corner of Madison County. The nonpoint sources of pollution in the 31,000-acre watershed include fecal coliform, nutrients and sediment. A study by the NC Division of Environmental Health (DEH), Public Water Supply Section, in late 1994-1995 indicated widespread fecal coliform contamination throughout the Madison County portion of the Ivy River Watershed. Unregulated domestic waste discharges and at least 36 locations where animals are concentrated in the stream or at the stream edge were deemed to be the source of this potential health problem.

The Madison County Health Department, with the assistance of the DEH – Waste Discharge Elimination (WaDE) Program and CWMTF straight pipe elimination grant, is currently in the midst of addressing the domestic discharge concerns. The Madison County SWCD plans to work on 40 of the animal operations identified in the Ivy River Fecal Coliform Study in Madison County over the next four years. This project will also concentrate on reducing fecal coliform discharges from livestock into the Ivy River Water Supply Watershed in Madison County by accelerating the implementation of cost-shared agricultural best management practices (BMPs).

The approach will be to establish a series of controlled grazing demonstrations, accompanied with an educational program. Installation of drystack feeding facilities and adoption of controlled grazing will result in reduced erosion and runoff from pastureland through improved ground cover, alternative watering systems, and better distribution of livestock away from streams. Vegetative areas along the streams will be installed or improved and will include such practices as riparian buffers and easements, livestock exclusion, cropland conversion, critical area stabilization, tree planting, livestock watering facilities, livestock heavy use areas and spring development. BMP effectiveness will be monitored with existing DWQ and VWIN monitoring.

Upper French Broad Riparian Restoration and Protection Project
Participants -- NC Cooperative Extension Service
Funding – Section 319, NRCS

This project will be located in the upper French Broad River basin in Transylvania and Henderson counties. The Upper French Broad River Commission, consisting of riparian

landowners, representatives of government agencies and private organizations, will be established to oversee and implement the goals of the project. The Commission will review the status of current riparian protection in the watershed and make recommendations for best management practices (BMPs). Specific BMPs will include livestock exclusion from riparian areas, alternative livestock watering systems, stream crossings, cropland conversion, tree planting and associated agricultural practices.

French Broad River Riparian Buffer Acquisition

As a follow-up to the riparian buffer project assessment (see Part 1.4.5), a 53-acre tract of land at the confluence of Middle Fork and East Fork with the mainstem of the French Broad River will be purchased. This will result in the protection of 17.5 acres of riparian area at this site. An additional 33 acres of easements will be donated to the Voluntary Buffer Partnership. Assessment and restoration work in the area is ongoing.

Madison County Straight-Pipe Elimination Program
Participants -- Madison County; Towns of Mars Hill, Marshall and Hot Springs; Land-of-Sky Regional Council; and the NC Division of Environmental Health WaDE Program
Funding – ARC and CDBG grants, CWMTF

In fall 1997, Madison County was awarded ARC and CDBG grant funds to conduct a year-long straight pipe elimination planning project. The overall goals of this project were to identify the need to eliminate straight piping into Madison County streams and to repair any failing septic systems. In 1997, it was estimated that 25% of all households in the county were either straight piping or have a failing septic system. The project involved a house-to-house survey of all households in the county. This project was the planning phase to assess the needs of the county and further funding was to be secured for the implementation phase of the project. Additional funding has been secured from the Clean Water Management Trust Fund to continue the implementation phase of this project.

Beaver Lake Bird Sanctuary Stormwater Wetland

This project within the Beaverdam Creek watershed will replace a 250-foot section of stormwater culvert with a wetland. This constructed wetland will slow flows and allow for deposition and detention of urban stormwater pollutants. Monitoring will be performed at the site to determine effectiveness of this stormwater management structure.

Mills River Watershed Protection and Restoration Project

The Mills River Partnership, with a grant from the CWMTF, has initiated a project to work with landowners to maintain and enhance streamside buffers, purchase conservation easements, replace pesticide-mixing areas, and install sediment control practices. The Carolina Mountain Land Conservancy will handle easement acquisitions and the Regional Water Authority of Asheville will conduct buffer and streambank work and replacement of streamside agrichemical loading facilities. These efforts will acquire and restore 50 acres of riparian buffer easements and protect more than seven miles of streams. Erosion control on recreational sites and unpaved

roads will be installed in cooperation with the USDA-Forest Service. Other elements of the project will be implemented by the SWCD, NRCS and Land of Sky Regional Council.

Asheville Motor Speedway Acquisition

Riverlink, Inc., with a grant from the CWMTF, the Janirve Foundation and others, acquired the Asheville Motor Speedway property adjacent to the French Broad River. The CWMTF money was used to purchase a 100-foot riparian buffer. The property was donated to the City of Asheville as an extension to the greenway system and for the development of a public riverside park.

Flat Rock Wastewater Collection System

This CWMTF funding will eliminate over 400 failing septic systems and four private wastewater treatment package plants by providing for a collection system. The total flow of the combined systems is approximately 184,000 gallons per day. The collection system will connect with the City of Hendersonville wastewater treatment facility.

Upper French Broad River Stream and Riparian Restoration Project
Participants – NC Cooperative Extension Service
Funding – Clean Water Management Trust Fund

This project will repair degraded streams and riparian areas at four sites in Transylvania County. Funding will be used to repair degraded stream channels and streambanks, restore wetlands, and establish forested riparian buffers. The project sites include Kings Creek at Brevard College, Hawkins Branch tributary to the Little River, Nicholson Creek at Brevard High School, and the French Broad River at Champion Park and Rosman High School.

French Broad River Watershed Education Training Center

This training center will provide nonpoint source educational programming to landowners, concerned citizens, natural resource managers, and public schools in the local area. A multiagency team will serve as a steering committee for the center. The center will provide hands-on workshops and demonstrations of various nonpoint source BMPs. The center will also coordinate education and demonstration with ongoing restoration projects in the watershed.

Swannanoa River Riparian Greenway Project

Participants – Quality Forward, TVA, NRCS, CP&L, and landowners

The Swannanoa River in Asheville flows through highly developed residential and industrial areas and is impacted by erosion, sedimentation and stormwater runoff. Beginning in the spring 2000, Quality Forward is directing greenway development along one mile of the Swannanoa River above Biltmore Village. The project includes planting a riparian buffer and filter strip of native plants; repairing erosion problems; constructing stormwater retention basins; and creating an unpaved walking path with river access points. The project is being used by several

organizations as a teaching tool for the implementation of riparian BMPs in a highly developed urban setting.

1.5.3 Nolichucky River and Tributaries

North Toe River Christmas Tree BMP Demonstration

The purpose of the NC Cooperative Extension Service North Toe River Christmas Tree BMP Demonstration project was to demonstrate existing and experimental BMPs designed to minimize the impacts of Christmas tree production on water quality using a variety of BMP practices. These include implementation and demonstration of ground cover maintenance, installation and maintenance of field borders, training in predator insect control, soil testing and nutrient management, maintenance techniques for farm roads on steep slopes, and demonstrations varying the site preparation techniques (stump removal versus leaving them). A variety of approaches were used on a number of sites. In addition, five field days were held with an average attendance of 31 people. Information about Christmas tree best management practices is available through the County Cooperative Extension Service Office or the North Carolina Christmas Tree Growers Association.

Toe River Straight Pipe Elimination Grant

The Toe River Health District was awarded a grant that will be managed as a Revolving Loan Program intended to eliminate straight piping and failing septic systems in three targeted watersheds of the Toe River: Roaring Creek, Little Rock Creek and Bald Creek. The revolving loan program will assist low and moderate income households with the installation or repair of on-site septic systems located within 500 feet of surface waters.

Chapter 2 -
Future Water Quality Initiatives

2.1 Overall DWQ Goals for the Future

The long-term goal of basinwide management is to protect the water quality standards and uses of the surface waters in the state while accommodating reasonable economic growth. Attainment of these goals and objectives will require determined, widespread public support; the combined cooperation of state, local and federal agencies, agriculture, forestry, industry and development interests; and considerable financial expenditure on the part of all involved. With this needed support and cooperation, DWQ believes that these goals are attainable through the basinwide water quality management approach.

In addition to these efforts, DWQ will continue to pursue several programmatic initiatives intended to protect or restore water quality across the state. These include NPDES Program Initiatives, better coordination of basinwide planning, use restoration waters program for nonpoint source pollution, and improving database management and use of GIS capabilities. Summaries of these initiatives are provided below.

NPDES Program Initiatives

In the next five years, efforts will be continued to:

- improve compliance with permitted limits;
- improve pretreatment of industrial wastes discharged to municipal wastewater treatment plants so as to reduce effluent toxicity;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination of chlorinated effluents or use of alternative disinfection methods for new or expanding facilities;
- require multiple treatment trains at wastewater facilities; and
- require plants to begin plans for enlargement well before they reach capacity.

Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling by-products of the treatment process (including reuse of nonpotable treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

DWQ requires all new and expanding dischargers to submit an alternatives analysis as part of its NPDES permit application. Non-discharge alternatives, including connection to an existing WWTP or land application of wastes, are preferred from an environmental standpoint. If the Division determines that there is an economically reasonable alternative to a discharge, DWQ may deny the NPDES permit.

DWQ will continue to make greater use of discharger self-monitoring data to augment the data it collects. Quality assurance, timing and consistency of data from plant to plant are issues of importance. Also, a system will need to be developed to enter the data into a computerized database for later analysis.

Coordinating Basinwide Planning with Other Programs

The basinwide planning process can be used by other programs as a means of identifying and prioritizing waters in need of restoration or protection efforts and provides a means of disseminating this information to other water quality protection programs. For example, the plan can be used to identify and prioritize wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. The plans can also assist in identifying projects and waters applicable to the goals of the Clean Water Management Trust Fund, Wetlands Restoration Program or Section 319 grants program. Information and finalized basin plans are provided to these offices for their use and to other state and federal agencies.

Use Restoration Waters (URW) Program for Nonpoint Source Impairment

DWQ has developed a conceptual strategy to manage watersheds with nonpoint source impairments as determined through the Use Support designations. In July 1998, the state Environmental Management Commission approved the Use Restoration Waters (URW) program concept which will target all NPS impaired waters in the state using a two-part approach. As envisioned, this classification will apply to all watersheds that are not supporting or partially supporting their designated uses. The program will catalyze voluntary efforts by stakeholder groups in impaired watersheds to restore those waters by providing various incentives and other support. Simultaneously, the program will develop a set of mandatory requirements for NPS pollution categories for locations where local groups choose not to take responsibility for restoring their impairments. This URW concept offers local governments an opportunity to implement site-specific projects at the local level as an incentive ("the carrot"). If the EMC is not satisfied with the progress made towards use restoration by local committees, impairment based rules will become mandatory in those watersheds ("the stick").

These mandatory requirements may not be tailored to specific watersheds but may apply more generically across the state or region. DWQ staff has developed a timeline to accomplish the following within five years from July 1998: work with stakeholder groups to develop mandatory requirements; acquire the resources needed to carry out the program; develop criteria for voluntary local programs and supporting incentive tools; and proceed through formal rule making for the mandatory requirements. The form of the URW program will be strongly influenced by the year-long stakeholder input process.

With more than 400 impaired watersheds or stream segments in the state, it is not realistic for DWQ to attempt to develop watershed specific restoration strategies for nonpoint source pollution. By involving the stakeholders in these watersheds, we believe we can catalyze large-scale restoration of impaired waters. We anticipate that one of the major implementation challenges of this new program will be educating public officials and stakeholders at the local level as to the nature and solutions to their impairments. To address this challenge, the state plans to develop a GIS-based program to help present information at a scale that is useful to local

land management officials. Other incentives that the state might provide include seed grants and technical assistance, as well as retaining the authority to mandate regulations on stakeholders who are not willing to participate.

In cases where incentives and support do not result in effective watershed restoration strategies, mandatory impairment source management requirements would be implemented in the watershed. This is not the state's preferred alternative, as it would add to state monitoring and enforcement workload. However, in areas where it is necessary, DWQ plans to implement such requirements. In the management area, DWQ would be assisted by regulatory staff from the Division of Coastal Management, Division of Environmental Health, Division of Land Resources and the Division of Marine Fisheries to insure compliance.

Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities

DWQ is in the process of centralizing and improving its computer data management systems. Most of its water quality program data (including permitted dischargers, waste limits, compliance information, water quality data, stream classifications, etc.) will be put in a central data center which will then be made accessible to most staff at desktop computer stations. Some of this information is also being submitted into the NC Geographic Data Clearinghouse (Center for Geographic Information and Analysis or CGIA). As this and other information (including land use data from satellite or air photo interpretation) is made available to the GIS system, the potential to graphically display the results of water quality data analysis will be tremendous.

Additional Research and Monitoring Needs

In each river basin, DWQ staff try to identify additional research and monitoring needs that would be useful for assessing, protecting and restoring the water quality of each river basin. The lists are not inclusive. Rather, they are meant to stimulate ideas for obtaining more information to better address water quality problems in each basin. With the newly available funding programs (Clean Water Management Trust Fund and Wetlands Restoration Program) and the existing Section 319 grant program, it may be desirable for grant applicants to focus proposals on the following issues:

- *More resources are needed to address nonpoint sources of pollution*. Identifying nonpoint sources of pollution and developing management strategies for impaired waters, given the current limited resources available, is an overwhelming task. Therefore, only limited progress towards restoring NPS impaired waters can be expected unless substantial resources are put towards solving NPS problems.
- *As resources allow, conduct monitoring on streams where other data indicates there are water quality problems*. The VWIN program and TVA gather data on many streams not currently monitored by DWQ. DWQ will make a greater effort to coordinate with these research efforts to assure that data are used to adjust biological and/or chemical monitoring stations and to develop management strategies within future French Broad River basinwide plans.

2.2 DWQ Compliance and Enforcement Policy Revisions

DENR began implementing a new two-stage compliance and enforcement policy in 1997. Both stages of the revised policy are in effect as of July 1, 1999. The five major elements of the policy are intended to provide a comprehensive route to strengthen enforcement and heighten compliance for all dischargers and nonpoint sources of water pollution in North Carolina. The five major components of the policy are to:

1. Foster compliance through pollution prevention, technical assistance and training, reevaluate existing grant and loan funding priority criteria, and develop recognition and incentive programs.
2. Enhance enforcement through increased penalties, penalties for sewer collection systems, reduced thresholds for noncompliance, and delegation of civil penalty assessment authority to the DWQ regional office supervisors.
3. Focus on chronic and willful violators through increased use of moratoriums on expanding and additional connections, expansion of notification to the public of violators, clarification of process of determining "noncompliance", and initiation of discussion with stakeholders on possible legislative actions.
4. Assure improvement in compliance and enforcement through development of accountability measures.
5. Find and use all available resources for compliance needs with local, state and nonprofit groups.

DENR is also in the process of conducting assessment of its enforcement programs. The goal of the assessment is to identify potential areas for improvement in DENR's efforts to enforce environmental laws and ultimately improve compliance. This effort got underway in July 1999 with two focus group meetings. DENR anticipates it will make recommendations for improvements by October 1999. If you would like to see the Scope of Work for the enforcement assessment, see DENR's web page at http://www.ehnr.state.nc.us/EHNR/novs/scope.htm/.

References

Crutchfield, J.U. and B.H. Tracy. 1996. Walters Hydroelectric Plant. Federal Energy Regulatory Commission Project No. 432. *Biotic Indices Studies of the Pigeon River at the Walters Hydroelectric Plant.* Appendix A Requirements. Carolina Power & Light Company. Raleigh, NC.

EA Engineering, Science and Technology, Inc. 1996. *A Study of the Aquatic Resources and Water Quality of the Pigeon River.* Prepared for Champion International Corporation, Canton, NC by EA Engineering, Science and Technology, Inc. Deerfield, IL and Hunt Valley, MD.

Karr, J.R. 1981. *Assessment of Biotic Integrity Using Fish Communities.* Fisheries. 6:21-27.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant and I.J. Schlosser. 1986. *Assessing Biological Integrity in Running Water: A Method and Its Rationale.* Ill. Nat. Hist. Surv. Spec. Publ. 5. 28 pp.

Maas, Richard P., S.C. Patch, M..J. Westphal, J.D. Cadeau and M.M. Reynolds. April 1998. *Eight-Year Spatial and Temporal Trends of Buncombe County Streams: The Volunteer Water Information Network.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #98-050.

Maas, Richard P., S.C. Patch, M..J. Westphal, E.A. Cook, C.C. Maurer and C.J. Walker. May 1999. *Nine-Year Spatial and Temporal Trends of Buncombe County Streams: The Volunteer Water Information Network.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #99-061.

Mass, R.P., S.C. Patch, M.J. Westphal, L.R. Christ, C.C. Maurer and C.J. Walker. 1999. *Stream Water Quality in Western North Carolina: Transylvania County Volunteer Water Information Network Three Year Report.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #99-060.

Maas, Richard P., S.C. Patch, M.J. Westphal, J.D. Cadeau and M.M. Reynolds. 1999. *Water Quality in the Mountains: Henderson County Volunteer Water Information Network Year Six Report.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #99-059.

Maas, Richard P., S.C. Patch, M.J. Westphal, E.A. Cook, C.C. Maurer and C.J. Walker. 1999. *Water Quality Trends of Haywood County Three Year Report.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #99-066.

Maas, Richard P., S.C. Patch, M.J. Westphal, E.A. Cook, C.C. Maurer and C.J. Walker. 1999. *Water Quality Trends of Madison County Three Year Report.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #99-067.

References

Maas, Richard P., S.C. Patch, M.J. Westphal, E.A. Cook, C.C. Maurer and C.J. Walker. 2000. *Water Quality in the Mountains: Henderson County Volunteer Water Information Network Year Seven Report.* Environmental Quality Institute. University of North Carolina at Asheville. Technical Report #00-069.

North Carolina Department of Environmental, Health and Natural Resources (NCDEHNR). 1994. Basinwide Assessment Report. Support Document. *French Broad River Basin.* North Carolina Department of Environment, Health and Natural Resources. Division of Environmental Management. Water Quality Section. Environmental Sciences Branch. Raleigh, NC. October 1994.

North Carolina Department of Environment and Natural Resources (DENR). Division of Land Resources. Land Quality Section. 1998. *What is Erosion and Sedimentation?* Raleigh, NC.

____. 1998. Basinwide Assessment Report. *French Broad River Basin.* Division of Water Quality. Environmental Sciences Branch. Raleigh, NC. November 1998.

North Carolina Department of Natural Resources and Community Development (NRCD). Division of Forest Resources. September 1989. *Forestry Best Management Practices Manual.* Raleigh, NC.

NCWRC. 1997. *North Carolina Trout Fishing Maps.* North Carolina Wildlife Resources Commission. Raleigh, NC.

US Environmental Protection Agency (EPA). 1999. Watershed Academy Website: http://www.epa.gov/OWOW/watershed/wacademy/.

Western North Carolina Tomorrow (WNCT). 1999. *A Mountain Home Before You Buy.* Cullowhee, NC.

Appendix I

NPDES Dischargers in the French Broad River Basin

Permit	Facility	County	Type	Ownership	Qw	Subbasin	Stream
NC0000078	P.H. Glatfelter - Ecusta Division	Transylvania	Major	Non-Municipal	27.5	40301	French Broad River
NC0021946	Rosman WWTP, Town of	Transylvania	Minor	Municipal	0.09	40301	French Broad River
NC0024295	Transylvania Utility Company	Transylvania	Minor	Non-Municipal	0.32	40301	French Broad River
NC0060534	Brevard, City of - WWTP	Transylvania	Major	Municipal	2.5	40301	French Broad River
NC0085979	NCDOT / Rosman Maintenance Facility	Transylvania	Minor	Non-Municipal	none	40301	French Broad River
NC0000108	Coats American	Transylvania	Minor	Non-Municipal	0.015	40301	Galloway Creek
NC0055905	Waterford Place Property Association	Transylvania	Minor	Non-Municipal	0.023	40301	Hunts Branch
NC0055336	Camp Carolina	Transylvania	Minor	Non-Municipal	0.02	40301	Lamb Creek
NC0000337	Sterling Diagnostic Imaging	Transylvania	Major	Non-Municipal	3	40301	Little River
NC0051021	Eagle's Nest Foundation - Camp	Transylvania	Minor	Non-Municipal	0.008	40301	Little River
NC0081001	Transylvania Evergreen Corporation	Transylvania	Minor	Non-Municipal	0.01	40301	Morgan Mill Creek
NC0085031	Conoco Convenience Store	Transylvania	Minor	Non-Municipal	0.01	40301	Morgan Mill Creek
NC0086223	D&D Catfish Resort	Transylvania	Minor	Non-Municipal	none	40301	Peter Weaver Creek
NC0077887	Camp Illahee	Transylvania	Minor	Non-Municipal	0.003	40301	UT French Broad River
NC0000311	M-B Industries - Mitchell Bissel	Transylvania	Minor	Non-Municipal	0.03	40301	W Fork French Broad River
NC0037176	Bon Worth, Inc	Henderson	Minor	Non-Municipal	0.006	40302	Allen Branch
NC0022811	Avery Acres MHP	Buncombe	Minor	Non-Municipal	0.0075	40302	Avery Creek
NC0061531	East Flat Rock Comm Development ***	Henderson	Minor	Non-Municipal	0.0189	40302	Bat Fork
NC0000507	GE Lighting Systems, Inc	Henderson	Major	Non-Municipal	0.5	40302	Bat Fork Creek
NC0069957	Laurelwood Mobile Home Park	Buncombe	Minor	Non-Municipal	0.002	40302	Beaverdam Creek
NC0056961	Ashe/Bun Water Authority - Beetree WTP	Buncombe	Minor	Non-Municipal	0	40302	Beetree Creek
NC0020478	USDA - Lake Powhatan	Buncombe	Minor	Non-Municipal	0.02	40302	Bent Creek
NC0036641	Fletcher Academy, Inc	Henderson	Minor	Non-Municipal	0.1	40302	Byers Creek
NC0033227	Communications Instruments, Inc	Buncombe	Minor	Non-Municipal	0.0175	40302	Cane Creek
NC0034924	Flesher's Fairview Rest Home	Buncombe	Minor	Non-Municipal	0.016	40302	Cane Creek
NC0066788	Buncombe Co BOE - Fairview Elem	Buncombe	Minor	Non-Municipal	0.011	40302	Cane Creek
NC0076147	San Guisto Estates	Buncombe	Minor	Non-Municipal	0.0325	40302	Cane Creek
NC0044784	Brevard-Cathey's Creek WTP	Transylvania	Minor	Non-Municipal	0	40302	Catheys Creek
NC0068799	Greystone Subdivision - D. Osteen	Henderson	Minor	Non-Municipal	0.026	40302	Clear Creek
NC0069370	Emeritus Corporation dba Pine Park	Henderson	Minor	Non-Municipal	0.025	40302	Clear Creek
NC0071862	Odom Associates Development	Henderson	Minor	Non-Municipal	0.022	40302	Clear Creek
NC0034304	Young Life Windy Gap Camp	Buncombe	Minor	Non-Municipal	0.05	40302	Coles Cove Branch
NC0073814	Buncombe Co BOE - N Buncombe Elem	Buncombe	Minor	Non-Municipal	0.011	40302	Dick Branch
NC0029882	Briarwood Subdivision	Buncombe	Minor	Non-Municipal	0.0075	40302	Dix Creek
NC0074136	Lakewood RV Resort	Henderson	Minor	Non-Municipal	0.015	40302	Dunn Creek
NC0083313	Brookside Village Association	Henderson	Minor	Non-Municipal	0.005	40302	Featherstone Creek
NC0067342	North View Mobile Home Park	Buncombe	Minor	Non-Municipal	0.032	40302	Flat Creek
NC0068152	Ridlee, LLC / Eden's Glen MHP	Buncombe	Minor	Non-Municipal	0.015	40302	Flat Creek
NC0000094	Cranston Print Works Company	Henderson	Major	Non-Municipal	4	40302	French Broad River
NC0000396	CP&L Asheville S.E. (Power Plant)	Buncombe	Major	Non-Municipal	4.8	40302	French Broad River
NC0023591	Silver-Line Plastics Corporation	Buncombe	Minor	Non-Municipal	0.24	40302	French Broad River

