LITTLE TENNESSEE RIVER BASINWIDE WATER QUALITY PLAN

April 2002

Prepared by:

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This document was approved and endorsed by the NC Environmental Management Commission on April 11, 2002 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 Little Tennessee River basin. This plan is the first five-year update to the Little Tennessee River Basinwide Water Quality Management Plan approved by the NC Environmental Management Commission in May 1997.

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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 (DWQ) 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 DWQ, 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 Little Tennessee River basin was completed in 1997.

This draft document is the first five-year update of the *Little Tennessee River Basinwide Water Quality Plan*. The format of this plan was revised in response to comments received during the first planning cycle. DWQ replaced much of the general information in the first plan with more detailed information specific to the Little Tennessee River basin. A greater emphasis was placed on identifying causes and sources of pollution for individual streams in order to facilitate local restoration efforts.

DWQ considered comments from three public workshops and two public meetings held in the basin. Discussions with local resource agency staff and citizens during draft plan development were also essential. This input will help guide continuing DWQ activities in the basin.

Goals of the Basinwide Approach

The 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.

Little Tennessee River Basin Overview

The Little Tennessee River begins in the mountains of northeastern Georgia. In North Carolina, the river flows about 25 miles north and 25 miles northwest between seven large and unique mountain ranges before entering Tennessee where it joins the Tennessee River. Major tributaries include the Cullasaja, Nantahala, Tuckasegee and Cheoah Rivers. Major lakes include Fontana, Santeetlah, Nantahala and Glenville. Although the Little Tennessee River basin is barely considered medium-sized when compared with other NC river basins (approximately 1,800 square miles), it contains more than 2,500 miles of streams and rivers and 18,000 acres of lakes. Both the Roanoke and Tar-Pamlico River basins, which are two and three times larger, respectively, have fewer stream miles.

The Little Tennessee River is thought to contain its full assemblage of native aquatic life. Water quality in the basin is generally excellent. Trout waters are abundant, and many streams are classified High Quality or Outstanding Resource Waters.

The land comprising the Little Tennessee River basin is mountainous and primarily rural. Nearly 89 percent of the land is forested, and less than 5 percent falls into the urban/developed category. More than half of the land in the basin is publicly owned and lies within the Great Smoky Mountains National Park or the Nantahala National Forest. The basin encompasses parts of six counties and nine municipalities, and the entire reservation of the Eastern Band of Cherokee Indians also lies within its boundaries.

The estimated population of the basin in 2000 was 79,493, and the population is projected to increase 31 percent by 2020. Most of the basin's population is located in and around Franklin, Sylva and Cherokee, and the largest population increases will likely be around these urban areas. The basin also experiences significant seasonal population increases due to recreation and tourism.

Assessment of Water Quality in the Little Tennessee River Basin

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality. Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met. For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, having inconclusive data, or for which criteria have not been developed are listed as not rated (NR).

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water.

<u>Aquatic Life/Secondary Recreation</u>

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (2564.6) and lake acres (21,158.4) in the North Carolina portion of the Little Tennessee River basin.

Approximately 20 percent of stream miles (524.7) and 33 percent of lake acres (6,881) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle (Table 1). Impaired waters account for 2.4 percent of monitored stream miles and 4.1 percent of monitored lake acres.

Table 1 Aquatic Life/Secondary Recreation Use Support Summary (1999)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**2027.4 mi 16,749.2 ac**	**79.1% 79.2%**		**508.7 mi 6,601 ac**	**97.0% 96.0%**
Impaired	**12.9 mi 280 ac**	**0.5% 1.3%**		**12.9 mi 280 ac**	**2.4% 4.1%**
Partially Supporting	*12.9 mi 280 ac*	*0.5% 1.3%*		*12.9 mi 280 ac*	*2.4% 4.1%*
Not Supporting	*0.0 mi 0.0 ac*	*0.0%*		*0.0 mi 0.0 ac*	*0.0% 0.0%*
Not Rated	**524.2 mi 4,359.2 ac**	**20.4% 10.6%**		**3.1 mi 0.0 ac**	**0.6% 0.0%**
TOTAL	**2564.5 mi 21,158.4 ac**			**524.7 mi 6,881 ac**	