Permit	Facility	County	Type	Ownership	Qw	Subbasin	Stream
NC0024911	MSD Buncombe County WWTP	Buncombe	Major	Municipal	40	40302	French Broad River
NC0057541	Cummings Cove Properties, LLC	Henderson	Minor	Non-Municipal	0.035	40302	French Broad River
NC0073741	Hydrologic, Inc - Mountain Valley	Henderson	Minor	Non-Municipal	0.02	40302	French Broad River
NC0076708	Riverwind MHP / Oakwood Land Develop	Henderson	Minor	Non-Municipal	0.036	40302	French Broad River
NC0085511	Mills River Regional WTP	Henderson	Minor	Non-Municipal	none	40302	French Broad River
NC0071323	Etowah Sewer Company	Henderson	Minor	Non-Municipal	0.065	40302	Gash Creek
NC0086088	SKF USA, Inc - Girmes Site Grw	Buncombe	Minor	Non-Municipal	0.108	40302	Gashes Creek
NC0025933	Days Inn - West Facility	Buncombe	Minor	Non-Municipal	0.02	40302	Georges Branch
NC0062928	Ferguson, David - SFR	Buncombe	Minor	Non-Municipal	0.0164	40302	Georges Branch
NC0033430	Camp Judaea	Henderson	Minor	Non-Municipal	0.03	40302	Henderson Creek
NC0000299	BASF Corporation Enka Plant	Buncombe	Major	Non-Municipal	1.25	40302	Hominy Creek
NC0085154	Weaverville, Town - Ivy River WTP	Buncombe	Minor	Non-Municipal	0	40302	Ivy River
NC0039721	Bonclarken Assembly	Henderson	Minor	Non-Municipal	0.07	40302	King Creek
NC0056928	Kenmure Properties LTD (#1)	Henderson	Minor	Non-Municipal	0.0252	40302	King Creek
NC0086070	Henderson Co Utilities - Edneyville	Henderson	Minor	Non-Municipal	0.03	40302	Lewis Creek
NC0075680	Rosewood Mobile Home Park	Buncombe	Minor	Non-Municipal	0.02	40302	Line Creek
NC0024431	Kanuga Conference	Henderson	Minor	Non-Municipal	0.035	40302	Little Mud Creek
NC0048658	D & D Environmental, Inc	Transylvania	Minor	Non-Municipal	0.015	40302	Little River
NC0084921	Biltmore Company, Fish Hatch	Buncombe	Minor	Non-Municipal	none	40302	Long Valley Lake
NC0066249	Country Acres Mobile Home Park	Henderson	Minor	Non-Municipal	0.006	40302	McDowell Creek
NC0032140	Flat Rock Playhouse	Henderson	Minor	Non-Municipal	0.01	40302	Meminger Creek
NC0038733	Payne, Christopher - SFR / Buncombe	Buncombe	Minor	Non-Municipal	0.0004	40302	Merrill Cove Creek
NC0066664	Henderson Co School - Rugby Junior HS	Henderson	Minor	Non-Municipal	0.015	40302	Mill Pond Creek
NC0025534	Hendersonville, City - WWTP	Henderson	Major	Municipal	3.2	40302	Mud Creek
NC0036251	Camp Blue Star	Henderson	Minor	Non-Municipal	0.04	40302	Mud Creek
NC0075311	Mud Creek Water & Sewer District	Henderson	Minor	Non-Municipal	0.3	40302	Mud Creek
NC0079251	Seneca Foods Corporation	Henderson	Minor	Non-Municipal	0.09	40302	Mud Creek
NC0070645	Willow Creek Farms	Henderson	Minor	Non-Municipal	0.0025	40302	N Fork Big Willow Creek
NC0035807	Asheville/Northfork WTF	Buncombe	Minor	Non-Municipal	0	40302	N Fork Swannanoa River
NC0075388	Havon, Inc - Pleasant Cove Home	Buncombe	Minor	Non-Municipal	0.012	40302	Pole Creek
NC0083178	Woodfin Sanitary Water & Sewer WTP	Buncombe	Minor	Non-Municipal	0	40302	Reems Creek
NC0067288	Hydrologic, Inc - Hunter Glen	Henderson	Minor	Non-Municipal	0.035	40302	Shaw Creek
NC0066796	Buncombe Co BOE - Leicester Elem	Buncombe	Minor	Non-Municipal	0.0057	40302	Sluder Branch
NC0061182	Buncombe Co BOE – N Buncombe HS	Buncombe	Minor	Non-Municipal	0.025	40302	Stanfield Branch
NC0085341	Paulette Carter McLane	Buncombe	Minor	Non-Municipal	none	40302	Swannanoa River
NC0085448	Mills, Howard W. - SFR	Buncombe	Minor	Non-Municipal	none	40302	Swannanoa River
NC0085456	Binkelman, Charles R. - SFR	Buncombe	Minor	Non-Municipal	none	40302	Swannanoa River
NC0085464	Seagle, Dianna V. - SFR	Buncombe	Minor	Non-Municipal	none	40302	Swannanoa River
NC0076082	Bear Wallow Valley MHP	Henderson	Minor	Non-Municipal	0.01	40302	UT Clear Creek
NC0073393	Dana-Hill Corporation	Henderson	Minor	Non-Municipal	0.01	40302	UT Devils Fork
NC0071897	Henderson's Rest Home	Henderson	Minor	Non-Municipal	0.007	40302	UT Featherstone Creek
NC0074110	Mountain View Rest Home	Henderson	Minor	Non-Municipal	0.005	40302	UT Featherstone Creek

Permit	Facility	County	Type	Ownership	Qw	Subbasin	Stream
NC0085952	Travel Ports of America, Inc	Buncombe	Minor	Non-Municipal	none	40302	UT George Branch
NC0039187	Lone Star Equities / Valley View	Buncombe	Minor	Non-Municipal	0.01	40302	UT Hominy Creek
NC0034401	Highland Lake Inn & Conf Center-B	Henderson	Minor	Non-Municipal	0.01	40302	UT King Creek
NC0069949	Kenmure Properties, LTD	Henderson	Minor	Non-Municipal	0.021	40302	UT King Creek
NC0070017	Kanuga Conference, Inc	Henderson	Minor	Non-Municipal	0.005	40302	UT Little Mud Creek
NC0068764	Lavista Condominiums	Henderson	Minor	Non-Municipal	0.0165	40302	UT McDowell Creek
NC0066681	Henderson Co School - West Henderson	Henderson	Minor	Non-Municipal	0.0099	40302	UT Mill Pond Creek
NC0060411	Veach Auto Shop	Henderson	Minor	Non-Municipal	none	40302	UT Mud Creek
NC0063240	Quality Floor Service	Henderson	Minor	Non-Municipal	0.0009	40302	UT Mud Creek
NC0066362	Benson Apartments	Henderson	Minor	Non-Municipal	0.008	40302	UT Mud Creek
NC0078859	TNS Mills, Inc - Bio Tech Division	Henderson	Minor	Non-Municipal	0.0995	40302	UT Mud Creek
NC0062634	Wedgefield Acres MHP	Buncombe	Minor	Non-Municipal	0.025	40302	UT Pond Branch
NC0033693	Christ School	Buncombe	Minor	Non-Municipal	0.02	40302	UT Robinson Creek
NC0060283	Ridge View Acres MHP	Buncombe	Minor	Non-Municipal	0.0078	40302	UT Smith Mill Creek
NC0036684	Carolina Water Service - Bent Creek	Buncombe	Minor	Non-Municipal	0.1	40302	Wesley Creek
NC0042277	Hendersonville WTP	Henderson	Minor	Non-Municipal	0.18	40303	Brandy Branch
NC0070335	Van Wingerden, International	Henderson	Minor	Non-Municipal	0.005	40303	Brandy Branch
NC0020460	USDA - Sliding Rock Recreational Area	Transylvania	Minor	Non-Municipal	0.005	40303	Looking Glass Creek
NC0069671	J.M.S. Builders & Developers	Henderson	Minor	Non-Municipal	0.015	40303	Mills River
NC0020486	USDA - North Mills River Recreational	Henderson	Minor	Non-Municipal	0.012	40303	North Fork Mills River
NC0062669	Mills River Restaurant, Inc	Henderson	Minor	Non-Municipal	0.003	40303	UT Mills River
NC0069388	JH Reaban Oil / Mills River Texaco	Henderson	Minor	Non-Municipal	0.0006	40303	UT Mills River
NC0033251	Camp Highlander (Pinecrest School)	Henderson	Minor	Non-Municipal	0.0074	40303	UT South Fork Mills River
NC0080659	Madison County Middle School	Madison	Minor	Non-Municipal	0.009	40304	Brush Creek
NC0021733	Marshall, Town of - WWTP	Madison	Minor	Municipal	0.4	40304	French Broad River
NC0025836	Hot Springs, Town of - WWTP	Madison	Minor	Municipal	0.08	40304	French Broad River
NC0027545	CP&L Marshall Hydroelectric Plant	Madison	Minor	Non-Municipal	none	40304	French Broad River
NC0049620	Hot Springs Housing Authority	Madison	Minor	Non-Municipal	0.01	40304	French Broad River
NC0057151	Mars Hill, Town - WWTP	Madison	Minor	Municipal	0.425	40304	Gabriel Creek
NC0061468	Skistok, Inc - Wolf Laurel Resort	Madison	Minor	Non-Municipal	0.015	40304	Hampton Creek
NC0039152	Ohio Electric Motors / HBD Industries	Buncombe	Minor	Non-Municipal	0.0025	40304	Paint Fork Creek
NC0034207	Madison Co BOE / Laurel Elem	Madison	Minor	Non-Municipal	0.005	40304	Shelton Laurel Creek
NC0076431	Carolina Water Service / Blue Mountain	Madison	Minor	Non-Municipal	0.0244	40304	Wolf Laurel Branch
NC0082716	English Wolf Lodge - WWTP	Madison	Minor	Non-Municipal	0.007	40304	Wolf Laurel Branch
NC0049409	Waynesville, Town of - WTP	Haywood	Minor	Non-Municipal	0	40305	Allen Creek
NC0067351	Haywood Co School - Bethel School	Haywood	Minor	Non-Municipal	0.015	40305	Bird Creek
NC0040355	Royal Oaks, Inc / Springdale	Haywood	Minor	Non-Municipal	0.025	40305	East Fork Pigeon River
NC0065986	Dogwood Trails Subdivision	Haywood	Minor	Non-Municipal	0	40305	Evans Branch
NC0066842	Ammons Foods / McElroy Restaurant	Haywood	Minor	Non-Municipal	0.003	40305	Factory Branch

Permit	Facility	County	Type	Ownership	Qw	Subbasin	Stream
NC0082953	Terry Lynn Motel	Haywood	Minor	Non-Municipal	0.0016	40305	Factory Branch
NC0030422	Green Valley Mobile Home Park	Haywood	Minor	Non-Municipal	0.009	40305	Hyatt Creek
NC0056561	Maggie Valley, Town of - WWTP	Haywood	Major	Municipal	1	40305	Jonathans Creek
NC0061824	Woodland Village POA, Inc	Haywood	Minor	Non-Municipal	0.0075	40305	Mine Branch
NC0000272	Blue Ridge Paper Products - Canton Site	Haywood	Major	Non-Municipal	29.9	40305	Pigeon River
NC0021741	Clyde, Town of - WWTP	Haywood	Minor	Municipal	0.21	40305	Pigeon River
NC0024805	DOT - Haywood County I-40 Rest Area	Haywood	Minor	Non-Municipal	0.026	40305	Pigeon River
NC0025321	Waynesville, Town of - WWTP	Haywood	Major	Municipal	6	40305	Pigeon River
NC0033600	Silver Bluff Nursing Facility	Haywood	Minor	Non-Municipal	0.025	40305	Pigeon River
NC0044199	McElroy, Inc / Citgo Truck Stop	Haywood	Minor	Non-Municipal	0.015	40305	Pigeon River
NC0032361	Autumn Care of Waynesville	Haywood	Minor	Non-Municipal	0.01	40305	Richland Creek
NC0022454	Midway Medical Center - Canton	Haywood	Minor	Non-Municipal	0.005	40305	Sally Haines Branch
NC0086053	Pilot Travel Center #353	Haywood	Minor	Non-Municipal	0.025	40305	Stingy Branch
NC0048143	Hemlock Villas, LTD	Haywood	Minor	Non-Municipal	0.0075	40305	UT Jonathan Creek
NC0072729	USDI - Blue Ridge Parkway - Mt. Pisgah	Haywood	Minor	Non-Municipal	0.032	40305	UT Pisgah Creek
NC0062863	Ithilien Lodge	Haywood	Minor	Non-Municipal	0.0024	40305	UT Richland Creek
NC0074063	Country Club Real Estate - WNC	Haywood	Minor	Non-Municipal	0	40305	UT Richland Creek
NC0082767	Spruce Pine, Town - WTP	Mitchell	Minor	Non-Municipal	none	40306	Beaver Creek
NC0083712	Mars Hill, Town of - WTP	Madison	Minor	Non-Municipal	0	40306	Big Laurel Creek
NC0025461	Bakersville, Town of - WWTP	Mitchell	Minor	Municipal	0.075	40306	Cane Creek
NC0036421	International Resistive Company, Inc	Avery	Minor	Non-Municipal	0.008	40306	Kentucky Creek
NC0023566	Taylor Togs, Inc	Yancey	Minor	Non-Municipal	0.01	40306	Little Crabtree Creek
NC0073695	Silver Bullet, Inc / Convenience Store	Yancey	Minor	Non-Municipal	0.0015	40306	Little Crabtree Creek
NC0000175	Unimin Corporation / Quartz	Mitchell	Major	Non-Municipal	3.6	40306	North Toe River
NC0000353	Feldspar Corporation / Spruce Pine	Mitchell	Major	Non-Municipal	3.5	40306	North Toe River
NC0000361	Unimin Corporation - Schoolhouse Quartz	Avery	Major	Non-Municipal	2.16	40306	North Toe River
NC0000400	K-T Feldspar Corporation	Mitchell	Major	Non-Municipal	1.73	40306	North Toe River
NC0021423	Spruce Pine, Town - WWTP	Mitchell	Minor	Municipal	0.6	40306	North Toe River
NC0021857	Newland, Town of - WWTP	Avery	Minor	Municipal	0.32	40306	North Toe River
NC0082571	New Life Fellowship, Inc	Avery	Minor	Non-Municipal	0.036	40306	North Toe River
NC0084620	Unimin Corporation - Crystal Operation	Mitchell	Minor	Non-Municipal	0.36	40306	North Toe River
NC0085839	Unimin Corporation - Red Hill Quartz Pr	Mitchell	Minor	Non-Municipal	0.682	40306	North Toe River
NC0066729	Mitchell Co School - Tipton Hill	Mitchell	Minor	Non-Municipal	0.005	40306	Raccoon Creek
NC0027685	DOC - Avery Correctional Center	Avery	Minor	Non-Municipal	0.0206	40306	Three Mile Creek
NC0073962	NC DOC - Blue Ridge Youth Center	Avery	Minor	Non-Municipal	0.007	40306	Three Mile Creek
NC0066737	Mitchell Co School - Mitchell HS	Mitchell	Minor	Non-Municipal	0.0144	40306	UT Cranberry Creek
NC0075647	Hidden Gap Mobile Home Park	Henderson	Minor	Non-Municipal	0.02	40306	UT Devils Fork
NC0083282	Mountain View Motel	Yancey	Minor	Non-Municipal	0.0025	40306	UT Little Crabtree Creek
NC0075965	Burnsville, Town of - WTP	Yancey	Minor	Non-Municipal	0	40306	UT Little Crabtree Creek
NC0033685	Avery Development Corporation	Avery	Minor	Non-Municipal	0.006	40306	Whiteoak Creek

Permit	Facility	County	Type	Ownership	Qw	Subbasin	Stream
NC0020290	Burnsville, Town of - WWTP	Yancey	Minor	Municipal	0.8	40307	Cane River
NC0027898	DOC - Yancey Correctional Center	Yancey	Minor	Non-Municipal	0.0177	40307	UT Cane River

Appendix II

Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**
- **Fish Community Assessments**

Appendix A-II Benthic Macroinvertebrate Collections

Freshwater Wadeable Flowing Waters

Benthic macroinvertebrates can be collected using two sampling procedures. DWQ's standard qualitative sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs. The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens), Common (3-9 specimens) or Abundant (≥10 specimens).

Several data analysis summaries (metrics) can be produced from standard qualitative samples to detect water quality problems. These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT S) is used with DWQ criteria to assign water quality ratings (bioclassifications). "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Water quality ratings also are based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI). Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions. Water quality ratings assigned with the biotic index numbers are combined with EPT taxa richness ratings to produce a final bioclassification, using criteria for Mountain/Piedmont/Coastal Plain streams. EPT abundance (EPT N) and total taxa richness calculations also are used to help examine between-site differences in water quality. If the EPT taxa richness rating and the biotic index differ by one bioclassification, the EPT abundance value is used to determine the final site rating.

Benthic macroinvertebrates can also be collected using the DWQ's EPT sampling procedure. Four composite samples are taken at each site instead of the 10 taken for the qualitative sample: 1 kick, 1 sweep, 1 leafpack and visual collections. Only intolerant EPT groups are collected and identified, and only EPT criteria are used to assign a bioclassification.

The expected EPT taxa richness values are lower in small high quality mountain streams, <4 meters in width or with a drainage area <3.5 square miles. For these small mountain streams, an adjustment to the EPT taxa richness values is made prior to applying taxa richness criteria. Both EPT taxa richness and biotic index values also can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling: June-September. For samples collected outside summer, EPT taxa richness can be adjusted by subtracting out winter/spring Plecoptera or other adjustment based on resampling of summer site. The biotic index values also are seasonally adjusted for samples outside the summer season.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis.

Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina.

Benthos Classification Criteria by Ecoregion *

EPT taxa richness values

	10-sample Qualitative Samples			4-sample EPT Samples		
	Mountains	Piedmont	Coastal	Mountains	Piedmont	Coastal
Excellent	>41	>31	>27	>35	>27	>23
Good	32-41	24-31	21-27	28-35	21-27	18-23
Good-Fair	22-31	16-23	14-20	19-27	14-20	12-17
Fair	12-21	8-15	7-13	11-18	7-13	6-11
Poor	0-11	0-7	0-6	0-10	0-6	0-5

Biotic Index Values (Range = 0-10) for 10-sample Qualitative Samples

	Mountains	Piedmont	Coastal
Excellent	<4.05	<5.19	<5.47
Good	4.06-4.88	5.19-5.78	5.47-6.05
Good-Fair	4.89-5.74	5.79-6.48	6.06-6.72
Fair	5.75-7.00	6.49-7.48	6.73-7.73
Poor	>7.00	>7.48	>7.73

* These criteria apply to flowing water systems only.

Appendix A-II Benthic Macroinvertebrate Collections in the French Broad River Basin, 1983-1997

FBR 01

Site	Site #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
French Broad R, SR 1129, Rosman, Trans.	B-1	6-(1)	07/97	93/51	3.30/2.57	Excellent
			07/92	108/51	3.74/2.50	Excellent
			08/90	98/43	3.73/2.63	Excellent
			03/89	107/57	3.35/2.40	Excellent
			08/88	96/48	3.99/3.02	Excellent
			07/86	102/50	3.92/2.79	Excellent
			08/84	89/38	4.09/2.99	Good
			08/84	84/32	3.99/2.98	Good
W Fk French Broad R, ab trout farms, off NC 281, Transylvania	B-2	6-2-(0.5)	08/90	83/45	2.58/1.97	Excellent
			05/90	96/55	2.55/1.71	Excellent
W Fk French Broad R, be trout farms, SR 1306,Transylvania	B-3	6-2-(0.5)	05/90	72/33	4.82/2.64	Good-Fair
			08/90	51/15	5.92/3.31	Fair
W Fk French Broad R, NC 281, Transylvania	B-4	6-2-(0.5)	08/90	78/32	4.84/3.65	Good
			05/90	97/44	4.41/2.85	Good
			03/89	-/27	-/3.54	Good-Fair
W Fk French Broad R, SR 1312, Transylvania	B-5	6-2-(0.5)	02/92	99/53	3.03/1.94	Excellent
			05/87	-/49	-/2.49	Excellent
			10/84	94/42	3.81/2.61	Good
W Fk French Broad R, US 64, ab Mitchell-Bissel Industry, Transylvania	B-6	6-2	07/97	94/50	2.88/2.11	Excellent
			07/92	87/47	3.52/2.30	Excellent
			02/92	110/57	3.28/2.27	Excellent
			03/89	87/50	3.07/2.31	Excellent
W Fk French Broad R, be M-B Industry, Transyl.	B-7	6-2	02/92	79/45	3.28/2.15	Excellent
Parker Cr, SR 1310, Transylvania	B-8	6-2-4	03/89	-/44	-/2.56	Good
N Flat Cr, SR 1319, Transylvania	B-9	6-2-10-1	03/89	-/38	-/2.77	Good
N Fk French Broad R, NC 215, Transylvania	B-10	6-3-(6.5)	03/89	-/45	-/1.98	Excellent
N Fk French Broad R, SR 1324, Transylvania	B-11	6-3-(6.5)	03/89	-/36	-/2.83	Good
N Fk French Broad R, SR 1322, Transylvania	B-12	6-3-(6.5)	07/97	76/41	3.22/2.38	Excellent
			07/92	85/42	3.28/2.30	Excellent
			03/89	89/44	3.39/2.49	Excellent
Tucker Cr, SR 1325, Transylvania	B-13	6-3-10	03/89	-/35	-/2.69	Good-Fair
M Fk French Broad R, NC 178, Transylvania	B-14	6-5	03/89	-/35	-/1.75	Good
E Fk French Broad R, SR 1105, Transylvania	B-15	6-6	03/89	-/51	-/1.96	Excellent
E Fk French Broad R, SR 1007, Transylvania	B-16	6-6	03/89	107/54	2.77/2.08	Excellent
Glady Fk, SR 1105, Transylvania	B-17	6-6-7	05/87	-/29	-/2.88	Good-Fair
Galloway Cr, US 64, ab landfill, Transyl.	B-18	6-8	05/87	-/16	-/2.61	Fair
Galloway Cr, US 64, be landfill, Transyl.	B-19	6-8	05/87	-/10	-/3.00	Poor
Morgan Mill Cr, SR 1195, Transylvania	B-20	6-10-1	07/97	-/12	-/4.63	Fair
Catheys Cr, SR 1338, Transylvania	B-21	6-16-(8.5)	03/89	-/58	-/2.02	Excellent
			05/87	-/49	-/1.79	Excellent
Norton Cr, US 64, Transylvania	B-22	6-28-2	05/87	-/14	-/4.82	Fair
Williamson Cr, SR 1541, Transylvania	B-23	6-32	05/87	-/44	-/2.42	Good
Little R NC 276, Transylvania	B-24	6-38-(1)	05/87	-/38	-/3.02	Good
Little R, nr Cedar Mt, ab High Falls, off SR 1536, Transylvania	B-25	6-38-(1)	08/87	83/19	6.33/4.69	Fair
			08/85	82/22	5.83/4.59	Fair
Little R, nr Cedar Mt, be High Falls, Trans.	B-26	6-38-(1)	07/89	81/32	4.55/3.72	Good
Little R, SR 1533, Transylvania	B-27	6-38-(20)	07/97	-/25	-/3.90	Good-Fair
			07/92	-/26	-/4.15	Good-Fair
Laurel Cr, SR 1536, Transylvania	B-28	6-38-17	05/87	-/44	-/2.10	Good
Crab Cr, SR 1532, Transylvania	B-29	6-38-23	05/87	-/38	-/2.94	Good

FBR 02

Site	Site #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
French Broad R,SR 1503 at Blantyre, Trans.	B-1	6-(38.5)	07/86	57/21	5.76/4.28	Fair
			08/83	55/20	5.85/4.43	Fair
Gash Cr, SR 1322 Henderson	B-2	6-41	09/86	40/5	7,58/5.94	Poor
Gash Cr, US 64, Henderson	B-3	6-41	09/86	21/1	8.07/5.77	Poor
Gash Cr, SR 1203, Henderson	B-4	6-41	09/86	26/1	8.31/6.22	Poor
Gash Cr, SR 1205, Henderson	B-5	6-41	06/96	50/6	7.09/5.16	Poor
			09/86	19/7	6.09/4.45	Fair
Mill Pond Cr, SR 1309, Henderson	B-6	6-51	06/96	47/14	5.98/4.68	Fair
Mud Cr, SR 1126, Henderson	B-7	6-55	09/97	-/2	-/6.99	Poor
Mud Cr, SR 1647 (Seventh Ave), Henderson	B-8	6-55	09/97	40/5	6.65/6.21	Poor
Mud Cr, SR 1508 ab WWTP, Henderson	B-9	6-55	09/97	40/5	6.97/6.12	Poor
			07/92	-/10	-/5.52	Poor
			09/85	53/10	6.88/5.57	Fair
Mud Cr, SR 1508 be WWTP, Henderson	B-10	6-55	09/97	47/8	6.89/5.63	Poor
			07/92	-/7	-/6.36	Poor
			09/85	31/3	7.73/7.09	Poor
Mud Cr, US 25, Henderson	B-11	6-55	09/97	49/12	6.67/5.58	Fair
Bat Fork, SR 1807, Henderson	B-12	6-55-8-1	04/89	-/2	-/2.55	Poor
Bat Fork , US 176, Henderson	B-13	6-55-8-1	04/89	44/6	7.60/5.98	Poor
Bat Fork, SR 1809, Henderson	B-14	6-55-8-1	04/89	19/2	8.61/1.29	Poor
Bat Fork, SR 1803, Henderson	B-15	6-55-8-1	04/89	25/4	7.73/6.65	Poor
Bat Fork, SR 1779, Henderson	B-16	6-55-8-1	09/97	48/7	6.87/6.23	Fair
			04/89	-/2	-/7.64	Poor
Clear Cr, SR 1591, Henderson	B-17	6-55-11-(1)	06/93	38/10	5.50/2.78	NR
Clear Cr, SR 1587, Henderson	B-18	6-55-11-(1)	06/93	35/12	5.47/4.25	Fair
Clear Cr, SR 1586, Henderson	B-19	6-55-11-(1)	06/93	47/12	6.14/4.74	Fair
Laurel Fk, SR 1591, Henderson	B-20	6-55-11-2	06/93	-/31	-/2.16	Good
Cox Cr, SR 1587, Henderson	B-21	6-55-11-3	06/93	-/10	-/3.19	NR
Puncheon Camp Cr, SR 1591, Henderson	B-22	6-55-11-4	06/93	-/22	-/3.12	Good-Fair
Clear Cr SR 1513, Henderson	B-23	6-55-11-(5)	07/97	-/8	-/5.10	Poor
			07/92	-/9	-/5.28	Poor
Cane Cr, SR 1006 nr Fletcher, Henderson	B-24	6-57-(9)	07/97	-/26	-/4.22	Good-Fair
			07/92	-/27	-/4.05	Good-Fair
French Broad R, NC 146 nr Skyland, Buncombe	B-25	6-(54.5)	07/97	77/32	5.24/4.31	Good-Fair
			07/92	86/41	4.97/4.08	Good
			07/90	80/34	5.23/3.88	Good
			08/87	80/30	5.35/4.12	Good-Fair
French Broad R, SR 1348, nr Asheville, Buncombe	B-26	6-(54.5)	07/97	72/32	4.92/3.88	Good
			07/92	73/32	5.13/4.22	Good-Fair
			08/87	71/24	5.11/3.87	Good-Fair
			08/85	53/19	5.55/4.28	Good-Fair
			08/83	56/19	5.97/4.39	Fair
French Broad R, SR 1634, nr Alexander, Buncombe	B-27	6-(54.5)	07/97	55/18	5.38/4.49	Good-Fair
			07/92	54/20	5.96/4.58	Fair
			07/90	61/19	5.61/4.10	Good-Fair
			08/87	68/26	5.55/4.01	Good-Fair
Dingle Cr, US 25, Buncombe	B-28	6-71	02/87	-/10	-/5.22	Poor
Dingle Cr, US 25, Buncombe	B-29	6-71	02/87	-/2	-/4.34	Poor
Dingle Cr, Blue Ridge Pkwy, Buncombe	B-30	6-71	02/87	-/14	-/3.03	Fair
Dingle Cr, Blue Ridge Pkwy, Buncombe	B-31	6-71	02/87	-/16	-/2.12	Good-Fair
Hominy Cr, SR 1141, Luther, Buncombe	B-32	6-76	01/89	-/18	-/3.19	Good-Fair
Hominy Cr, NC 151 at Candler, Buncombe	B-33	6-76	09/97	71/32	4.96/3.55	Good-Fair
			07/92	-/28	-/3.31	Good
Hominy Cr, NC 112 ab Enka Lake, Buncombe	B-34	6-76	09/97	63/16	5.71/4.30	Fair
			07/92	-/11	-/3.94	Fair
Hominy Cr, SR 3412 at Sand Hill, Buncombe	B-35	6-76	09/97	63/13	6.38/4.85	Fair
			07/97	-/13	-/4.12	Fair
			07/92	-/8	-/3.58	Poor
S Hominy Cr, NC 151 at Candler, Buncombe	B-36	6-76-5	09/97	38/8	6.15/4.53	Poor
			07/92	-/20	-/3.21	Good-Fair

FBR 02 (con't)

Site	Site #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Swannanoa R, SR 2500 at Black Mt., Bun.	B-37	6-78	10/87	56/19	5.61/4.45	Fair
Swannanoa R, SR 2727 at Swannanoa, Bun.	B-38	6-78	10/87	50/18	5.14/4.00	Good-Fair
Swannanoa R, SR 2416 at Warren Wilson	B-39	6-78	10/87	60/22	5.01/3.91	Good-Fair
Buncombe			07/87	73/33	5.13/3.96	Good-Fair
Swannanoa R, NC 81/240 at River Rd, Bun.	B-40	6-78	03/88	70/24	5.87/4.14	Fair
			10/87	68/24	5.81/4.24	Good-Fair
			07/87	76/29	5.51/4.32	Good-Fair
Swannanoa R, NC 81 be 240, River Rd, Bun.	B-41	6-78	03/88	56/18	6.26/4.39	Fair
Swannanoa R, US 25 nr Biltmore, Buncombe	B-42	6-78	07/97	62/28	5.24/4.00	Good-Fair
			07/92	72/27	5.65/4.38	Good-Fair
			07/89	60/15	6.30/4.50	Fair
			03/88	47/8	7.02/5.96	Poor
			10/87	54/17	6.34/4.87	Fair
			07/87	73/33	5.13/3.96	Good-Fair
			08/85	41/9	7.38/4.99	Poor
Flat Cr, nr NC 9 ab Big Piney Cr, Buncombe	B-43	6-78-6-(1)	12/91	-/35	-/1.54	Excellent
Flat Cr, US 70, Buncombe	B-44	6-78-6-(4)	10/87	-/15	-/4.02	Good-Fair
Big Slaty Br, nr NC 9, ab Slaty Br, Bun.	B-45	6-78-6-2	12/91	-/34	-/1,50	Excellent
Slaty Br, (Little Slaty Br), nr NC 9	B-46	6-78-6-3	12/91	-/37	-/1.54	Excellent
ab Big Piney Cr, Buncombe						
Big Piney Cr, nr NC 9 nr Montreat, Bun.	B-47	6-78-6-5	12/91	-/32	-/1.37	Excellent
Wolfpit Br, nr High Top Colony Rd, Bun.	B-48	6-78-10-(1)	12/91	-/26	-/1.35	Excellent
N Fk Swannanoa R, SR 2576 ab Grovestone,Bun.	B-49	6-78-11-(13)	10/87	-/14	-/3.85	Fair
N Fk Swannanoa, US 70, be Grovestone, Bun.	B-50	6-78-11-(13)	10/87	-/12	4.46	Fair
Laurel Br, nr mouth, Buncombe	B-51	6-78-11-16	02/92	58/32	2.77/1.67	Excellent
Beetree Cr, SR 2427, Buncombe	B-52	6-78-15-(6)	03/86	72/39	3.56/2.83	Excellent
Beetree Cr, SR 2429, Buncombe	B-53	6-78-15-(6)	10/87	-/15	-/3.01	Good-Fair
Beetree Cr, SR 2416, Buncombe	B-54	6-78-15-(6)	10/87	-/19	-/3.72	Good-Fair
Bull Cr, SR 2408, Buncombe	B-55	6-78-18	10/87	-/27	-/3.47	Good
Christian Cr, SR 2838, Buncombe	B-56	6-78-19	10/87	-/17	-/4.53	Good-Fair
Gashes Cr, SR 3071, Buncombe	B-57	6-78-21	05/94	61/20	4.62/2.90	Good-Fair
Sweeten Cr, US 25A, Buncombe	B-58	6-78-24	10/87	-/1	-/5.50	Poor
Newfound Cr, SR 1296, Buncombe	B-59	6-84	06/89	74/38	3.88/3.14	Excellent
			06/88	94/39	4.13/3.30	Excellent
Newfound Cr, SR 1297, Buncombe	B-60	6-84	06/89	56/16	6.53/4.53	Fair
			06/88	62/17	6.45/4.81	Fair
Newfound Cr, SR 1378, Buncombe	B-61	6-84	04/86	50/12	6.73/4.77	Poor
Newfound Cr, SR 1622, Buncombe	B-62	6-84	07/97	-/20	-/4.97	Good-Fair
			07/89	59/17	7.05/5.36	Fair
			06/89	53/8	7.50/5.63	Poor
			04/89	47/7	7.21/5.65	Poor
			02/89	40/3	7.96/6.77	Poor
			06/88	65/13	7.23/5.66	Poor
			04/86	43/10	6.65/5.20	Poor
Reems Cr, NC 251, Buncombe	B-63	6-87-(10)	07/97	-/30	-/3.33	Good
			07/92	-/20	-/3.37	Good-Fair
Flat Cr, SR 1741, Buncombe	B-64	6-88	04/86	75/24	4.91/3.49	Good-Fair
Sandymush Cr, SR 1114, Madison	B-65	6-92-(9)	07/97	-/30	-/3.71	Good
			07/92	-/36	-/4.06	Excellent

FBR 03

Site	DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Davidson R, US 276 ab campground, Trans.	B-1	6-54-(15.5)	07/97	113/52	3.60/2.42	Excellent
			07/92	-/44	-/1.83	Excellent
Boylston Cr, SR 1314, Henderson	B-2	6-52-(0.5)	07/97	71/23	5.38/4.08	Good-Fair
			07/92	-/26	-/4.71	Good-Fair

FBR 03 (con't)

Site	Site #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Mills R, SR 1337 at Mills River, Henderson	B-3	6-54-(1)	07/97	115/53	3.32/2.18	Excellent
			08/94	-/43	-/2.45	Excellent
			07/92	89/51	3.05/2.14	Excellent
			07/90	105/51	3.52/2.34	Excellent
			08/88	-/32	-/2.34	Good
			08/88	84/37	3.91/2.68	Excellent
			07/86	90/48	3.51/2.71	Excellent
			08/84	90/45	3.30/2.42	Excellent
N Fk Mills R, FS Rd 5000	B-4	6-54-2-(4)	09/97	54/34	2.84/2.40	Good
N Fk Mills R, ab Rocky Br, Henderson	B-5	6-54-2-(4)	07/97	-/41	-/1.66	Excellent
			06/93	93/47	2.87/1.84	Excellent
Wash Cr, off SR 1345 (Rec Area Trail), Henderson	B-6	6-54-2-6	06/93	73/47	2.11/1.71	Excellent
N Fk Mills R, SR 1341, Henderson	B-7	6-54-2-(9)	06/93	103/51	2.85/2.11	Excellent
			09/85	91/37	4.04/2.90	Excellent
Bradley Cr, FSR 1206, Transylvania	B-8	6-54-3-17	04/91	-/55	-/1.58	Excellent
Bradley Cr, FSR 1206 ab State Rock Cr, Henderson	B-9	6-54-3-17	04/91	-/47	-/1.82	Excellent
Bradley Cr, FSR 1206 ab Yellow Gap Cr, Hender.	B-10	6-54-3-17	07/91	-/38	-/1.52	Excellent
			04/91	-/60	-/1.61	Excellent
Bradley Cr, be Laurel Cr	B-11	6-54-3-17	09/97	66/40	2.40/1.74	Excellent
S Fk Mills R, SR 1340, Henderson	B-12	6-54-3-(17.5)	06/93	113/57	2.95/1.98	Excellent
Mills R, SR 1353, Henderson	B-13	6-54-(5)	07/97	78/24	5.09/3.28	Good-Fair
			08/94	31/5	5.82/4.43	Poor
			06/93	90/40	4.08/2.70	Good
			07/92	81/35	4.07/3.07	Good
UT Mills R, SR 1345, Henderson	B-14	6-54-(5)	10/94	-/19	-/2.65	Good-Fair
Brandy Br, NC 191, Henderson	B-15	6-54-6	10/94	49/10	6.58/5.67	Fair

FBR 04

Site	DWQ #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
French Broad R, NC 213 at Marshall, Madison	B-1	6-(67.5)	07/97	52/24	4.68/3.82	Good-Fair
			07/92	67/25	5.23/4.42	Good-Fair
			07/90	49/18	5.34/4.53	Good-Fair
			08/88	71/22	5.82/4.56	Fair
			07/86	79/31	5.39/3.85	Good-Fair
			08/85	62/18	5.58/4.28	Good-Fair
			08/84	41/16	5.18/4.04	Good-Fair
			08/83	54/19	5.54/4.22	Good-Fair
Ivy Cr (R), SR 2153, Buncombe	B-2	6-96-(0.5)	08/93	100/41	4.41/3.59	Good
Ivy Cr (R), SR 2150, Buncombe	B-3	6-96-(0.5)	07/97	-/27	-/2.78	Good-Fair
			07/92	-/38	-/3.35	Excellent
Dillingham Cr, SR 2173, ab Stoney Cr, Buncombe	B-4	6-96-1-(1)	08/93	-/31	-/2.32	Good
Dillingham Cr, SR 2173, be Stoney Cr, Buncombe	B-5	6-96-1-(1)	08/93	86/36	4.20/2.85	Good
Stoney Cr, SR 2178, Buncombe	B-6	6-96-1-5	08/93	77/33	3.15/2.12	Good
Carter Cr, off SR 2178, Buncombe	B-7	6-96-1-5-1	08/83	-/29	-/1.92	Excellent
Mineral Cr, off SR 2178, Buncombe	B-8	6-96-1-5-2	08/93	-/29	-/1.39	Excellent
N Fk Ivy Cr, SR 2027, Buncombe	B-9	6-96-3	09/93	-/35	-/2.70	Good
Little Ivy Cr, SR 1547, Madison	B-10	6-96-10	01/97	-/24	-/3.63	Good-Fair
Little Ivy Cr, SR 1610, Madison	B-11	6-96-10	07/97	-/16	-/3.91	Fair
			08/93	-/27	-/4.21	Good-Fair
			07/92	-/34	-/3.26	Good
California Cr, SR 1349, Madison	B-12	6-96-10-2	01/97	-/31	-/2.33	Good
California Cr, SR 1541, Madison	B-13	6-96-10-2	01/97	53/29	3.71/2.65	Good-Fair
Gabriel Cr, SR 1559, Madison	B-14	6-96-12	08/93	-/21	-/3.86	Good-Fair
Bull Cr, NC 213, Madison	B-15	6-96-16	08/93	-/25	-/3.46	Good-Fair
Ivy Cr, SR 1565, Madison	B-16	6-99-(11.7)	08/93	85/39	4.92/3.86	Good
Ivy Cr (R), US 25/70., Madison	B-17	6-99-(11.7)	07/97	59/28	4.49/3.26	Good-Fair
			09/93	-/34	-/3.26	Good
			07/92	87/36	4.61/3.61	Good
Hunter Cr, nr Hunter Cr R nr Marshall, Madison	B-18	6-106-2-(1)	12/91	-/30	-/1.65	Excellent

FBR 04 (con't)

Site	Site #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Big Laurel Cr, SR 1503, Madison	B-19	6-112	07/97	-/33	-/2.11	Good
Big Laurel Cr, SR 1318/SR 1334, Madison	B-20	6-112	01/97	-/33	-/1.98	Good
Big Laurel Cr, SR 1318, Madison	B-21	6-112	01/97	65/37	2.52/2.14	Excellent
Big Laurel Cr, NC 208, Madison	B-22	6-112	07/97	-/36	-/2.66	Excellent
			08/92	-/38	-/3.00	Excellent
Puncheon Fk, SR 1503, Madison	B-23	6-112-5	07/97	-/31	-/2.14	Good
Shelton Laurel Cr, NC 208/212, Madison	B-24	6-112-26	07/97	-/32	-/2.59	Good
			08/92	-/32	-/2.90	Good
			05/90	-/44	-/2.55	Excellent
Hickory Fk (Hickey Cr), SR 1310, Madison	B-25	6-112-26-7	05/90	-/43	-/1.90	Excellent
W Pr Hickory Fk (W Pr Hickey Cr), SR 1310, Madison	B-26	6-112-26-7-1	05/90	-/38	-/1.62	Excellent
E Pr Hickory Fk (Little Pr E Pr Hickey Cr), FR 465, Madison	B-27	6-112-26-7-2	05/90	-/32	-/1.35	Excellent
Spring Cr, NC 209, Madison	B-28	6-118-27	07/97	-/31	-/3.04	Good
			08/92	-/26	-/2.75	Good-Fair

FBR 05

Site	DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Pigeon R, off NC 215, nr Woodrow, Haywood	B-1	5-(1)	07/84	87/37	4.85/3.49	Good
Pigeon R, NC 215 at Canton, Haywood	B-2	5-(1)	07/97	94/44	3.65/2.74	Excellent
			09/95	74/29	4.45/2.94	Good
			08/94	70/30	4.36/3.31	Good
			01/93	86/34	4.26/3.10	Good
			08/92	84/37	4.38/3.30	Good
			08/88	86/33	5.09/3.66	Good-Fair
			02/88	87/35	4.47/3.52	Good
			07/86	80/38	4.61/3.63	Good
			07/84	82/32	4.20/2.65	Good
			08/83	86/29	4.95/3.44	Good-Fair
W Fk Pigeon R, Burnett Siding, SR 1216, Haywood	B-3	5-2	07/97	-/49	-/1.59	Excellent
			01/93	81/47	2.37/1.70	Excellent
			07/91	-/44	-/1.85	Excellent
			05/90	-/48	-/1.83	Excellent
UT W Fk Pigeon R, nr NC 215, Haywood	B-4	5-2	05/90	-/34	-/1.26	Excellent*
Tom Cr, nr NC 215, Haywood	B-5	5-2-5	12/91	-/35	-/1.52	Excellent*
			07/91	-/39	-/1.73	Excellent*
M Pr W Fk Pigeon R, at mouth, Haywood	B-6	5-2-7	07/91	-/39	-/1.55	Excellent
			04/91	-/42	-/1.40	Excellent
			05/90	-/42	-/1.70	Excellent
R Pr M Pr W Fk Pigeon R, Haywood	B-7	5-2-7-7	12/91	-/36	-/1.75	Excellent
			07/91	-/34	-/1.65	Excellent
			04/91	-/42	-/1.37	Excellent
			05/90	-/36	-/1.50	Excellent
UT Little E Fk Pigeon R, nr Shining Rock, Hay.	B-8	5-2-12-(0.5)	04/91	-/38	-/1.45	Excellent*
Little E Fk Pigeon R, SR 1129 ab camp, Haywood	B-9	5-2-12-(5.5)	04/91	-/51	-/1.50	Excellent
E Fk Pigeon R, US 276, nr Cruso, Haywood	B-10	5-3-(6.5)	07/97	109/50	3.31/2.13	Excellent
			07/84	87/39	3.96/2.39	Excellent
Pigeon R, SR 1642 at Clyde, Haywood	B-11	5-(7)	07/97	79/25	5.79/4.03	Good-Fair
			09/95	44/16	5.78/5.20	Fair
			08/94	44/13	5.88/4.88	Fair
			08/92	63/16	6.70/4.27	Fair
			09/89	47/7	6.70/4.39	Poor
			08/88	31/4	7.83/5.19	Poor
			02/88	51/12	6.82/4.52	Poor
			07/86	34/2	8.23/3.59	Poor
			08/84	39/5	7.63/4.89	Poor
Pigeon R, SR 1625, be Richland Cr, Haywood	B-12	5-(7)	08/94	54/16	5.92/4.62	Fair
Pigeon R, at Crabtree Cr nr Crabtree, Haywood	B-13	5-(7)	02/88	53/16	6.13/3.97	Fair

FBR 05 (con't)

Site	Site #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Pigeon R, SR 1338 nr Hepco, Haywood	B-14	5-(7)	07/97	78/27	5.23/3.85	Good-Fair
			08/94	57/22	5.08/4.29	Good-Fair
			08/88	49/14	5.95/3.84	Fair
			02/88	46/24	4.79/3.76	Good-Fair
Pigeon R, at Counterfeit Br, Haywood	B-15	5-(7)	04/92	94/43	4.26/2.77	Good
			03/92	77/41	4.02/2.85	Good-Fair
Pigeon R, at Hurricane Cr, Haywood	B-16	5-(7)	04/92	74/28	5.69/4.42	Good-Fair
			03/92	74/30	5.52/3.68	Good-Fair
Pigeon R, off I-40, at Waterville, Haywood	B-17	5-(7)	07/97	81/40	4.51/2.77	Good
			08/94	58/27	4.10/3.26	Good
			07/90	57/22	4.57/3.75	Good-Fair
			07/89	62/28	5.01/3.91	Good-Fair
			08/88	67/24	4.67/3.25	Good-Fair
			08/87	58/25	4.88/3.51	Good-Fair
			07/86	67/28	4.61/3.74	Good-Fair
			08/85	57/17	5.67/3.64	Fair
			08/84	68/30	4.56/3.21	Good
			08/83	66/24	5.29/3.39	Good-Fair
Rough Cr, nr SR 1616, Haywood	B-18	5-8-4-(1)	09/97	-/29	-/1.22	Excellent*
Richland Cr, SR 1184 at Waynesville, Haywood	B-19	5-16-(1)	07/97	-/24	-/3.22	Good-Fair
			08/92	-/26	-/3.38	Good-Fair
			08/88	42/11	6.07/4.87	Fair
			08/85	28/9	5.89/3.54	Poor
			08/83	42/9	7.15/3.70	Poor
Richland Cr, US 23-Bus ab Dayco Corp, Haywood	B-20	5-16-(1)	07/97	-/23	-/2.79	Good-Fair
			08/92	-/17	-/3.51	Fair
Hyatt Cr, SR 1159, Haywood	B-21	5-16-6	04/84	41/17	5.44/3.68	Fair
Hyatt Cr, SR 1159, Haywood	B-22	5-16-6	04/84	30/10	6.20/3.82	Poor
Shiny Cr, ab Allen Res., Haywood	B-23	5-16-7-3	07/97	-/43	-/1.30	Excellent
Rocky Br, SR 1219, Haywood	B-24	5-16-7-9	12/91	-/35	-/1.38	Excellent*
Richland Cr, SR 1519, Haywood	B-25	5-16-(16)	07/97	-/15	-/4.42	Fair
			08/92	-/14	-/4.47	Fair
Jonathans Cr, SR 1306, Haywood	B-26	5-26-(7)	07/97	-/46	-/1.50	Excellent
			08/92	-/41	-/1.85	Excellent
Jonathans Cr, SR 1322, Haywood	B-27	5-26-(7)	07/97	-/41	-/2.67	Excellent
			08/92	-/33	-/3.30	Good
Jonathans Cr, SR 1349, Haywood	B-28	5-26-(7)	07/97	-/39	-/3.11	Excellent
			08/92	-/23	-/3.70	Good-Fair
Fines Cr, SR 1355 nr I-40, Haywood	B-29	5-32	07/97	-/27	-/2.63	Good-Fair
			08/92	-/19	-/3.74	Good-Fair
Cataloochee Cr, SR 1395 (Gov. Rd), Haywood	B-30	5-41	07/97	102/50	2.56/1.55	Excellent
			08/92	84/42	2.93/1.83	Excellent
			07/91	80/48	2.57/1.84	Excellent
			10/90	86/47	2.60/1.73	Excellent
			07/90	95/51	2.97/1.73	Excellent
			04/90	86/56	2.191.82	Excellent
			01/90	85/51	2.21/1.80	Excellent
			07/89	101/53	2.85/1.76	Excellent
			07/86	102/47	3.38/1.95	Excellent
			08/84	96/42	3.16/1.72	Excellent
Cataloochee Cr, nr SR 1395 ab Palmer Cr, Hay.	B-31	5-41	01/90	-/45	-/1.52	Excellent
UT Rough Br, nr SR 1395, Haywood	B-32	5-41-1	04/91	-/47	-/1.66	Excellent*
Palmer Cr, nr SR 1395, Haywood	B-33	5-41-2	04/91	-/46	-/1.51	Excellent
Pretty Hollow Cr, nr SR 1395, Haywood	B-34	5-41-2-4	04/91	-/47	-/1.46	Excellent
Lower Double Br, ab Cataloochee Cr nr Gov. Rd., Haywood	B-35	5-41-6	10/90	63/37	2.64/1.48	Excellent*
			07/90	54/31	2.81/1.73	Excellent*
			04/90	57/36	2.09/1.41	Excellent*
			01/90	57/36	1.84/1.31	Excellent*
Little Cataloochee Cr, SR 1397, Haywood	B-36	5-41-10	01/90	-/40	-/1.95	Excellent

* Classified with small-stream criteria (expect lower EPT values)

FBR 06

Site	DWQ #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Cold Springs Cr, Gov't. Rd nr cmpg, Haywood	B-37	5-45	04/92	84/48	2.75/1.98	Excellent
			03/92	78/45	2.73/1.71	Excellent
Big Cr, in GSMNP, ab campground, Haywood	B-38	5-59	07/97	-/47	-/1.38	Excellent
Nolichucky R, SR 1321 nr Poplar, Mitchell	B-1	7	07/97	72/38	3.87/3.47	Excellent
			07/92	88/42	4.14/3.37	Good
			07/90	83/38	4.31/3.27	Good
			08/88	93/35	4.86/3.81	Good
			07/86	84/37	4.86/3.57	Good
			08/85	72/28	4.63/3.36	Good
			08/84	68/31	4.47/3.73	Good
			08/83	78/34	4.55/3.86	Good
North Toe R, bel Brushy Cr, Avery	B-2	7-2-(0.5)	02/89	59/35	4.01/2.68	Good
North Toe R, US 19E at Ingalls, Avery	B-3	7-2-(0.5)	07/97	72/42	3.80/3.21	Excellent
			07/92	99/41	4.13/3.01	Good
			08/89	93/34	4.28/3.48	Good
			02/89	58/29	4.45/3.14	Good
			08/88	-/34	-/2.83	Good
			08/87	92/38	4.58/3.23	Good
			09/85	85/35	4.78/3.33	Good
			08/84	84/36	4.15/2.93	Good
Jones Cr, SR 1100, Avery	B-4	7-2-24	09/85	75/29	3.67/2.27	Good
Brushy Cr, SR 1101 ab landfill, Avery	B-5	7-2-29	02/89	-/27	-/2.36	Good-Fair
Brushy Cr, SR 1101 bel landfill, Avery	B-6	7-2-29	02/89	-/24	-/3.40	Good-Fair
North Toe R, SR 1162 at Penland, Mitchell	B-7	7-2-(38.5)	07/97	70/34	4.62/3.49	Good
			07/92	78/23	5.14/2.98	Good-Fair
			08/89	63/24	5.49/3.27	Good-Fair
			08/88	-/10	-/2.88	Poor
			08/87	62/20	5.97/3.68	Fair
			07/86	70/22	5.89/3.59	Fair
			09/85	46/12	6.20/3.67	Fair
			08/84	63/22	5.36/3.27	Good-Fair
North Toe R, SR 1121 ab Feldspar, Mitchell	B-8	7-2-(38.5)	09/85	77/32	4.94/3.64	Good-Fair
North Toe R, NC 226 bel Feldspar, Mitchell	B-9	7-2-(38.5)	09/85	62/23	5.40/4.01	Good-Fair
North Toe R, SR 1551, Mitchell	B-10	7-2-(38.5)	08/85	61/17	6.29/3.85	Fair
North Toe R be Indusmin, Mitchell	B-11	7-2-(38.5)	09/85	50/18	5.70/3.45	Fair
North Toe R, SR 1314 at Loafers Glory, Yancey	B-12	7-2-(38.5)	07/97	74/40	4.38/3.88	Good
			07/92	92/40	4.65/3.87	Good
Little Bear Cr, nr NC 226 ab IMC Corp, Mitch.	B-13	7-2-46-1	09/85	31/8	4.74/2.76	Fair
Little Bear Cr, bel IMC Corp., Mitchell	B-14	7-2-46-1	09/85	9/2	7.59/4.29	Poor
Big Crabtree Cr, SR 1002, Mitchell	B-15	7-2-48	07/92	-/32	-/2.06	Good
Big Crabtree Cr, off US 19E, Mitchell	B-16	7-2-48	07/97	-/40	-/2.24	Excellent
South Toe R, ab SR 1205, Yancey	B-17	7-2-52-(1)	01/96	56/44	1.91/1.50	Excellent
South Toe R, bel SR 1205, Yancey	B-18	7-2-52-(1)	01/96	43/35	1.84/1.55	Excellent
South Toe R, SR 1168, Yancey	B-19	7-2-52-(1)	01/96	71/48	2.15/1.72	Excellent
South Toe R, ab NC 80, Yancey	B-20	7-2-52-(1)	01/91	-/51	-/2.01	Excellent
			06/90	-/41	-/2.05	Excellent
South Toe R, be NC 80, Yancey	B-21	7-2-52-(1)	01/91	-/44	-/1.70	Good
			06/90	-/46	-/2.12	Excellent
South Toe R, SR 1167 at Celo, Yancey	B-22	7-2-52-(1)	07/97	82/40	3.09/2.29	Excellent
			07/92	102/48	3.43/2.44	Excellent
			08/88	113/48	4.02/2.73	Excellent
			08/85	99/42	3.85/2.96	Excellent
			08/83	100/41	4.12/2.92	Good
Big Rock Cr, NC 197, Mitchell	B-23	7-2-64	07/97	-/34	-/2.38	Good
			07/92	-/44	-/2.73	Excellent

FBR 07

Site	DWQ #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Cane R, US 19W at Ramseytown nr Sioux,Yancey	B-1	7-3	07/97	84/46	4.19/3.34	Excellent
			07/92	94/49	4.37/3.44	Excellent

FBR 07 (con't)

Site	DWQ #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
			08/89	81/37	4.57/3.84	Good
			08/87	77/34	4.71/3.75	Good
			08/85	62/23	5.23/3.65	Good-Fair
			08/83	70/27	5.35/4.05	Good-Fair
Cattail Cr, SR 1102, Yancey	B-2	7-3-9	01/96	39/26	2.25/1. 51	Good
Bald Mt Cr, SR 1408, Yancey	B-3	7-3-32	07/97	-/32	-/2.24	Good
			07/92	-/26	-/3.50	Good-Fair

Appendix A-II Fish Community Assessments

Sampling Methods

At each sample site, a 200-meter section of stream was selected and measured. The fish in the designated stretch of stream were then collected using two backpack electrofishing units. After collection, all readily identifiable fish (usually sport fishes, catfishes and suckers) were examined for sores, lesions, fin damage and skeletal anomalies, measured (total length to the nearest 1 mm), and then released. The remaining fish (i.e., those fish that were not readily identifiable) were preserved in 10% formalin and returned to the laboratory for identification, examination and total length measurement. Young-of-year fish were excluded from all analyses. The resulting data were then analyzed with the North Carolina Index of Biotic Integrity (NCIBI).

NCIBI Analysis

The assessment of biological integrity using the NCIBI is provided by the cumulative assessment of 12 parameters or metrics. The values provided by the metrics are converted into scores on a 1, 3 or 5 scale. A score of 5 represents conditions which would be expected for relatively undisturbed streams in the specific river basin or ecoregion, while a score of 1 indicates that the conditions deviate greatly from those expected in undisturbed streams of the region. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Finally, the score (an even number between 12 and 60) is then used to determine the ecological integrity class, as proposed by Karr (1981), of the stream from which the sample was collected Table A-II-1).

Table A-II-1 Scores, Integrity Class and Class Attributes for Evaluating a Wadeable Stream Using the North Carolina Index of Biotic Integrity

NCIBI Scores	Karr's Integrity Classes	Class Attributes[1]
58 or 60	Excellent	Comparable to the best situations without human disturbance. All regionally expected species for the habitat and stream size, including the most intolerant forms are present, along with a full array of size classes and a balanced trophic structure.
54 or 56	Good-Excellent	
48, 50, or 52	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant species; some species are present with less than optimal abundances or size distributions; and the trophic structure shows some signs of stress.
46	Fair-Good	
40, 42, or 44	Fair	Signs of additional deterioration include the loss of intolerant species, fewer species, and a highly skewed trophic structure.
36 or 38	Poor-Fair	
28, 30, 32, or 34	Poor	Dominated by omnivores, tolerant species, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; and diseased fish often present.
24 or 26	Very Poor-Poor	
12, 14, 16, 18, 20, or 22	Very Poor	Few fish present, mostly introduced or tolerant species; and disease fin damage and other anomalies are regular.
-----	No fish	Repeated sampling finds no fish.

[1] Over-lapping classes share attributes with classes greater than and less than the respective NCIBI score.

The NCIBI has been revised since the initial French Broad River basinwide monitoring was conducted in 1992 and 1993 (NCDEHNR, 1994). The focus of using and applying the NCIBI is now restricted to wadeable streams that can be sampled by a crew of four persons and following the DWQ Standard Operating Procedures (NCDEHNR, 1997). Further refinements have been made to the number of fish, species and pool dwelling species as functions of a stream's watershed size (Metrics 1, 2 and 4), tolerance rankings (Metrics 6 and 7), trophic guild classifications (Metrics 8-10), and percentage of species with multiple age groups (Metric 12).

These refinements in the metrics and classification scheme resulted in substantial changes in the French Broad River basin fish community assessments previously reported in NCDEHNR (1994). For example, for the 15 wadeable stream sites monitored in 1992-1993, the NCIBI scores decreased by 4-14 units as shown in Table A-II-2.

Table A-II-2 Differences in Scoring of NCIBI as Previously Reported in Versus Current Score

	Old	New
Site	**NCIBI Score**	**NCIBI Score**
Hominy Creek	48	44
South Hominy Creek	48	38
Swannanoa River	46	34
Reems Creek	56	50
Sandymush Creek	52	40
Boylston Creek	44	38
Mills River - SR 1337 - 1993	54	48
Mills River - SR 1337 - 1994	58	44
Mills River - SR 1353	56	46
Big Ivy Creek	58	48
Ivy River	52	40
Shelton Laurel Creek	50	42
Richland Creek - Bus. US 23	42	36
Richland Creek - SR 1184	38	32
Jonathans Creek	50	40

In an effort to simplify and standardize the evaluation of a stream's ecological integrity and water quality bioclassification, whether using a fish community or benthic invertebrate assessment, the fish community integrity classes were also modified. The revised scores and classes for evaluating the fish community of a wadeable stream using the North Carolina Index of Biotic Integrity were also modified (Table A-II-3).

Table A-II-3 Revised Scores and Classes for Evaluating the Fish Community of a Wadeable Stream Using the NCIBI

NCIBI Scores	NCIBI Classes
56-60	Excellent
50-54	Good
44-48	Good-Fair
38-42	Fair
< 36	Poor

Even though NCIBI classes are given in this appendix, NCIBI scores only are given in the report, so that the data will not be used for use support evaluations. One primary reason for this are that many of the streams sampled in the French Broad basin had high numbers of trout with corresponding low NCIBI scores and should not be rated. The second reason is that a survey of mountain reference streams in September 1998 found that none of the streams sampled could achieve the Excellent NCIBI class expected at such sites. A review of the revisions made to the metrics will be done, and metrics will be further modified to allow reference sites to reflect an Excellent NCIBI class.

The same warning should be applied to the TVA classes as shown later. Many of their Poor streams had a high number of trout and would not be rated using the NCIBI. Overall, the TVA data suggest fish community problems throughout the basin, which is in disagreement with DWQ benthos and other data.

TVA fishery biologists sampled the fish communities at 44 sites within the river basin in 1997 and applied their version of the Index of Biotic Integrity (TVA, 1995). Some of the TVA metrics are different than the NCIBI metrics although the scoring and integrity classes are similar to those found in Table A-II-1. The watershed sizes for these 44 monitored streams ranged across two order of magnitude from 15.8 (Little Crabtree Creek in Yancey County) to 1,565 mi^2 (French Broad River in Madison County); the median watershed size was 65.3 mi^2. The TVA IBI scores and IBI classifications ranged from 26 to 54 and from Very Poor-Poor to Good-Excellent.

Eight of the streams monitored in 1997 by the NCDWQ were also monitored by the TVA. These streams were sampled at either the same bridge crossing or the watersheds of a specific stream at the two sample sites differed by less than 8 mi^2 (e.g., Richland Creek). The TVA classification system (Table A-II-1) was adjusted to the NCDWQ classification system (Table A-II-3) to compare the two methods in their ability to assess the same fish community (Table A-II-4). The number of fish and the number of native species collected per site and the catch per unit effort were all positively correlated between the TVA and NCDWQ methods (Pearson product moment correlations = r = 0.750, 0.822 and 0.477, respectively). The differences in scores ranged from 8 lower for TVA at Flat Creek to 10 higher for TVA at Newfound Creek. There was no consistent pattern to the differences between TVA and DWQ scores.

Table A-II-4 A Comparison of Fish Community Scores by TVA and DWQ Index of Biological Integrity, French Broad River Basin, 1997 [1]

Stream	TVA IBI Score	TVA IBI Class	NCDWQ Equivalent IBI Class	NCDWQ IBI Score	IBI Score Difference
Cane Creek	46	Fair-Good	Good-Fair	46	0
Flat Creek	42	Fair	Fair	50	-8
Ivy Creek	52	Good	Good	50	+2
Jonathan Creek	36	Poor-Fair	Poor	42	-6
Mills River	48	Good	Good-Fair	46	+2
Newfound Creek	40	Fair	Fair	30	+10
Richland Creek	30	Poor	Poor	32	-2
South Hominy Creek	44	Fair	Good-Fair	40	+4

[1] The data from the two Reems Creek sites were not included. Although the watersheds differed by only 4.3 mi^2, the two sites differed too greatly in their instream physical characteristics and stream gradients to compare.

Appendix A-II Fish Community Assessments in the French Broad River Basin, 1992-1997

Stream	Road	County	Map F#	Index #	D.A. (mi^2)	Date	NCIBI Score
Subbasin 040301							
W Fk French Broad R	SR 1309	Transylvania	1	6-2-(7.5)	18.8	10/23/97	36
Little R	SR 1533	Transylvania	2	6-38-(20)	60.1	10/23/97	44
Subbasin 040302							
Mud Cr	SR 1647	Henderson	1	6-55-(1)	23.6	09/16/97	36
Bat Fork	SR 1779	Henderson	2	6-55-8-1	6	09/16/97	38
Cane Cr	US 25	Henderson	3	6-57-(9)	82.1	09/16/97	46
Hominy Cr	NC 151	Buncombe	4	6-76	30.2	09/17/97	42
						07/23/92	44
S Hominy Cr	NC 151	Buncombe	5	6-76-5	38.3	04/09/97	38
						07/23/92	38
Swannanoa R	SR 2435	Buncombe	6	6-78	62.7	09/19/97	38
	US 25	Buncombe	7	6-78	130	06/28/93	34
Beetree Cr	SR 2427	Buncombe	8	6-78-15-(6)	9.3	06/25/97	36
Newfound Cr	SR 1641	Buncombe	9	6-84	34.2	04/09/97	30
Reems Cr	NC 251	Buncombe	10	6-87-(10)	36.3	09/17/97	48
						11/17/93	50
Flat Cr	SR 1742	Buncombe	11	6-88	24.5	04/10/97	50
Sandymush Cr	SR 1107	Madison	12	6-92-(9)	79.5	09/17/97	42
						11/16/93	40
Subbasin 040303							
Boylston Cr	SR 1314	Henderson	1	6-52-(10.5)	15.3	09/15/97	46
						07/23/92	38
Mills R	SR 1337	Henderson	2	6-54-(1)	66.7	09/15/97	44
						10/19/94	44
						06/29/93	48
	SR 1353	Henderson	3	6-54-(5)	73	10/19/94	46
Subbasin 040304							
Ivy Cr (River)	SR 2150	Buncombe	1	6-96-(0.5)	60	09/18/97	50
						11/17/93	48
Ivy Cr (River)	US 25/70	Madison	2	6-99-(11.7)	161	11/16/93	40
Big Laurel Cr	NC 208	Madison	3	6-112	75	09/18/97	42
Shelton Laurel Cr	NC 208	Madison	4	6-112-26	40	06/03/97	48
						07/24/92	42
Subbasin 040305							
Richland Cr	US 23	Haywood	1	5-16-(1)	13.2	07/23/92	36
	SR 1184	Haywood	2	5-16-(1)	58	07/23/92	32
	Walnut Trail	Haywood	3	5-16-(16)	64.7	10/22/97	32
Crabtree Cr	NC 209	Haywood	4	5-22	25.8	06/03/97	32
Jonathan Cr	US 276	Haywood	5	5-26-(7)	55.8	10/22/97	42
						11/16/93	40
Fines Cr	SR 1355	Haywood	6	5-32	27.2	10/22/97	42
Subbasin 040306							
N Toe River	SR 1121	Avery	1	7-2-(0.5)	29.5	06/23/97	48
Big Crabtree Cr	SR 1002	Mitchell	2	7-2-48	16.4	06/24/97	54
Cane Cr	SR 1211	Mitchell	3	7-2-59	16.2	06/24/97	40
Jacks Cr	SR 1337	Yancey	4	7-2-63	20.2	10/20/97	40
Pigeonroost Cr	SR 1349	Mitchell	5	7-2-69	14.1	10/20/97	50
Subbasin 040307							
Price Cr	SR 1126	Yancey	1	7-3-21	22.1	10/21/97	46
Bald Mountain Cr	SR 1408	Yancey	2	7-3-32	15	10/21/97	40

[1] The NCIBI Classifications are: G = Good, G-F = Good-Fair, F = Fair, P = Poor, and NR = Not Rated.

Appendix A-II Fish Community Assessments Conducted by the Tennessee Valley Authority in the French Broad River Basin, 1997

Subbasin	Stream	Road	County	D.A. (mi^2)	Date	TVA IBI Score	TVA IBI Class	NCDWQ Equivalent Class
040301	French Broad R	US 178	Transylvania	67.9	07/15/97	50	Good	Good
	Little R	SR 1536	Transylvania	43.2	08/13/97	54	Good-Excellent	Good
040302	Clear Cr	SR 1513	Henderson	41.2	06/24/97	42	Fair	Fair
	Mud Cr	SR 1508	Henderson	52.1	06/24/97	36	Poor-Fair	Poor
	Mud Cr	US 25	Henderson	110	04/16/97	36	Poor-Fair	Poor
	Cane Cr	US 25	Henderson	82.4	04/17/97	46	Fair-Good	Good-Fair
	French Broad R	SR 3495	Buncombe	652	07/16/97	42	Fair	Fair
	Hominy Cr	NC 191	Buncombe	104	04/16/97	44	Fair	Good-Fair
	South Hominy Cr	NC 151	Buncombe	38.3	04/09/97	44	Fair	Good-Fair
	Swannanoa R	US 25	Buncombe	130	04/15/97	42	Fair	Fair
	Flat Cr	SR 1742	Buncombe	24.5	04/10/97	42	Fair	Fair
	Reems Cr	SR 1740	Buncombe	32	04/09/97	26	Very Poor-Poor	Poor
	French Broad R	SR 1348	Buncombe	945	07/28/97	42	Fair	Fair
	Newfound Cr	SR 1641	Buncombe	34.2	04/07/97	40	Fair	Fair
	Sandymush Cr	SR 1629	Madison	47	04/08/97	44	Fair	Good-Fair
040303	Mills R	SR 1353	Henderson	75	04/17/97	48	Good	Good-Fair
	Davidson R	US 276	Transylvania	48	06/11/97	46	Fair-Good	Good-Fair
040304	French Broad R	SR 1001	Madison	1339	07/29/97	46	Fair-Good	Good-Fair
	Ivy Cr	SR 2150	Buncombe	59.5	06/26/97	52	Good	Good
	Ivy Cr	Bus US 25/70	Madison	160	06/12/97	46	Fair-Good	Good-Fair
	Little Ivy Cr	SR 1610	Madison	45.9	06/25/97	46	Fair-Good	Good-Fair
	French Broad R	NC 209	Madison	1565	07/30/97	44	Fair	Good-Fair
	Spring Cr	NC 209	Madison	71	04/21/97	36	Poor-Fair	Poor
	Big Laurel Cr	NC 208	Madison	127.5	04/22/97	44	Fair	Good-Fair
	Shelton Laurel Cr	NC 208	Madison	53	07/07/97	48	Good	Good-Fair
040305	E Fk Pigeon R	US 276	Haywood	44.8	07/09/97	32	Poor	Poor
	W Fk Pigeon R	NC 215	Haywood	33.9	07/17/97	44	Fair	Good-Fair
	Pigeon R	NC 215	Haywood	132	07/23/97	48	Good	Good-Fair
	Pigeon R	SR 1642	Haywood	168	07/22/97	38	Poor-Fair	Fair
	Pigeon R	SR 1338	Haywood	381	07/21/97	34	Poor	Poor
	Big Cr	SR 1332	Haywood	36.5	08/04/97	28	Poor	Poor
	Jonathan Cr	SR 1338	Haywood	65.3	07/08/97	36	Poor-Fair	Poor
	Richland Cr	SR 1184	Haywood	60	04/15/97	30	Poor	Poor
040306	North Toe R	NC 80	Yancey	180	08/05/97	40	Fair	Fair
	North Toe R	SR 1314	Mitchell	282	08/14/97	40	Fair	Fair
	North Toe R	SR 1336	Yancey	295	08/15/97	48	Good	Good-Fair
	South Toe R	NC 80	Yancey	60.8	08/04/97	48	Good	Good-Fair
	Little Crabtree Cr	US 19E	Yancey	15.8	08/06/97	44	Fair	Good-Fair
	Cane Cr	NC 80	Mitchell	27.1	06/05/97	32	Poor	Poor
	Big Rock Cr	NC 197	Mitchell	62.7	08/05/97	50	Good	Good
040307	Cane R	US 19E	Yancey	61	06/04/97	44	Fair	Good-Fair
	Cane R	US 19W	Yancey	117	08/07/97	40	Fair	Fair
	Cane R	US 19W	Yancey	145	06/24/97	46	Fair-Good	Good-Fair
	Nolichucky R	SR 1321	Mitchell	608	08/13/97	50	Good	Good

Appendix A-II Fish Tissue Criteria

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with Federal Food and Drug Administration (FDA) action levels, US Environmental Protection Agency (EPA) recommended screening values, and criteria adopted by the North Carolina State Health Director.

The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs, and thus, employ a "safe level" approach to fish tissue consumption. A list of fish tissue analytes accompanied by their FDA criteria are presented below (USFDA, 1980). At present, the FDA has only developed metals criteria for mercury. Individual parameters which appear to be of potential human health concern are evaluated by the NC Division of Occupational and Environmental Epidemiology by request of the Water Quality Section.

In the guidance document, *Fish Sampling and Analysis: Volume 1* (USEPA, 1993), EPA has recommended screening values for target analytes which are formulated from a risk assessment procedure. These are the concentrations of analytes in edible fish tissue that are of potential public health concern. The DWQ compares fish tissue results with EPA screening values to evaluate the need for further intensive site-specific monitoring. A list of target analytes and EPA recommended screening values for the general adult population is presented below.

The North Carolina State Health Director has adopted a selenium limit of 5 ppm for issuing fish consumption advisories. Total DDT includes the sum of all its isomers and metabolites (i.e., p,p DDT, o,p DDT, DDE and DDD). Total chlordane includes the sum of cis-and trans- isomers as well as nonachlor and oxychlordane. Although the EPA has suggested a screening value of 7.0 x 10^{-7} ppm for dioxins, the State of North Carolina currently uses a value of 3.0 ppt (3 x 10^{-3}) in issuing fish consumption advisories.

Food and Drug Administration (FDA) Action Levels

		Metals	
	Mercury	1.0 ppm	
		Organics	
Aldrin	0.3 ppm	p,p DDE	5.0 ppm
Dieldrin	0.3 ppm	o,p DDT	5.0 ppm
Endrin	0.3 ppm	p,p DDT	5.0 ppm
o,p DDD	5.0 ppm	PCB-1254	2.0 ppm
p,p DDD	5.0 ppm	cis-chlordane	0.3 ppm
o,p DDE	5.0 ppm	trans-chlordane	0.3 ppm

Environmental Protection Agency (EPA) Screening Values

Metals

Cadmium	10.0 ppm
Mercury	0.6 ppm
Selenium	50.0 ppm

Organics

Chlorpyrifos	30.0 ppm	Heptachlor epoxide	0.01 ppm
Total chlordane	0.08 ppm	Hexachlorobenzene	0.07 ppm
Total DDT	0.3 ppm	Lindane	0.08 ppm
Dieldrin	0.007 ppm	Mirex	2.0 ppm
Dioxins	7.0×10^{-7} ppm	Total PCB's	0.01 ppm
Endosulfan (I and II)	20.0 ppm	Toxaphene	0.1 ppm
Endrin	3.0 ppm		

* *Total DDT includes the sum of all its isomers and metabolites (i.e., p,p DDT, o,p DDT, DDE and DDD). Total chlordane includes the sum of cis-and trans- isomers as well as nonachlor and oxychlordane.*

Lakes Assessment Program

Numerical indices are often used to evaluate the trophic state of lakes. An index was developed specifically for North Carolina lakes as part of the state's original Clean Lakes Classification Survey (NCDNRCD, 1982). The North Carolina Trophic State Index (NCTSI) is based on total phosphorus (TP in mg/l), total organic nitrogen (TON in mg/l), Secchi depth (SD in inches), and chlorophyll *a* (CHL in μg/l). Lakewide means for these parameters are used to produce a NCTSI score for each lake, using the following equations:

$$TON_{Score} = \frac{Log(TON) + 0.45}{0.24} \times 0.90$$

$$TP_{Score} = \frac{Log(TP) + 1.55}{0.35} \times 0.92$$

$$SD_{Score} = \frac{Log(SD) - 1.73}{0.35} \times -0.82$$

$$CHL_{Score} = \frac{Log(CHL) - 1.00}{0.48} \times 0.83$$

$$NCTSI = TON_{Score} + TP_{Score} + SD_{Score} + CHL_{Score}$$

In general, NCTSI scores relate to trophic classifications as follows: less than -2.0 is oligotrophic, -2.0 to 0.0 is mesotrophic, 0.0 to 5.0 is eutrophic, and greater than 5.0 is hypereutrophic. When scores border between classes, best professional judgment is used to assign an appropriate classification. NCTSI scores may be skewed by highly colored water

typical of dystrophic lakes. Some variation in the trophic state of a lake between years is not unusual due to the potential variability of data collections which usually involve sampling on a limited number of times during the growing season.

Two lakes were sampled for their potential of supporting algal blooms with the Algal Growth Potential Test (AGPT). The results of the Algal Growth Potential Test is discussed in the appropriate subbasin sections. The objective of the Algal Growth Potential Test is to assess a waterbody's potential for supporting algal biomass and to determine whether algal growth is limited by nitrogen, by phosphorus, or co-limited by both nutrients. When a waterbody supports algal growth at bloom levels without additional increases in nitrogen and/or phosphorus, the system may be subject to frequent nuisance algal blooms. The test exposes a standard alga, *Selenastrum capricornutum*, to the test water (this constitutes the control). Additional test samples are enriched with nitrogen or phosphorus. When one of these nutrients is added to a water sample which is growth limiting to that nutrient, the resulting mean standing crop (MSC) will generally reflect the level of added nutrient. In some cases, the bioavailable nitrogen and phosphorus in a sample may approach their optimum ratio for growth of the test alga and the addition of nutrients may not clearly identify the limiting nutrient. A waterbody may be protected from nuisance algal blooms if an AGPT value is consistently less than or equal to 5 mg/l.

References

Karr, J.R. 1981. *Assessment of Biotic Integrity Using Fish Communities*. Fisheries. 6:21-27.

NCDEHNR. 1997. *Standard Operating Procedures*. Biological Monitoring. Environmental Sciences Branch. Ecosystems Analysis Unit. Biological Assessment Group. North Carolina Department of Environment, Health and Natural Resources. Division of Water Quality. Water Quality Section. Raleigh, NC.

TVA. 1995. *Protocol for Conducting an Index of Integrity Biological Assessment, 1995 (Draft)*. Tennessee Valley Authority. Norris, TN.

Appendix III

Use Support Methodology
and
Use Support Ratings

Use Support: Definitions and Methodology

A. Introduction to Use Support

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses (*use support* status) is another important method of interpreting water quality data and assessing water quality. Use support assessments are presented in Section A, Chapter 3 and for each subbasin in Section B.

Surface waters (streams, lakes or estuaries) are rated as either *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are fully supported, partially supported or are not supported. For instance, waters classified for fishing and water contact recreation (Class C for freshwaters or SC for saltwaters) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of exceedence.

An additional use support category, fully supporting but threatened (ST), was used in previous 305(b) reports. In the past, ST was used to identify a water that was fully supporting but had some notable water quality problems. ST could represent constant, degrading or improving conditions. North Carolina's use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that are characterized by declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). In addition, the US EPA requires the inclusion of ST waters on the 303(d) list in its proposed revision to the 303(d) list rules (Federal Register, Vol. 64, No. 162, August 23, 1999). Due to the difference between US EPA's and North Carolina's definitions of ST, North Carolina no longer uses this term. Because North Carolina has used fully supporting but threatened as a subset of fully supporting (FS) waters, those waters formerly called ST are now rated FS.

Waters that are either partially supporting or not supporting are considered *impaired* and are rated based on specific criteria discussed more fully below. There must be a specified degree of degradation before a stream is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad. Waters which had no data to determine their use support were listed as not rated (NR).

B. Interpretation of Data

The assessment of water quality presented in this document involved evaluation of available water quality data to determine a waterbody's use support rating. In addition, an effort was made to determine likely causes (e.g., habitat degradation or nutrients) and sources (e.g., agriculture, urban runoff, point sources) of waterbody degradation. Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data and Division of

Environmental Health shellfish sanitation surveys (as appropriate). Although there is a general procedure for analyzing the data and determining a waterbody's use support rating, each waterbody is reviewed individually, and best professional judgment is applied during these determinations.

Interpretation of the use support ratings compiled by DWQ should be done with caution. The methodology used to determine the ratings must be understood, as should the purpose for which the ratings were generated. The intent of this use support assessment was to gain an overall picture of the water quality, to describe how well these waters support the uses for which they were classified, and to document the relative contribution made by different categories of pollution within the basin.

The data are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Since the assessment methodology is geared toward general conclusions, it is important not to manipulate the data to support policy decisions beyond the accuracy of these data.

C. Assessment Methodology – Freshwater Streams

Many types of information were used to determine use support assessments and to determine causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. In these files, stream segments are listed as individual records. All existing data pertaining to a stream segment are entered into its record. In determining the use support rating for a stream segment, corresponding ratings are assigned to data values where appropriate. The following data and the corresponding use support ratings are used in the process.

1. Biological Data

Benthic Macroinvertebrate Bioclassification

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPTs) and the Biotic Index (BI) which summarizes tolerance data for all taxa in each collection. The bioclassifications are translated to use support ratings as follows:

Bioclassification	Rating
Excellent	Fully Supporting
Good	Fully Supporting
Good-Fair	Fully Supporting
Fair	Partially Supporting
Poor	Not Supporting

Fish Community Structure

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The index incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. The index is translated to use support ratings as follows:

NCIBI	Rating
Excellent	Fully Supporting
Good	Fully Supporting
Good-Fair	Fully Supporting
Fair	Partially Supporting
Poor	Not Supporting

Phytoplankton and Algal Bloom Data

Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of alga may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. An algal sample with a biovolume larger than 5,000 mm3/m3, density greater than 10,000 units/ml, or chlorophyll *a* concentration approaching or exceeding 40 micrograms per liter (the NC state standard) constitutes a bloom. Best professional judgment is used on a case-by-case basis in evaluating how bloom data should be used to determine the use support rating of specific waters. The frequency, duration, spatial extent, severity of blooms, associated fish kills, or interference with recreation or water supply uses are all considered.

2. Chemical/Physical Data

Chemical/physical water quality data are collected through the Ambient Monitoring System as discussed in Section A, Chapter 3. These data are downloaded from the ambient database, the Surface Water Information Management System, to a desktop computer for analysis. Total number of samples and percent exceedences of the NC state standards are used for use support ratings. Percent exceedences correspond to use support ratings as follows:

Standards Violation*	Rating
Criterion exceeded ≤10%	Fully Supporting
Criterion exceeded 11-25%	Partially Supporting
Criterion exceeded >25%	Not Supporting

* Percentages are rounded to the nearest whole number. A minimum of ten samples is needed.

It is important to note that some waters may exhibit characteristics outside the appropriate standards due to natural conditions. These natural conditions do not constitute a violation of water quality standards.

Data for copper, iron and zinc are not used according to the percent excess scheme outlined above. Because these metals are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility and stream characteristics, they have *action level* standards. In order for an action level standard to be violated, there must be a toxicological test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc. Best professional judgement is used to determine which streams have metal concentrations at potentially problematic levels. Streams with high metal concentrations are evaluated for toxicity, and they may be rated as PS or NS if toxicity tests or biomonitoring (e.g., benthic macroinvertebrate communities) indicate problematic metal levels.

Fecal coliform bacteria data are not used alone to determine a partially or not supporting rating. The geometric mean is calculated using monthly samples, and if the geometric mean is above 200 colonies per 100 ml, fecal coliform bacteria are listed as a problem parameter. Because North Carolina's fecal coliform bacteria standard is 200 colonies per 100 ml for the geometric mean of *five samples taken in a thirty-day period*, fecal coliform bacteria are listed as a cause of impairment for the 303(d) list only when the standard is exceeded.

3. Source and Cause Data

In addition to the above data, existing information is documented for potential sources and causes of stream degradation. It is important to note that not all impaired waterbodies have sources and/or causes listed for them. Additionally, fully supporting waterbodies may have sources and/or causes of stream degradation as well. Staff and resources do not currently exist to collect this level of information for all waterbodies. Much of this information is obtained through the cooperation of other agencies (federal, state and local), organizations and citizens.

Point Source Data

Whole Effluent Toxicity Data: Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Streams that receive a discharge from a facility that has failed its whole effluent toxicity tests may have that facility listed as a potential source of pollution.

Daily Monitoring Reports: Streams which receive a discharge from a facility significantly out of compliance with permit limits may have that facility listed as a potential source of pollution.

Nonpoint Source Data

Nonpoint sources of pollution (i.e., agriculture, urban and construction) are identified by monitoring staff, other agencies (federal, state and local), land use reviews, and public workshops.

Problem Parameters

Causes of stream degradation (problem parameters), such as habitat degradation and low dissolved oxygen, are also identified for specific stream segments where possible. For streams

with ambient water quality stations, those parameters which exceed the water quality standard ≥11 percent of the time for the review period are listed as a problem parameter. Zinc, copper and iron are listed as problem parameters if levels are high enough to impact the biological community (see *Physical/Chemical Data* section). Fecal coliform bacteria are listed as a problem parameter if the geometric mean is greater than 200 colonies per 100 ml. For segments without ambient stations, information from reports, other agencies and monitoring staff is used if available.

Habitat degradation is identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, streambed scour, lack of riparian vegetation, loss of pools or riffles, and loss of woody habitat.

4. Outside Data

DWQ actively solicits outside data and information. Data from outside DWQ, such as USGS ambient monitoring data, volunteer monitoring data, and data from academic researchers, are screened for data quality and quantity. If data are of sufficient quality and quantity, they are incorporated into use support assessments. A minimum of ten samples over a period of two years is needed to be considered for use support assessments. The way the data are used depends on the degree of confidence DWQ staff have in the data. Data of the highest quality are used in the same fashion as DWQ data to determine use support ratings. Data with lower quality assurance may be used to pinpoint causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream from a DWQ monitoring location. The locations of DWQ biological and ambient monitoring sites may be adjusted where outside data indicate a potential problem.

5. Monitored vs. Evaluated

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information that was available. Because a monitored rating is based on more recent and site-specific data, it is treated with more confidence than an evaluated rating.

Refer to the following summary for an overview of assigning use support ratings.

Summary of Basis for Assigning Use Support Ratings to Freshwater Streams		
Overall Basis	**Specific Basis**	**Description**
Monitored	Monitored (M)	Monitored stream segments[1] with data[2] <5[3] years old.
	Monitored/Evaluated (ME)	Stream segment[1] is unmonitored but is assigned a use support rating based on another segment of same stream for which data[2] <5[3] years old are available.
Evaluated	Evaluated (E)	Unmonitored streams that are direct or indirect tributaries to stream segments rated FS.
	Evaluated/Old Data (ED)	Monitored stream segments[1] with available data[2] >5[3] years old.
Not Rated	Not Rated (NR)	No data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.

[1] A stream segment is a stream, or a portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (index number).

[2] Major data sources include benthic macroinvertebrate bioclassifications, fish community structure (NCIBI), and chemical/physical monitoring data.

[3] From the year that basin monitoring was done.

6. Assigning Use Support Ratings to Freshwater Streams

At the beginning of each assessment, all data are reviewed by subbasin with the monitoring staff. Discrepancies between data sources are resolved during this phase of the process. For example, a stream may be sampled for both benthic and fish community structure, and the benthic bioclassification may differ from the NCIBI (i.e., the bioclassification may be FS while the NCIBI may be NS). To resolve this, the final rating may defer to one of the samples (resulting in FS or NS), or it may be a compromise between both of the samples (resulting in PS).

After reviewing the existing data, use support ratings are assigned to the streams. If one data source exists for the stream, the rating is assigned based on the translation of the data value as discussed above. If more than one source of data exists for a stream, the rating is assigned according to the following hierarchy:

Benthic Bioclassification/Fish Community Structure
Chemical/Physical Data
Monitoring Data >5 years old
Compliance/Toxicity Data

This is only a general guideline for assigning use support ratings and not meant to be restrictive. Each segment is reviewed individually, and the resulting rating may vary from this process based on best professional judgment, which takes into consideration site specific conditions.

After assigning ratings to streams with existing data, streams with no existing data are assessed. Streams that are direct or indirect tributaries to streams rated FS receive the same rating (with an evaluated basis) if they have no known significant impacts, based on a review of the watershed

characteristics and discharge information. Streams that are direct or indirect tributaries to streams rated PS or NS, or that have no data, are assigned a NR rating.

D. Assessment Methodology – Lakes

The complex and dynamic ecosystem interactions that link chemical and physical water quality parameters and biological response variables must be considered when evaluating use support. In general, North Carolina assesses use support by determining if a lake's *uses*, such as water supply, fishing and recreation, are met; violations of water quality standards are not equated with use impairment unless uses are not met. In following this approach, use support for agriculture, aquatic life propagation, maintenance of biological integrity, wildlife, recreation and water supply can be holistically evaluated.

Nutrient enrichment, or eutrophication, is one of the main causes of lake impairment. Several water quality variables may help to describe the level of eutrophication. These include pH, chlorophyll *a*, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases, and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

North Carolina does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*). Likewise, North Carolina does not depend on a fixed index composed of several water quality variables, which do not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. The weight of evidence approach is most appropriate to determine use support in terms of nutrient enrichment in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll *a*)
- third party reports
- analysis of water quality complaints
- algal bloom reports
- macrophyte observations
- reports from water treatment plant operators
- reports from lake associations
- fish kill reports
- taste and odor observations
- aesthetic complaints
- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission

E. Assessment Methodology – Estuaries

Estuarine waters are delineated according to Division of Environmental Health (DEH) shellfish management areas (e.g., Outer Banks, Area H-5) for use support assessment (for map of shellfish management areas, see 1996 305(b) report). As with the freshwater assessments, many types of information are used to determine use support ratings and to determine causes and sources of use support impairment for saltwater bodies. The following data sources are used when assessing estuarine areas:

1. DEH Sanitary Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Growing areas are sampled continuously and reevaluated every three years to determine if their classification is still applicable. Classifications are based on fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

- *Approved Area* - an area determined suitable for the harvesting of shellfish for direct market purposes.
- *Conditionally Approved-Open* - waters that are normally open to shellfish harvesting but are closed on a temporary basis in accordance with management plan criteria.
- *Conditionally Approved-Closed* - waters that are normally closed to shellfish harvesting but are open on a temporary basis in accordance with management plan criteria.
- *Restricted Area* - an area from which shellfish may be harvested only by permit and subjected to an approved depuration process or relayed to an approved area.
- *Prohibited Area* - an area unsuitable for the harvesting of shellfish for direct market purposes.

2. Chemical/Physical Data

Chemical/physical water quality data are collected monthly through the Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, to a desktop computer for analysis. The total number of samples and percent exceedences of the NC state standards are used for use support ratings (see methods for freshwater streams). Parameters are evaluated based on the salt waterbody classification and corresponding water quality standards.

Fecal coliform bacteria data from DWQ ambient monitoring are considered for SB and SC waters (saltwaters not classified by DWQ for shellfishing), but are not used alone to determine a partially or not supporting rating. The geometric mean is calculated using monthly samples, and if the geometric mean is above 200 colonies per 100 ml, fecal coliform bacteria are listed as a problem parameter. Because North Carolina's fecal coliform bacteria standard for SB and SC waters is 200 colonies per 100 ml for the geometric mean of *five samples taken in a thirty-day period*, fecal coliform bacteria are listed as a cause of impairment for the 303(d) list only when the standard is exceeded.

3. Phytoplankton and Algal Bloom Data

Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of algae may discolor the water or form visible mates on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. An algal sample with a biovolume larger than 5000 mm3/m3, density greater than 10,000 units/ml, or chlorophyll *a* concentrations approaching or exceeding 40 micrograms per liter (the NC standard) constitutes a bloom. Best professional judgment is used on a case-by-case basis in evaluating how bloom data should be used to determine the use support rating of specific waters. The frequency, duration, spatial extent, severity of blooms, associated fish kills, or interference with recreation or water supply uses are all considered.

4. Assigning Use Support Ratings to Estuarine Waters

Saltwaters are classified according to their best use. When assigning a use support rating, the waterbody's assigned classification is used with the above parameters to make a determination of use support. The following table describes how these factors are combined in use support determination.

DWQ Classification	DEH Shellfish Classification	Chemical/ Physical Data[1]
Fully Supporting		
SA	Approved or Conditionally Approved-Open	standard exceeded ≤10% of measurements
SB & C	Does not Apply	standard exceeded ≤10% of measurements
Partially Supporting		
SA	Prohibited[2], Restricted or Conditionally Approved-Closed	standard exceeded 11-25% of measurements
SB & SC	Does not Apply	standard exceeded 11-25% of measurements
Not Supporting		
SA	Prohibited[2] or Restricted	standard exceeded >25% of measurements
SB & SC	Does not Apply	standard exceeded >25% of measurements

[1] Percentages are rounded to the nearest whole number. A minimum of ten samples is needed.

[2] DEH classifies some SA waters as prohibited, because DEH does not sample them due to the absence of a shellfish resource. DEH is federally required to prohibit harvesting in such areas, although actual fecal coliform bacteria concentrations are unknown. These waters are not rated (NR) for use support.

It is important to note that DEH classifies <u>all</u> actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting, but different DWQ use classifications may be assigned to separate segments within DEH management areas. In determining use support, the DEH classifications and management strategies are only

applicable to those areas that DWQ has classified as SA (shellfish harvest waters). This will result in a difference of acreage between DEH areas classified as conditionally approved-closed, prohibited or restricted, and DWQ waterbodies rated as PS or NS. For example, if DEH classifies a 20-acre waterbody as prohibited, but only 10 acres have a DWQ use classification of SA, only those 10 acres classified as SA will be rated as partially supporting their uses based on DEH information. DWQ areas classified as SB and SC are rated using chemical/physical data, phytoplankton data, and algal bloom and fish kill data.

5. Cause and Source Data

See methods for freshwater streams.

6. Outside Data

See methods for freshwater streams.

F. Revisions to Methodology Since 1992-1993 305(b) Report

Three significant changes to use support methodology have been made since the 1992-1993 305(b) report pertaining to the use of older information and fish consumption advisories.

Methodology for determining use support has been revised to more accurately reflect water quality conditions. In the 1992-1993 305(b) report, information from older reports and workshops was included in making use support determinations. Streams assessed using this information were rated on an evaluated basis, because the reports were considered outdated, and the workshops relied on best professional judgment since actual monitoring data were not available. In place of these older reports and workshop information, DWQ is now relying more heavily on data from its expanded monitoring network. These changes resulted in a reduction in streams rated on an evaluated basis. The basinwide process allows for concentrating more resources on individual basins during the monitoring phase. See the discussion above for more information on how 'monitored' versus 'evaluated' is defined.

The rating fully supporting but threatened (ST) is no longer used. Instead, three categories are now used, including fully supporting (FS), partially supporting (PS) and not supporting (NS). Waters that are fully supporting but have some notable water quality problems are discussed in the subbasin chapters of the basinwide plan.

Mercury levels in surface waters are primarily related to increases in atmospheric mercury deposition from global/regional sources, rather than from local surface water discharges. As a result, fish consumption advisories due to mercury have been posted in many areas (primarily coastal areas) of the state. Waters with fish consumption advisories (mercury, dioxin, etc.) are no longer considered for use support determination. However, these waters will continue to appear on the 303(d) list, and management strategies will be developed for these waters as required by the Clean Water Act.

USE SUPPORT RATINGS FOR MONITORED STREAMS IN THE FRENCH BROAD RIVER BASIN. DRAFT, JANUARY 2000. NC DIVISION OF WATER QUALITY

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
FRENCH BROAD RIVER	From source to Nicholson Creek	40301	20.2	US Hwy 168; SR 1129 at Rosman (Transyl)	FS					E	FS	FS				M
West Fork French Broad River	From Transylvania Co SR-1312 to French Broad R	40301	4.8	NC 64; be M-B Industry, Transylvania Co.						E	FS	FS	habitat degradation	NP	road, trails	M
North Fork French Broad River	From Indian Creek to French Broad R.	40301	10.3	SR 1324; SR 1322, Transyl. Co.						E	FS	FS				M
Peter Weaver Creek	From Morgan Mill Cr. to French Broad River	40301	0.8	SR 1195, Transyl. Co.						F	PS	PS		P	trout farm	M
Morgan Mill Creek	From trout farm (US 64) to Peter Weaver Cr.	40301	0.3									PS		P	trout farm	ME
FRENCH BROAD RIVER	Nicholson Creek to the downstream side of the mouth of Gash Cr.	40301	19.2	at Blantyre, SR 1503	FS							FS				M
Little River	From Cascade Lake Dam to French Broad River	40301	4.8	SR 1533, Transyl.						G-F	FS	FS	habitat degradation, turb	NP	ag	M
Gash Creek	From source to French Broad R	40302	3.7	SR 1205, Henderson					P		NS	NS	habitat degradation	NP	non-urban development	M
FRENCH BROAD RIVER	From Gash Cr. To Mill Pond Cr.	40302	7.7									FS				ME
FRENCH BROAD RIVER	From Mill Pond Cr. To 0.6 mi ab Mills R.	40302	3.1									FS				ME
FRENCH BROAD RIVER	From 0.6 mi ab Mills R to Mills R.	40302	0.6									FS				ME
FRENCH BROAD RIVER	From Mills R to SR 1348	40302	22.6	NC 146, SR 1348 (Buncombe)	FS					G-F, G	FS	FS		NP		M
FRENCH BROAD RIVER	From SR 1348 to SR 1634	40302	9.6	SR 1634	FS					G-F	FS	FS		NP		M
FRENCH BROAD RIVER	From SR 1634 to NC/TN state line	40302	33.9	NC 213 at Marshall	PS					G-F	FS	FS	turb	NP		M
Mill Pond Creek	From source to French Broad River	40302	3.6						F		PS	PS		NP	landfill	M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
Mud Creek	From source to Byers Cr	40302	15.2	SR 1126, SR 1647, SR 1508 ab&be WWTP, Henderson	FS					P/P/P/P	NS	NS	habitat degradation	NP, P	ag, urban	M
Bat Fork	From source to Johnson Drainage Ditch	40302	4.8	SR 1807, NC 176 , SR 1809, SR 1803, SR 1779 (Henderson)						F	PS	PS	habitat degradation	NP	ag, urban, non-urban development	M
Clear Creek	From source to Lewis Creek	40302	11.7	SR 1591, SR 1587 (Henderson)		F/F					PS	PS	pesticides?, habitat degradation	NP	apple orchards	M
Laurel Fork	From source to Clear Creek	40302	2.3	SR 1591, Henderson		G					FS	FS		NP		M
Puncheon Camp Creek	From source to Clear Creek	40302	2.6	SR 1591, Henderson		G-F					FS	FS	habitat degradation	NP	ag	M
Clear Creek	From Lewis Creek to Mud Creek	40302	6.3	SR 1513, Henderson						P	NS	NS	pesticides?, habitat degradation	NP	apple orchards	M
Mud Creek	From Byers Cr to French Broad River	40302	3.2	US 25, Henderson						F	PS	PS	habitat degradation	NP	ag, urban	M
Cane Creek	From Ashworth Creek to French Broad	40302	12.4	SR 1006, Henderson						G-F	FS	FS	habitat degradation	NP, P	ag	M
Hominy Creek	From source to NC 151, Buncombe	40302	9.7	SR 1141, NC 151, Buncombe Co.						G-F	FS	FS	habitat degradation	NP	non-urban development	M
Hominy Creek	From NC 151 to NC 112	40302	3.1	NC 112 ab. Enka Lake, Buncombe						F	PS	PS	habitat degradation	NP	urban, non-urban development, ag	M
Hominy Creek	From NC 112 to French Broad R	40302	8.7	SR 3412 @ Sand Hill, Buncombe	FS					F/F	PS	PS	habitat degradation	NP	urban, non-urban development, ag	M
South Hominy Creek	From source to Hominy Creek	40302	6.4	NC 151, Buncombe						P	NS	NS	pesticides?, habitat degradation	NP	tomato farms	M
Swannanoa River	From source to SR 2416	40302	12.4	SR-2500								FS	habitat degradation	NP	urban, non-urban development	ME
Flat Creek	From Big Piney Br. To Swannanoa R.	40302	3.2	ab US 70, Buncombe						99:G-F	FS	FS	habitat degradation	NP	urban	M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
Swannanoa River	From SR 2416 to NC 81	40302	10.6	NC 81/240, NC 81 be 240 (Buncombe)								FS	habitat degradation	NP	urban, non-urban development	ME
Swannanoa River	From NC 81 to US 25	40302	0.2	US 25, Buncombe						G-F	FS	FS	habitat degradation	NP	urban, non-urban development	M
Swannanoa River	From US 25 to French Broad R	40302	1.3	Swannanoa R at Biltmore	FS							FS	habitat degradation	NP	urban, non-urban development	M
North Fork Swannanoa	From source to Asheville Water Supply	40302	6.5		FS(lakes)							FS				M
Beetree Creek	From source to Asheville Water Supply	40302	4.3	ab Beetree reservoir	FS(lakes)							FS				M
Christian Creek	From source to SR 2748, Buncombe	40302	1.2	SR 2748, Buncombe						99: G	FS	FS		NP		M
Gashes Creek	From source to SR 3071	40302	2.2	SR 3071, Buncombe			G-F				FS	FS		NP	urban	M
Ross Creek	From source to I-240	40302	2.6	Chunn's Cove Rd, ab Episcopal Church						99:G-F	FS	FS	habitat degradation	NP	non-urban development, cattle	M
Ross Creek	From I-240 to Swannanoa River	40302	1.7	Tunnel Rd., near Waffle House						99:P	NS	NS	habitat degradation, nutrients	NP	urban	M
Newfound Creek	From SR 1296 to SR 1297	40302	1.3	SR 1297, Buncombe								FS	habitat degradation, turb, fecal	NP	cattle farms, ag, non-urban development	ME
Newfound Creek	From SR 1297 to SR 1378	40302	2.3									FS	habitat degradation, turb, fecal	NP	cattle farms, ag, non-urban development	ME
Newfound Creek	SR 1378 to French Broad R	40302	6.6	SR 1622, Buncombe						G-F; 99:G-F	FS	FS	habitat degradation, turb, fecal	NP	cattle farms, ag, non-urban development	M
Reems Creek	From U.S.23 Bridge to French Broad R	40302	4.2	NC 251, Buncombe						G	FS	FS		NP		M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
Sandymush Creek	From source to Little Sandymush Creek	40302	9.0									FS		NP		ME
Sandymush Creek	From Little Sandymush Creek to French Broad R	40302	11.1	SR 1114 Madison						G	FS	FS		NP		M
Davidson River	From source to Looking Glass Creek	40303	6.4									FS				ME
Davidson River	From Looking Glass Creek to Avery Cr	40303	2.5									FS				ME
Davidson River	From Avery Cr to proposed Davidson R Flats Recreation Area Sewage effluent outfall.	40303	0.3	US 276, ab campground, Transyl.						E	FS	FS				M
Davidson River	From proposed Davidson River Flats Rec Area Sew. effluent outfall to Olin Corp WS Dam	40303	2.3	US 64 near Brevard	FS							FS				M
Davidson River	From Olin Corporation Water Supply Dam to Fr Br	40303	2.2									FS				ME
Boylston Creek	From source to 0.3 mi ab Murray Br	40303	6.5									FS		NP	ag, non-urban development	ME
Boylston Creek	From 0.3 mi ab Murray Branch to French Broad R	40303	5.6	SR 1314, Henderson						G-F	FS	FS		NP	ag, non-urban development	M
Mills River	From source to SR 1337	40303	1.4	SR 1337, Henderson	FS		E			E	FS	FS				M
Mills River	From SR 1337 to 0.5 mile upstream of NC Hwy 191	40303	1.4									NS	pesticides?	NP	tomato farms	ME
North Fork Mills River	source to Hendersonville Water Supply Dam	40303	0.1									FS				ME
North Fork Mills River	From Hendersonville Water Supply Dam to Rocky Fk	40303	3.1	FS Rd 5000; ab Rocky Br. (Henderson)		E				G/E	FS	FS				M
Wash Creek	From source to North Fork Mills River	40303	4.2	off SR 1345, Henderson		E					FS	FS				M
North Fork Mills River	From Rocky Fork to North Fork Mills R. Rec. Area Swimming Pool Intake	40303	0.2									FS				ME

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
North Fork Mills River	From North Fork Mills River Recreation to Mills River	40303	2.8	SR 1341, Henderson		E					FS	FS				M
South Fork Mills River	From source to upstream side of Queen Creek	40303	26.1									FS				ME
Bradley Creek	From source to Hendersonville Water Supply Dam	40303	6.8	b-FS Rd 1206 ab Darb Br., ab State Rock Cr., ab Yellow Gap Cr.; a-FS 1206 at Yellow Gap	PS						FS	FS	low pH		acid rain?	M
Bradley Creek	From Hendersonville Water Supply Dam to SF Mills R.	40303	2.6	be Laurel Cr.						E	FS	FS				M
South Fork Mills River	From the upstream side of mouth of Queen Cr to Mills R	40303	3.7	SR 1340, Henderson		E					FS	FS				M
Mills River	From .5 mi upstr NC Hwy 191 to City of Hendersonville WS, located 0.1 mile upstream of NC 191	40303	0.6									NS	pesticides?	NP	tomato farms	ME
Mills River	From City of Hendersonville WS to 0.7 mi upstream of Mills R	40303	1.9	Mills R, SR 1353		G	P			G-F; 98:P	NS	NS	pesticides?	NP	tomato farms	M
Mills River	From 0.7 mi upstream of mouth of Mills R to French Broad R	40303	0.7										pesticides?	NS	tomato farms	ME
Brandy Branch	From source to Mills River	40303	1.9	NC 191, Henderson			F				PS	PS		NP		M
Ivy Creek (River)	From source to Adkins Branch	40304	7.7	SR 2153; SR 2150 (Buncombe)		G				G-F	G-F	FS	habitat degradation	NP	ag	M
Dillingham Creek	From source to F.F.A. Camp	40304	3.4	SR 2173, ab & be Stoney Cr (Buncombe)		G/G					FS	FS				M
Stony Creek	From source to Dillingham Creek	40304	1.8	SR 2178, Buncombe		G					FS	FS				M
Carter Creek	From source to Stony Creek	40304	3.5	off SR 2178, Buncombe		E					FS	FS				M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
Mineral Creek	From source to Stony Creek	40304	3.5	off SR 2178, Buncombe		E					FS	FS				M
Dillingham Creek	From F.F.A. Camp to Ivy Creek	40304	1.8									FS				ME
North Fork Ivy Creek	From source to Ivy Creek	40304	7.0	SR 2027, Buncombe		G					FS	FS				M
Little Ivy Creek	From source to SR 1547	40304	2.1	SR 1547, Madison						G-F	FS	FS		NP	ag, rural runoff	M
Little Ivy Creek	From SR 1547 to Ivy Creek	40304	2.6	SR 1610, Madison		G-F				F	PS	PS		NP	ag, rural runoff	M
California Creek	From SR 1349 to Little Ivy Creek	40304	3.8	SR 1541, Madison						G-F	FS	FS	habitat degradation	NP	ag, non-urban development	M
Ivy Creek (River)	From Adkins Br to 0.6 mile downstream of Adkins Branch (Mars Hill WS)	40304	0.6									FS	habitat degradation	NP	ag, rural runoff	ME
Ivy Creek (River)	From 0.6 miles downstream of Adkins Branch to French Broad River	40304	10.2	SR 1565; NC 25/70, Madison		G/G				G-F	FS	FS	habitat degradation	NP	ag, rural runoff	M
Gabriel Creek	From NC 213 to Ivy Creek	40304	7.2	SR 1559, Madison		G-F					FS	FS		NP	ag, urban	M
Bull Creek	From source to Ivy Creek	40304	4.1	NC 213, Madison		G-F					FS	FS		NP		M
Big Laurel Creek	From source to French Broad River	40304	33.1	SR 1503; SR 1318/1334; SR 1318; NC 208 (Madison)						G/G/E/E		FS	nutrients	NP	straight piping	M
Puncheon Fork	From source to Big Laurel Creek	40304	5.4	SR 1503, Madison						G	G	FS				M
Shelton Laurel Creek	From source to Big Laurel Creek	40304	17.2	NC 208/212, Madison Co.						G	FS	FS				M
Spring Creek	From source to Reservoir Branch	40304	21.0									FS				ME
Spring Creek	From Reservoir Branch to French Broad	40304	1.8	NC 209, Madison						G	FS	FS				M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM	BENTHOS					Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
					93-97	93	94	95	96	97						
PIGEON RIVER	From source to Garden Cr.	40305	4.2	NC 215 near Canton, Haywood	FS	G	G	G		E; 99:G	FS	FS				M
West Fork Pigeon River	Source to Pigeon River	40305	18.2	SR 1216, Burnett Siding, Haywood	FS	E				E	FS	FS				M
East Fork Pigeon River	From source to a point 0.5 miles upstream of Bee Br	40305	5.2									FS				ME
East Fork Pigeon River	From a point 0.5 miles upstream of Bee Br to Pigeon R	40305	12.6	US 276 nr Cruso, Haywood						E	FS	FS				M
PIGEON RIVER	From Garden Cr to Canton Water Intake	40305	0.6									FS				ME
PIGEON RIVER	From Canton Water Intake to Clyde/At Clyde, SR-1642, Haywood Co	40305	7.0	SR 1642, Haywood			F	F		G-F; 99:F	PS	PS		NP, P	BRPP/Champion paper mill	M
PIGEON RIVER	From Clyde/At Clyde, SR-1642, Haywood Co to Crabtree Cr	40305	7.9	SR 1625, be Richland Cr., Haywood			F					FS		NP, P	BRPP/Champion Paper Mill	M
PIGEON RIVER	From Crabtree Ck to SR-1338 near Hepco	40305	7.0	SR-1338 nr Hepco, Haywood	FS		G-F			G-F	FS	FS		P, NP	BRPP/Champion Paper Mill	M
PIGEON RIVER	From SR-1338 near Hepco to Hurricane Cr, Haywood	40305	8.7	at Hurrican Cr, Haywood							FS	FS		P, NP	BRPP/Champion Paper Mill	ME
PIGEON RIVER	Counterfeit Br to NC/Tenn State line	40305	2.6	off I-40 at Waterville, Haywood	FS		G			G	FS	FS				M
Rough Creek	From source to Canton Reservoir	40305	2.3									FS				ME
Rough Creek	From Canton Reservoir to Beaverdam Cr.	40305	1.0	nr SR 1616, Haywood						E	FS	FS				M
Richland Creek	Source to Bus US 23	40305	8.0	Bus 23 above Dayco, Haywood						G-F	FS	FS	habitat degradation	NP	ag, non-urban development	M
Richland Creek	From Bus US 23 to Lake Junaluska Dam	40305	6.7	SR-1184, Haywood						G-F	FS	FS	habitat degradation	NP	ag, urban, non-urban development	M
Shiny Creek	From source to Allen Creek	40305	3.1	ab Allen Reservoir						E	FS	FS				M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
Richland Creek	From Lake Junaluska Dam to Pigeon R	40305	2.4	SR 1519, Haywood	FS					F	PS	PS	habitat degradation	NP	ag, urban, non-urban development	M
Jonathans Creek	From source to Carpenters Br.	40305	3.1									FS		NP		ME
Jonathans Creek	From Carpenters Br. to 0.4 miles downstream of mouth of Fie Cr (Town of Maggie Valley Water Sup. Intake)	40305	0.6									FS	habitat degradation	NP		ME
Jonathans Creek	From 0.4 miles downstream of Fie Cr to Pigeon R	40305	14.5	SR 1306, SR 1322, NC 276, SR 1349 (Haywood)	FS					E/E/E	FS	FS	habitat degradation	NP	cattle farms	M
Fines Creek	From source to Pigeon River	40305	10.4	Fines Cr, SR 1355 nr I-40 Haywood						G-F	FS	FS	nutrients	NP	cattle farms, ag, non-urban development	M
Cataloochee Creek	Source to Walters Lake,Pigeon R	40305	8.5	nr SR 1395; SR 1395, Haywood	FS					E	FS	FS				M
Big Creek	From source to Pigeon River	40305	14.1	in GSMNP, ab campground						E	FS	FS				M
NOLICHUCKY RIVER	From source to NC / Tenn. State Line	40306	10.0	SR 1321 nr Poplar, Mitchell	FS					E	FS	FS		NP		M
North Toe River	From source to 0.2 mi ab Pyatt Cr	40306	22.3									FS	habitat degradation	NP		ME
North Toe River	From 0.2 mi ab Pyatt Cr to 0.5 mi ab US Hwy 19E	40306	9.7	US 19Eat Ingalls, Avery	FS					E	FS	FS	habitat degradation	NP		M
North Toe River	From 0.5 mi upstream of US Hwy 19E to Spruce Pine WS intake (Hwy 19E)	40306	0.5									FS		NP		ME
North Toe River	From Spruce Pine WS to Grassy Cr	40306	9.5									FS	habitat degradation	NP		ME
North Toe River	From Grassy Cr to S Toe R	40306	32.5	SR 1162 at Penland, Mitchell	PS					G	FS	FS	turb, habitat degradation	NP	urban, mines	M
North Toe River	From S Toe R to Nolichucky R	40306	21.5	SR 1314 at Loafer's Glory, Yancey						G	FS	FS				M
Big Crabtree Creek	From source to North Toe River	40306	15.5	off US 19E, Mitchell						E	FS	FS		NP		M

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
South Toe River	Source to Near Deep Gap/Deep Gap, N. C.	40306	1.3	headwaters, near Deep Gap	PS							FS	low pH		acid rain?	M
South Toe River	From Deep Gap to US 19E	40306	24.0	SR 1205 (Yancey), SR 1168, ab/be NC 80, SR 1168, SR 1167 at Celo (Yancey)	FS				E/E	E	FS	FS				M
South Toe River	From U.S. Hwy 19E to North Toe River	40306	7.2									FS				ME
Big Rock Creek	From source to North Toe River	40306	14.6	NC 197, Mitchell						G	FS	FS	habitat degradation	NP	ag	M
Cane River	From source to 1.0 mi ab Burnsville WS, 0.4 mi ab Bowlens Cr.	40307	13.0									FS		NP		ME
Cattail Creek	From source to Cane River	40307	3.2	SR 1102, Yancey					G		FS	FS				M
Cane River	From .4 mi upstream Bowlens Creek to Burnsville WSI, .6 mi downstr. of Bowlens	40307	1.0									FS		NP		ME
Cane River	From .6 mi downstream of Bowlens Creek to Nolichucky River	40307	23.9	Cane R SR 1417/US 19W, Yancey	PS							FS	turb	NP		M
Bald Mountain Creek	From source to Cane River	40307	8.4	SR 1408, Yancey						G	FS	FS		NP	road	M
NOTES: See next page for key and comments																

Name of stream	Description	Subbasin	Miles	Monitoring station location	CHEM 93-97	BENTHOS 93	94	95	96	97	Bio rating	Rating	Problem parameter	Major source	Possible source	Basis
NOTES																
*"Ag" denotes agriculture, which could include row crops and animal operations. Where "cattle" is noted, cattle were observed on site at the time of sampling																
or the watershed hosts many cattle farms.																
"Rating" = Use Support Rating																
"Basis"=Rating basis																
"Habitat degradation" is identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion,																
channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and stream bed scour.																
"Non-urban development" is residential and/or commercial development outside urban areas.																
"Rural runoff" is non-point source runoff from rural areas, including that from low density residential and commercial areas.																
ABBREVIATION KEY																
E = Excellent		nut = high nutrient levels														
G = Good		turb = turbidity														
G-F = Good-fair		fecal = fecal coliform bacteria														
F = Fair		sed = sediment														
P = Poor (Benthos ratings)																
P = Point Source Pollution (Major source)		BRPP = Blue Ridge Paper Products														
NP = Non-point Source Pollution																
M = Monitored																
ME = Monitored-evaluated																
FS = Fully Supporting																
PS = Partially Supporting																
NS = Not Supporting																
NR = Not Rated																

Appendix IV

303(d) Listing
and
Reporting Methodology

303(d) LISTING AND REPORTING REQUIREMENTS

What is the 303(d) List?

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses. Waters may be excluded from the list if existing control strategies for point and nonpoint source pollution will improve water quality to the point that standards or uses are being met. Listed waters must be prioritized, and a management strategy or total maximum daily load (TMDL) must subsequently be developed for all listed waters. This draft of the 303(d) list will be submitted to EPA for approval in the year 2000. The latest approved 303(d) list was published on May 15, 1998. A summary of the 303(d) process follows. More complete information can be obtained from *North Carolina's 1998 303(d) List* (DENR, 1998), which can be obtained by calling the Planning Branch of DWQ at (919) 733-5083.

303(d) List Development

Generally, there are four steps to preparing North Carolina's 303(d) list. They are: 1) gathering information about the quality of North Carolina's waters; 2) screening those waters to determine if any are impaired and should be listed; 3) determining if a total maximum daily load (TMDL) has been developed; and 4) prioritizing impaired waters for TMDL development. This document also indicates whether the Division of Water Quality (DWQ) intends to develop a TMDL as part of a Management Strategy (MS) to restore the waterbody to its intended use. The following subsections describe each of these steps in more detail.

Sources of Information

For North Carolina, the primary sources of information are the basinwide management plans, 305(b) reports and accompanying assessment documents, which are prepared on a five-year cycle. Basinwide management plans include information concerning permitting, monitoring, modeling and nonpoint source assessment by basin for each of the 17 major river basins within the state. Basinwide management allows the state to examine each river basin in detail and to determine the interaction between upstream and downstream, point and nonpoint pollution sources. As such, more effective management strategies can be developed across the state.

Listing Criteria

Waters whose use support ratings were not supporting (NS) or partially supporting (PS) based on monitored information in the 305(b) report were considered as initial candidates for the 303(d) list. Waters that were listed on the previously approved 303(d) list were evaluated and automatically included if the use support rating was NS, PS or not rated (NR).

Fish consumption advisory information was then reviewed to determine if other waters should be added to the list. Fish consumption advisories are no longer considered when determining use support since a fish advisory for mercury contamination in Bowfin was posted for the entire state in June 1997. While fish consumption advisories do indicate impairment, DWQ did not want to mask other causes and sources of impairment by having the entire state (or an entire basin) listed as impaired due to fish consumption advisories. However, DWQ believes that advisories on specific waters are cause to include the water on the 303(d) list; therefore, advisories other than

the statewide Bowfin posting were considered when developing North Carolina's 303(d) list. Waters listed due to fish consumption advisories may have overall ratings of fully supporting (FS) because fish advisories are not considered in the 305(b) use support process.

Guidance from EPA on developing the 1998 303(d) lists indicated that impaired waters without an identifiable problem parameter should not be included on the 303(d) list. However, DWQ feels that waters listed in the 305(b) report as impaired for biological reasons, where problem parameters have not been identified, should remain on the 303(d) list. The Clean Water Act states that chemical, physical and biological characteristics of waters shall be restored. The absence of an identified cause of impairment does not mean that the waterbody should not receive attention. Instead, DWQ should resample or initiate more intensive studies to determine why the waterbody is impaired. Thus, biologically impaired waters without an identified cause of impairment are on the draft 303(d) list.

Assigning Priority

North Carolina is required to prioritize its 303(d) list in order to direct resources to those waters in greatest need of management. The CWA states that the degree of impairment (use support rating) and the uses to be made of the water (stream classification) are to be considered when developing the prioritization. In addition, DWQ reviews the degree of public interest and the probability of success when developing its prioritization schemes. Waters harboring endangered species are also given additional priority. A method to assign ratings to freshwaters that have recent data indicating impairment has been devised based on these criteria.

The prioritization process results in ratings of high, medium and low. Generally, waters rated with the highest priority are classified for water supply use, rated not supporting, and harbor an endangered species. Waters receiving a high priority are important natural resources for the State of North Carolina and generally serve significant human and ecological uses. High priority waters will be addressed first within their basin cycles when technically feasible. TMDLs are not possible where the pollutant(s) have yet to be identified. TMDLs cannot be attempted without flow data. Collecting physical/chemical data and accumulating flow data are milestones that must precede developing TMDLs of any priority.

EPA recently issued guidance that suggested states should develop TMDLs and management strategies on all of their impaired waters within the next eight to thirteen years. To meet this federal guidance, the DWQ is striving to address all 303(d) listed waters that have a priority of high, medium or low within the next 10 years. Numeric TMDLs, if proper technical conditions exist, and management strategies will be developed for these waters. The DWQ is constantly reviewing its resource allocations in order to meet this aggressive schedule.

Other priorities have also been assigned to waters. A monitor priority indicates that the waterbody is listed based on: 1) data older than 5 years; 2) biological impairment without an identified pollutant; or 3) biological impairment where the criteria used to originally rate the stream as impaired has been deemed inappropriate. Many low flow streams and swamp waters were rated as biologically impaired in the past using inappropriate criteria. These waters will be resampled and rated using specialized criteria currently in development. Until the updated rating criteria is finalized, these waters will continue to be rated NR and will stay on the 303(d) list. Further information on the monitoring approaches that have a monitor priority is provided in the next section.

The final priority listed on the 303(d) list is N/A for not applicable. This priority was assigned to waters that DWQ believes will meet their uses based on the current management strategies. DWQ will not develop a new TMDL or management strategy for these waters unless data continue to indicate impairment, and sufficient time has passed for the waterbody to respond to the management action. An example of this priority is a water impaired by a point source, and the pollutant causing the impairment has been completely removed from the point source.

Additional Guidance on Using the 303(d) List

The column headings in the 303(d) list refer to the following:

Class – The information in this column indicates the classification assigned to the particular waterbody. Stream classifications are based on the existing and anticipated best usage of the stream as determined through studies and information obtained at public hearings. The stream classifications are described in 15A NCAC 2B .0300.

Subbasin – The number in this column refers to the DWQ subbasin in which the waterbody is located. The NRCS 14-digit hydrologic units nest within the DWQ subbasins.

Cause of Impairment – The cause of impairment as identified in the use support rating process. When a chemical problem parameter is identified, the parameter listed exceeded the state's water quality standards for that parameter. Biological impairment is based on data relating to benthic and fish habitat as well as community structure. There may be other unidentified causes contributing to the impairment. Causes included in the 303(d) list are listed below:

Chl *a* – chlorophyll *a*
Cl – chloride
Cu – copper
DO – dissolved oxygen
Fecal – fecal coliform bacteria
Hg – mercury
NH3 – ammonia
Nutr – nutrients
Pb – lead
pH – pH
Tox – toxicity
Turb – turbidity
Aq. Weeds – aquatic weeds
Biological Impairment – Impairment based on benthic/fish data
Fish Advisory – Fish advisory issued by DEH

Overall Rating – This column lists the overall use support rating. These values may be **NS** (not supporting), **PS** (partially supporting), **FS** (fully supporting) and **NR** (not rated). A rating of not rated is typically assigned to waters that were sampled using biocriteria that may not apply, or there are no data available on the water. These waters appeared on earlier lists, and they continue to be listed for administrative reasons, but no TMDL or management strategy will be developed until we have updated information that the water continues to be impaired. For waters listed solely on the basis of fish consumption advisories, the rating may be fully supporting (FS). The 305(b) report describes these use support ratings further. On the 303(d) list of lakes, the overall use support rating is found in the column entitled "Overall Use Rating." Ratings for specific uses are found in the columns entitled "Fish Consumption", "Aquatic Life and Secondary Contact", "Swimming" and "Drinking Water."

Source – This column indicates which sources are the probable major sources of impairment.

Approach – This column indicates the approach DWQ will take to restore the waterbody. More than one approach may be listed. TMDLs are typically developed for DO, nutrients, fecal coliform, ammonia and metals. Management strategies are typically done for pH, sediment and turbidity. Further information on each approach is provided below.

TMDL – A numeric TMDL (total, maximum, daily, load), as defined by EPA, will be developed.

MS – Management Strategy. These waters are on the list based on data collected within the five years prior to when the use support assessment was completed. A cause of impairment has been identified, but North Carolina cannot develop a numeric TMDL as EPA defines it. A management strategy may contain the following elements: further characterization of the causes and sources of impairment, numeric water quality goals other than TMDLs, and best management practices to restore the water.

RES – Resample. This waterbody was identified as being impaired based on water quality data that were greater than 5 years old or invalid at the time the use support assessment was performed. This waterbody will be resampled prior to TMDL or management strategy development to ensure the impairment continues to exist.

PPI – Problem Parameters Identification. Available chemical data do not show any parameters in violation of applicable standards, but biological impairment has been noted within the five years prior to use support assessment. DWQ will resample these waters for chemical and biological data to attempt to determine the cause of impairment. TMDLs or management strategies will be developed within 2 basin cycles of pollutant identification.

SWMP – Swamp waters. This water may not actually be impaired. Swamp waters previously evaluated using freshwater criteria will continue to be monitored and will be reevaluated when swamp criteria are available.

Priority – Priorities of high, medium and low were assigned for waters identified as being impaired based on data that were not greater than 5 years of age at the time the use support assessment was done and for which a cause of impairment has been identified. All waters assigned a priority of high, medium or low will be addressed within the next two basin cycles. Priorities of monitor and N/A have also been assigned where appropriate. Further explanation on each of these is provided below:

High – Waters rated high are important resources for the state in terms of human and ecological uses. Typically, they are classified as water supplies, harbor federally endangered species, and are rated as not supporting. These waters will be addressed first within their basin cycles when technically feasible.

Medium – Waters rated medium may be classified for water supply or primary recreational use, may have state endangered or other threatened species, and may be rated as partially or not supporting.

Low – Waters rated low generally are classified for aquatic life support and secondary recreation (i.e., Class C waters) and harbor no endangered or threatened species.

Monitor – The waterbody is included on the 303(d) list based on:

1. Data that are greater than 5 years of age when use support assessment is done (denoted by RES in approach column).
2. Biological data collected within 5 years of use support assessment, but no cause of impairment has been identified (available chemical data show full use support denoted by PPI in approach column).
3. Freshwater biological criteria applied to swamp waters.

In general, waters given this priority based on recent biological data will be sampled prior to waters listed based on older information. All waters with this priority will be resampled as resources allow. Waters with a monitor priority will not have a management strategy or TMDL developed for it before updated sampling or analyses of the biological criteria is complete. Once updated sampling is done and problem pollutants have been identified, these waters will be addressed by either a management strategy or TMDL within two basin planning cycles (10 years).

N/A – DWQ believes that its current management strategy will address the water quality impairment, but it may take a number of years before standards are met. In this case, DWQ plans to continue monitoring the water to determine if improvements are occurring, but no new management strategy or TMDL will be developed unless sufficient time has passed for improvement to occur, and data indicate the water is still impaired.

The lakes table column entitled "Trophic Status" refers to the trophic status of the lake, a relative description of the biological productivity of the lake. The lake may be hypereutrophic, eutrophic, mesotrophic or oligotrophic. Oligotrophic lakes are nutrient poor and biologically unproductive. Mesotrophic lakes have intermediate nutrient availability and biological productivity. Eutrophic lakes are nutrient rich and highly productive. Hypereutrophic lakes are extremely eutrophic.

Appendix V

Workshop Summaries

French Broad River Basin Workshops
Clyde, NC
May 6, 1999

Short-Term Issues

- Sedimentation
  - → control
  - → instream bank erosion-related
- Imperviousness
  - → What can we do about it?
  - → How can we prevent it or control in future?
  - → (Noted example: bank erosion at golf course above Lake Junaluska)
- Urbanization
  - → more stormflow
  - → pollution

Long-Term Issues

- Sedimentation

Actions Needed

- Regular participation in local efforts
- Inform public and show them how to make a difference
- BMPs – both required and suggested; need to enforce them
- Land use planning in general
- Exempt activities need opportunities to use BMPs
- Incentives for local governments to do things – "carrot approach"
- More coordination between efforts
  - → facilitate information exchange

Responsibilities

- DWQ and other local agencies
- Everybody
- Grade 4-7 video ⟶ HWA Pigeon River Fund
- Kids in creek program ⟶ HWA Pigeon River Fund
- Urban runoff
  - → state stormwater program
  - → DOT
  - → local governments (through the technology transfer program)
- DWQ and other state agencies

Issues

- Statewide planning initiatives
  - → e.g., state highway plan
  - → 4-lane roads within 20 miles of all residents
- Contradictions between state programs
  - → e.g., state highway plan and water quality
  - → (Note: new DOT stormwater permit)
  - → new stream restoration and management
- Land use planning needed, but need to overcome local resistance
  - → education
    - ➢ elected / local officials
  - → state leadership
    - ➢ education?
    - ➢ rules?
- Growth – Development, Demographics (use change)
  - → human population
  - → recreational uses and standards – (Public Perception)
  - → point source is good – continue trends
  - → nonpoint issues
    - ➢ housing development
    - ➢ forestry – increased harvests in higher quality waters
    - ➢ sedimentation from agriculture
  - → straight piping – black & gray – extend elimination programs throughout watershed (need grants/funding)
  - → channelization

French Broad River Basin Workshops
Fletcher, NC
May 7, 1999

Short-Term Issues

- DOT highway construction
  - → South Hominy Creek, Ivy River, Hwy 26, Gash Creek, Sweeten Creek
- Development
  - → erosion, flooding
  - → planning need!
  - → local erosion program may have lack of enforcement
    - ➢ example: Lowes and Park Place
  - → change in land use
    - ➢ example: Hwy 26
    - ➢ increase land price
    - ➢ more $$ in selling than farming
  - → Lambs Creek – 300 acres
- Buffer requirements as in Neuse may not work in mountains, if implemented statewide – mountains differ from Piedmont – the shoe may not fit here.
- Cattle fencing
- Trash containers on French Broad parks that are well maintained
- Providing incentives to local governments for water quality issues
- Resistance to change (land owner issues)
- Land use planning
- Urbanization
- Rural development on marginal lands (steep topography)
- Urban runoff management – no system in place for water quality concerns
- Wetlands filling (stronger enforcement for loss of wetlands)
- General public education, programs, etc.
- Shift agency focus to NPS
- Get agencies on same priority system (Division of Land Quality, Soil and Water Conservation Districts, Division of Forest Resources, local government, Division of Water Quality)
- Lack of a coordinated NPS program – strengthen focus and get specific
- Use water quality data from all sources (citizen groups – strengthen quality control)
- Incentive programs for land owners to promote buffer development
- Measure nonpoint sources
  - → need resources to increase monitoring
  - → (need volunteers – Haywood Waterways Association)
  - → coordinate sampling sites with TVA
- Adopt-a-Highway type of action
- Community education
  - → educate people on BMPs (silt fences, riparian buffers)
  - → Soil and Water conservation
  - → Section 319 Clean Water Act for partial funding of projects
- Sedimentation
  - → need land use planning

→ BMPs needed
→ insufficient enforcement staff
→ BMPs not adequate for mountains

- Logging operations
  → forest practice guidelines not adequate
  → demand increasing for hardwoods
  → lots of pressure on private landowners to supply timber
- Chip mills
- Water quality in Mills River for water supply
- Need for sewer lines in Mills River area to serve new development – handle package plants
- Pesticides
  → mixing and disposal
- Mud Creek
- Ivy River
  → I-26 corridor
- Straight piping (especially Madison County)
- Davidson River – runoff from Wal-Mart (nutrients)?
  → (no detention ponds or BMPs)
- More recreational activity on French Broad River
  → (e.g., air boats, more people and trash)
- Livestock in streams
- Trout farm impacts

Long-Term Issues

- Development with city sewer
  → 400 acre development by Cascade Lake west on Little River
- Lack of central sewer; however, central sewer would increase land desirability for development
- Lack of erosion control enforcement, staff; water quality vs. land quality
- Lack of monitoring or shared data and types of data to determine quality or use
- Funding commitment to local governments for water quality issues (long-term political will)
- Education of landowners – may need ethic change
- Development pressures/changes to economy as affected by urbanization
- Need better planning and infrastructure for rural development on marginal lands
- Development of a regulatory system for urban runoff control
- Need education for landowners and better coverage of wetlands enforcement actions
- Organization and funding of nonpoint source control activities
- Implications for coordination of all levels of agencies
- Buffer rules statewide (legislative action)
- How do we measure impacts of storm events on sedimentation?
- Funding for projects
  → General Assembly pressure for funding
- Reduce area of disturbance needing erosion control permit – local/county action
- Logging operations
- DOT/Roads
  → local government

- → forest service
  - ➢ need to give closer scrutiny to projects
- → maintenance
  - ➢ close mowing
  - ➢ eroding bank
  - ➢ state/local cooperation

- I-26 corridor growth
- Mud Creek
  - → package plants
  - → WWTPs – Hendersonville
  - → agriculture
  - → urban development
  - → Bat Fork (agriculture impacts)
  - → stormwater
    - ➢ lack of controls
    - ➢ floor drains
    - ➢ lack of effective strainers at entrance to stormwater systems
  - → URBAN SPRAWL
- Parking areas ⟶ need to explore options to impervious surfaces
- Sedimentation
  - → growth and development
  - → roads – gravel roads (non-paved)
  - → trails in USFS/streamside recreation
- Henderson County pesticides (farming)
- French Broad River
  - → streambank erosion
  - → lack of buffers
- More recreational activity on French Broad River
  - → (e.g., air boats, more people and trash)
- Livestock in streams
- Stormwater runoff
- Nutrients from all sources
- Acid deposition

Actions

- Protect/increase stream buffers
- More emphasis on upgrade of wastewater facilities
- Increased development should include more planning to protect streams
- Industries should reuse water and do better monitoring of permitted discharges
- Sedimentation (causes)
  - → cleaning of water channels
- Grants/funds for administration/personnel and private use improvements
- Preventing/improving nonpoint discharges by increased monitoring and enforcement

Appendix VI

French Broad River Basin Nonpoint Source Program Description and Contacts

Statewide Nonpoint Source Management Program Description

The North Carolina Nonpoint Source Management Program consists of a broad framework of federal, state and local resource and land management agencies. More than 2,000 individuals administer programs that are directly related to nonpoint source pollution management within the state. A range of responsibilities have been delegated to county or municipal programs including the authority to inspect and permit land clearing projects or septic system performance. In the field of agriculture, a well established network of state and federal agricultural conservationists provide technical assistance and program support to individual farmers.

Staff in the DWQ Water Quality Section's Planning Branch lead the Nonpoint Source Management Program, working with various agencies to insure that program goals are incorporated into individual agencies' management plans. The goals include:

1. Coordinate implementation of state and federal initiatives addressing watershed protection and restoration.
2. Continue to target geographic areas and waterbodies for protection based upon best available information.
3. Strengthen and improve existing nonpoint source management programs.
4. Develop new programs that control nonpoint sources of pollution not addressed by existing programs.
5. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico National Estuary Program).
6. Monitor the effectiveness of BMPs and management strategies, both for surface and groundwater quality.

Coordination between state agencies is achieved through reports in the *North Carolina Nonpoint Source Management Program Update*. Reports are intended to keep the program document current and develop a comprehensive assessment identifying the needs of each agency to meet the state nonpoint source program goals. Annual reports are developed to describe individual program priorities, accomplishments, significant challenges, issues yet to be addressed, and resource needs. A copy of the latest Annual Report (FY1998) is available online: http://h2o.enr.state.nc.us/nps/nps_mp.htm.

The nature of nonpoint source pollution is such that involvement at the local level is imperative. Basinwide Water Quality Plans identify watersheds that are impaired by nonpoint sources of pollution. Identification, status reports and recommendations are intended to provide the best available information to local groups and agencies interested in improving water quality. The plans also make available information regarding federal, state and local water quality initiatives aimed at reducing or preventing nonpoint source pollution.

The following table is a comprehensive guide to contacts within the state's Nonpoint Source Management Program. For more information, contact Alan Clark at (919) 733-5083 ext. 570.

Agriculture

USDA Natural Resources Conservation Service:

Part of the US Department of Agriculture, formerly the Soil Conservation Service. Technical specialists certify waste management plans for animal operations; provide certification training for swine waste applicators; work with landowners on private lands to conserve natural resources, helping farmers and ranchers develop conservation systems unique to their land and needs; administer several federal agricultural cost share and incentive programs; provide assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems; conduct soil surveys; offer planning assistance for local landowners to install best management practices; and offer farmers technical assistance on wetlands identification.

Area 1 Conservation	Jacob Crandall	828-456-6341	PO Box 1109, Waynesville, NC 28786
County	**Contact Person**	**Phone**	**Address**
Avery	Allen Childers	828-264-3943	971 West King Street, Boone, NC 28607
Buncombe	Victor McIntyre	828-250-4715	94 Coxe Ave, Asheville, NC 28801
Haywood	Lynne Newton	828-456-5132	Federal Building, Room 117, Waynesville, NC 28786
Henderson	Robert Carter, Jr.	828-693-1629	Federal Building, Room 100, Hendersonville, NC 28792
Madison	Russell Blevins	828-649-3313	296-2 Marshall Bypass, Marshall, NC 28753
Mitchell	Kenneth Deyton	828-688-4883	PO Box 5, Bakersville, NC 28705
Transylvania		828-884-3230	203 East Morgan Street, Brevard, NC 28712
Yancey	J. Clifford Vinson	828-682-2466	22 East Bypass, Suite 1, Burnsville, NC 28714

Soil & Water Conservation Districts:

Boards and staff under the administration of the NC Soil and Water Conservation Commission (SWCC). Districts are responsible for: administering the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* at the county level; identifying areas needing soil and/or water conservation treatment; allocating cost share resources; signing cost share contracts with landowners; providing technical assistance for the planning and implementation of BMPs; and encouraging the use of appropriate BMPs to protect water quality.

County	**Board Chairman**	**Phone**	**Address**
Avery	Eddie Storey	828-898-4607	Route 1, Box 394E, Elk Park, NC 28622
Buncombe	Jim Canaan	828-250-4785	94 Coxe Ave., Asheville, NC 28801
Haywood	Charles P. Francis	828-456-5132	Federal Building, Room 117, Waynesville, NC 28786
Henderson		828-891-7531	80 School House Road, Horse Shoe, NC 28742
Madison	Jim Brown	828-649-9099	296-2 Marshall Bypass, Marshall, NC 28753
Mitchell	James Williams	828-688-4883	PO Box 5, Bakersville, NC 28705
Transylvania	Steve Cochran	828-884-3230	203 East Morgan Street, Brevard, NC 28712
Yancey	Jack Boone, Jr.	828-682-3410	22 East Bypass Suite 1, Burnsville, NC 28714

Division of Soil and Water Conservation:

State agency that administers the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* (ACSP). Allocates ACSP funds to the Soil & Water Conservation Districts; and provides administrative and technical assistance related to soil science and engineering. Distributes Wetlands Inventory maps for a small fee.

Central Office	Carroll Pierce	919-715-6110	Archdale Bldg, 512 N. Salisbury St., Raleigh, NC 27626
Asheville Region*	Jeff Young	828-251-6208	59 Woodfin Place, Asheville, NC 28801

NCDA Regional Agronomists:

The NC Department of Agriculture technical specialists: certify waste management plans for animal operations; provide certification training for swine waste applicators; track, monitor and account for use of nutrients on agricultural lands; operate the state *Pesticide Disposal Program*; and enforce the state pesticide handling and application laws with farmers.

Central Office	Tom Ellis	919-733-7125	Box 27647, Raleigh, NC 27611
Region 13	Bill Yarborough	828-456-3943	443 Pisgah View Drive, Waynesville, NC 28786

Education

NC Cooperative Extension Service:

Provides practical, research-based information and programs to help individuals, families, farms, businesses and communities.

County	Contact Person	Phone	Address
Avery	Michael Pitman	828-733-2415	Courthouse, PO Box 640, Newland, NC 28657
Buncombe	Kenneth Reeves	828-255-5522	PO Box 7667, Asheville, NC 28802
Haywood	Steve West	828-456-3575	PO Box 308, Waynesville, NC 28786
Henderson	Joy Staton	828-697-4891	740 Glover Street, Hendersonville, NC 28792
Madison	Maurice McAlister	828-649-2411	Robert Building, Marshall, NC 28753
Mitchell	Gary Hyatt	828-688-2051	Annex Admin Building, Box 67, Bakersville, NC 28705
Transylvania	Eric Caldwell	828-884-3109	Community Service Building, Brevard, NC 28712
Yancey	Johnny Hensley	828-682-6186	10 Orchard Street, Burnsville, NC 28714

Forestry

Division of Forest Resources:

Develop, protect and manage the multiple resources of North Carolina's forests through professional stewardship, enhancing the quality of our citizens while ensuring the continuity of these vital resources.

Districts 1, 2, 9	Greg Yates	828-667-5211	220 Sardis Road, Asheville, NC 28806
Central Office	Bill Swartley	919-733-2162	1616 Mail Service Center, Raleigh, NC 27699-1616

Construction/Mining

DENR Division of Land Resources:

Administers the *NC Erosion and Sedimentation Control Program* for construction and mining operations. Conducts land surveys and studies, produces maps, and protects the state's land and mineral resources.

Central Office	Mel Nevills	919-733-4574	512 North Salisbury Street, Raleigh, NC 27626
Asheville Reg Office	Richard Phillips	828-251-6208	59 Woodfin Place, Asheville, NC 28801

Local Erosion and Sedimentation Control Ordinances:

Several local governments in the basin have qualified to administer their own erosion and sedimentation control ordinances.

City of Asheville	Maria Keranis	828-259-5837	PO Box 7148, Asheville, NC 28802
Buncombe County	Michael Brookshire	828-250-4848	46 Valley Street, Asheville, NC 28801
Haywood County	Bob Miller	828-452-6706	2143 Asheville Road, Waynesville, NC 28786

General Water Quality

DWQ Water Quality Section:

Coordinate the numerous nonpoint source programs carried out by many agencies; coordinate the French Broad and Neuse River Nutrient Sensitive Waters Strategies; administer the Section 319 grants program statewide; conduct stormwater permitting; model water quality; conduct water quality monitoring; perform wetlands permitting; conduct animal operation permitting and enforcement; and conduct water quality classifications and standards activities.

NPS Planning	Alan Clark	919-733-5083 x570	1617 Mail Service Center, Raleigh, NC 27699-1617
Urban Stormwater	Bradley Bennett	919-733-5083 x525	1617 Mail Service Center, Raleigh, NC 27699-1617
Modelling	Ruth Swanek	919-733-5083 x503	1617 Mail Service Center, Raleigh, NC 27699-1617
Monitoring	Jimmie Overton	919-733-9960 x204	1621 Mail Service Center, Raleigh, NC 27699-1621
Wetlands	John Dorney	919-733-1786	1621 Mail Service Center, Raleigh, NC 27699-1621
Animal Operations	Dennis Ramsey	919-733-5083 x528	1617 Mail Service Center, Raleigh, NC 27699-1617
Classifications/Standards	Boyd DeVane	919-733-5083 x559	1617 Mail Service Center, Raleigh, NC 27699-1617

DWQ Regional Offices:

Conduct permitting and enforcement field work on point sources, stormwater, wetlands and animal operations; conduct enforcement on water quality violations of any kind; and perform ambient water quality monitoring.

Asheville Region*	Forrest Westall	828-251-6208	59 Woodfin Place, Asheville, NC 28801

Wildlife Resources Commission:

To manage, restore, develop, cultivate, conserve, protect and regulate the wildlife resources of the state; and to administer the laws enacted by the General Assembly relating to game, game and non-game freshwater fishes, and other wildlife resources in a sound, constructive, comprehensive, continuing and economical manner.

Central Office	Frank McBride	919-528-9886	PO Box 118, Northside, NC 27564
Pisgah Center for Wildlife Education	J.P. McCann	828-877-4423	PO Box 1600, Pisgah Forest, NC 28768

US Army Corps of Engineers:

Responsible for: investigating, developing and maintaining the nation's water and related environmental resources; constructing and operating projects for navigation, flood control, major drainage, shore and beach restoration and protection; hydropower development; water supply; water quality control, fish and wildlife conservation and enhancement, and outdoor recreation; responding to emergency relief activities directed by other federal agencies; and administering laws for the protection and preservation of navigable waters, emergency flood control and shore protection. Responsible for wetlands and 404 Federal Permits.

Asheville Field Office	Robert Johnson	828-271-4854	151 Patton Ave., Asheville, NC 28801

DWQ Groundwater Section:

Groundwater classifications and standards; enforcement of groundwater quality protection standards and cleanup requirements; review of permits for wastes discharged to groundwater; issuance of well construction permits; underground injection control; administration of the underground storage tank (UST) program (including the UST Trust Funds), well head protection program development, and ambient groundwater monitoring.

Central Office	Carl Bailey	919-733-3221	PO Box 29578, Raleigh, NC 27626-0578
Asheville Region*	Vacant	828-251-6208	59 Woodfin Place, Asheville, NC 28801

Solid Waste

DENR Division of Waste Management:

Management of solid waste in a way that protects public health and the environment. The Division includes three sections and one program -- Hazardous Waste, Solid Waste, Superfund and the Resident Inspectors Program.

Central Office	Brad Atkinson	919-733-0692	401 Oberlin Road, Suite 150, Raleigh, NC 27605
Asheville Region*	Al Hetzell	828-251-6208	59 Woodfin Place, Asheville, NC 28801

On-Site Wastewater Treatment

Division of Environmental Health and County Health Departments:

Safeguard life, promote human health, and protect the environment through the practice of modern environmental health science, the use of technology, rules, public education, and above all, dedication to the public trust.

Services include:

- Training of and delegation of authority to local environmental health specialists concerning on-site wastewater.
- Engineering review of plans and specifications for wastewater systems 3,000 gallons or larger and industrial process wastewater systems designed to discharge below the ground surface.
- Technical assistance to local health departments, other state agencies, and industry on soil suitability and other site considerations for on-site wastewater systems.

Central Office	Steve Steinbeck	919-715-3273	2728 Capital Boulevard, Raleigh, NC 27604
Asheville *	James Boyer	828-251-6784	59 Woodfin Place, Asheville, NC 28801

County	Primary Contact	Phone	Address
Avery	Thomas Singleton, Interim	828-733-6031	545 Schultz Fox Circle, PO Box 325, Newland, NC 28657
Buncombe	George F. Bond, Jr.	828-250-5203	35 Woodfin Street, Asheville, NC 28801-3075
Haywood	Robert C. Wood	828-452-6675	2177 Asheville Road, Waynesville, NC 28786
Henderson	Thomas D. Bridges	828-692-4223	1347 Spartanburg Hwy, Hendersonville, NC 28792
Madison	Kenneth D. Ring	828-649-3531	140 Health Care Lane, Marshall, NC 28753
Mitchell	Thomas Singleton, Interim	828-688-2371	124 School Street, Bakersville, NC 28705
Transylvania	Terry Pierce	828-884-3135	Community Services Building, Brevard, NC 28712
Yancey	Thomas Singleton, Interim	828-682-6118	10 Swiss Avenue, Burnsville, NC 28714
Waste Discharge Elimination Program (WADE)			
	Terrell Jones	828-251-6784	852 Merrimon Avenue, Asheville, NC 28804

* **DENR Asheville Region Office covers the following counties:** Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania and Yancey.

Appendix VII

Glossary
of
Terms and Acronyms

Glossary

30Q2	The minimum average flow for a period of 30 days that has an average recurrence of one in two years.
7Q10	The annual minimum 7-day consecutive low flow, which on average will be exceeded in 9 out of 10 years.
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing.
basin	The watershed of a major river system. There are 17 major river basins in North Carolina.
benthic macroinvertebrates	Aquatic organisms, visible to the naked eye (macro) and lacking a backbone (invertebrate), that live in or on the bottom of rivers and streams (benthic). Examples include, but are not limited to, aquatic insect larvae, mollusks and various types of worms. Some of these organisms, especially aquatic insect larvae, are used to assess water quality. See EPT index and bioclassification for more information.
benthos	A term for bottom-dwelling aquatic organisms.
best management practices	Techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point and nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Often, BMPs are applied as system of practices and not just one at a time.
bioclassification	A rating of water quality based on the outcome of benthic macroinvertebrate sampling of a stream. There are five levels: Poor, Fair, Good-Fair, Good and Excellent.
BMPs	See *best management practices.*
BOD	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed by the decomposition of biological matter or chemical reactions in the water column. Most NPDES discharge permits include a limit on the amount of BOD that may be discharged.
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.
chlorophyll *a*	A chemical constituent in plants that gives them their green color. High levels of chlorophyll *a* in a waterbody, most often in a pond, lake or estuary, usually indicate a large amount of algae resulting from nutrient overenrichment or eutrophication.
coastal counties	Twenty counties in eastern NC subject to requirements of the Coastal Area Management Act (CAMA). They include: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell and Washington.

Coastal Plain	One of three major physiographic regions in North Carolina. Encompasses the eastern two-fifths of state east of the *fall line* (approximated by Interstate I-95).
conductivitiy	A measure of the ability of water to conduct an electrical current. It is dependent on the concentration of dissolved ions such as sodium, chloride, nitrates, phosphates and metals in solution.
degradation	The lowering of the physical, chemical or biological quality of a waterbody caused by pollution or other sources of stress.
DENR	Department of Environment and Natural Resources.
DO	Dissolved oxygen.
drainage area	An alternate name for a watershed.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
dystrophic	Naturally acidic (low pH), "black-water" lakes which are rich in organic matter. Dystrophic lakes usually have low productivity because most fish and aquatic plants are stressed by low pH water. In North Carolina, dystrophic lakes are scattered throughout the Coastal Plain and Sandhills regions and are often located in marshy areas or overlying peat deposits. NCTSI scores are not appropriate for evaluating dystrophic lakes.
effluent	The treated liquid discharged from a wastewater treatment plant.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
EPT Index	This index is used to judge water quality based on the abundance and variety of three orders of pollution sensitive aquatic insect larvae: Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).
eutrophic	Elevated biological productivity related to an abundance of available nutrients. Eutrophic lakes may be so productive that the potential for water quality problems such as algal blooms, nuisance aquatic plant growth and fish kills may occur.
eutrophication	The process of physical, chemical or biological changes in a lake associated with nutrient, organic matter and silt enrichment of a waterbody. The corresponding excessive algal growth can deplete dissolved oxygen and threaten certain forms of aquatic life, cause unsightly scums on the water surface and result in taste and odor problems.
fall line	A geologic landscape feature that defines the line between the piedmont and coastal plain regions. It is most evident as the last set of small rapids or rock outcroppings that occur on rivers flowing from the piedmont to the coast.
FS	Fully supporting. A rating given to a waterbody that fully supports its designated uses and generally has good or excellent water quality.

GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
headwaters	Small streams that converge to form a larger stream in a watershed.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
Hydrilla	The genus name of an aquatic plant - often considered an aquatic weed.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222 subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975 square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
hypereutrophic	Extremely elevated biological productivity related to excessive nutrient availability. Hypereutrophic lakes exhibit frequent algal blooms, episodes of low dissolved oxygen or periods when no oxygen is present in the water, fish kills and excessive aquatic plant growth.
impaired	Term that applies to a waterbody that has a use support rating of partially supporting (PS) or not supporting (NS) its uses.
kg	Kilograms. To change kilograms to pounds multiply by 2.2046.
lbs	Pounds. To change pounds to kilograms multiply by 0.4536.
loading	Mass rate of addition of pollutants to a waterbody (e.g., kg/yr)
macroinvertebrates	Animals large enough to be seen by the naked eye (macro) and lacking backbones (invertebrate).
macrophyte	An aquatic plant large enough to be seen by the naked eye.
mesotrophic	Moderate biological productivity related to intermediate concentrations of available nutrients. Mesotrophic lakes show little, if any, signs of water quality degradation while supporting a good diversity of aquatic life.
MGD	Million gallons per day.
mg/l	Milligrams per liter (approximately 0.00013 oz/gal).
NCIBI	North Carolina Index of Biotic Integrity. A measure of water quality factors affecting the fish in a given waterbody.

NH_3-N	Ammonia nitrogen.
nonpoint source	A source of water pollution generally associated with rainfall runoff or snowmelt. The quality and rate of runoff of NPS pollution is strongly dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from forested lands will generally contain much less pollution and runoff more slowly than runoff from urban lands.
NPDES	National Pollutant Discharge Elimination System.
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NS	Not supporting. A rating given to a waterbody that does not support its designated uses and has poor water quality and severe water quality problems. Both PS and NS are called impaired.
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed).
NTU	Nephelometric Turbidity Units. The units used to quantify turbidity using a turbidimeter. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions.
oligotrophic	Low biological productivity related to very low concentrations of available nutrients. Oligotrophic lakes in North Carolina are generally found in the mountain region or in undisturbed (natural) watersheds and have very good water quality.
ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
pH	A measure of the concentration of free hydrogen ions on a scale ranging from 0 to 14. Values below 7 and approaching 0 indicate increasing acidity, whereas values above 7 and approaching 14 indicate a more basic solution.
phytoplankton	Aquatic microscopic plant life, such as algae, that are common in ponds, lakes, rivers and estuaries.
Piedmont	One of three major physiographic regions in the state. Encompasses most of central North Carolina from the Coastal Plain region (near I-95) to the eastern slope of the Blue Ridge Mountains region.

PS	Partially supporting. A rating given to a waterbody that only partially supports its designated uses and has fair water quality and severe water quality problems. Both PS and NS are called impaired.
riparian zone	Vegetated corridor immediately adjacent to a stream or river. See also SMZ.
river basin	The watershed of a major river system. North Carolina is divided into 17 major river basins: Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar-Pamlico, Watauga, White Oak and Yadkin River basins.
river system	The main body of a river, its tributary streams and surface water impoundments.
runoff	Rainfall that does not evaporate or infiltrate the ground, but instead flows across land and into waterbodies.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival.
sedimentation	The sinking and deposition of waterborne particles (e.g., eroded soil, algae and dead organisms).
silviculture	Care and cultivation of forest trees; forestry.
ST	Fully supporting but threatened. A rating given to a waterbody that fully supports it designated uses, but has notable water quality problems.
streamside management zone (SMZ)	The area left along streams to protect streams from sediment and other pollutants, protect streambeds, and provide shade and woody debris for aquatic organisms.
subbasin	A designated subunit or subwatershed area of a major river basin. Subbasins typically encompass the watersheds of significant streams or lakes within a river basin. Every river basin is subdivided into subbasins ranging from one subbasin in the Watauga River basin to 24 subbasins in the Cape Fear River basin. There are 133 subbasins statewide. These subbasins are not a part of the national uniform hydrologic unit system that is sponsored by the Water Resources Council (see *hydrologic unit*).
Sw	Swamp Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are common in the Coastal Plain and are often naturally discolored giving rise to their nickname of "blackwater" streams.
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses.

TN	Total nitrogen.
TP	Total phosphorus.
tributary	A stream that flows into a larger stream, river or other waterbody.
trophic classification	Trophic classification is a relative description of a lake's biological productivity, which is the ability of the lake to support algal growth, fish populations and aquatic plants. The productivity of a lake is determined by a number of chemical and physical characteristics, including the availability of essential plant nutrients (nitrogen and phosphorus), algal growth and the depth of light penetration. Lakes are classified according to productivity: unproductive lakes are termed "oligotrophic"; moderately productive lakes are termed "mesotrophic"; and very productive lakes are termed "eutrophic".
TSS	Total Suspended Solids.
turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. All particles in the water that may scatter or absorb light are measured during this procedure. Suspended sediment, aquatic organisms and organic particles such as pieces of leaves contribute to instream turbidity.
UT	Unnamed tributary.
watershed	The region, or land area, draining into a body of water (such as a creek, stream, river, pond, lake, bay or sound). A watershed may vary in size from several acres for a small stream or pond to thousands of square miles for a major river system. The watershed of a major river system is referred to as a basin or river basin.
WET	Whole effluent testing. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WS	Class WS Water Supply Water Classification. This classification denotes freshwaters used as sources of water supply. There are five WS categories. These range from WS-I, which provides the highest level of protection, to WS-V, which provides no categorical restrictions on watershed development or wastewater discharges like WS-I through WS-IV.
WWTP	Wastewater treatment plant.