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

Fish Consumption

Like the aquatic life/secondary recreation use support category, fish consumption is also applied to all waters in the state. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there are no fish consumption advisories specific to the NC portion of the basin. Therefore, all waters are considered to be fully supporting the fish consumption category. No waters were monitored for fish consumption during this basinwide cycle because of the lack of any significant contaminant concerns in the Little Tennessee River basin.

Primary Recreation

There are 237.3 stream miles and 16,879.2 lake acres currently classified for primary recreation in the Little Tennessee River basin. Primary recreation use support ratings are based on swimming advisories issued by the NC Department of Health and Human Services (DHHS). Approximately 58 percent of stream miles (136.8) and 40 percent of lake acres (6,731) were monitored for the protection of primary recreation by DWQ over the past five years (Table 2). Impaired waters account for 4.2 percent of monitored lake acres.

Table 2 Primary Recreation Use Support Summary (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles	%		Miles	%
Fully Supporting	**136.8 mi** **16,599.2 ac**	**57.6%** **98.3%**		**136.8 mi** **6,451 ac**	**100%** **95.8%**
Impaired	0.0 mi 280 ac	**0.0%** **1.7%**		**0.0 mi** **280 ac**	**0.0%** **4.2%**
Partially Supporting	*0.0 mi* *280 ac*	*0.0%* *1.7%*		*0.0 mi* *280 ac*	*0.0%* *0.0%*
Not Supporting	*0.0 mi* *0.0 ac*	*0.0%* *0.0%*		*0.0 mi* *0.0 ac*	*0.0%* *0.0%*
Not Rated	**100.5 mi** **0.0 ac**	**42.4%** **0.0%**		**0.0 mi** **0.0 ac**	**0.0%** **0.0%**
TOTAL	**237.3 mi** **16,879.2 ac**			**136.8 mi** **6,731 ac**	

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

Water Supply

There are 530.6 stream miles and 2,426 lake acres currently classified for water supply in the Little Tennessee River basin. All were evaluated within the past five years based on reports from regional Public Water Supply water treatment plant consultants. All are fully supporting. A basinwide summary of current water supply use support ratings is presented in Table 3.

Table 3 Water Supply Use Support Summary (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only	
	Miles	%		Miles	%
Fully Supporting	**530.6 mi** **2,426.0 ac**	**100%**		**0.0 mi** **0.0 ac**	**0%**
Impaired	**0.0 mi** **0.0 ac**	**0%**		**0.0 mi** **0.0 ac**	**0%**
Not Rated	**0.0 mi** **0.0 ac**	**0%**		**0.0 mi** **0.0 ac**	**0%**
TOTAL	**530.6 mi** **2,426.0 ac**			**0.0 mi** **0.0 ac**	

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

Recommended Management Strategies for Restoring Impaired Waters

The long-range mission of basinwide planning is to provide a means of addressing the complex problem of planning for increased development and economic growth while maintaining, protecting and enhancing water quality and intended uses of the Little Tennessee River basin's surface waters. Within this basinwide plan, DWQ presents management strategies and recommendations for those waters considered to be impaired or that exhibit some notable water quality problem.

Table 4 presents impaired waters in the Little Tennessee River basin, summaries of the recommended management strategies, and location of further information in the basinwide plan. All are partially supporting the aquatic life/secondary recreation use support category.

Subbasin	Chapter in Section B	Impaired Water	Use Support Rating	Potential Sources	Recommended Management Strategy
04-04-01	1 (pg 77)	**Cullasaja River+**	PS Aquatic Life / Secondary Recreation	NP	DWQ Watershed Assessment and Restoration Project. DWQ will continue to work with local governments and resource agency staff to reduce NP pollution.
04-04-01	1 (pg 77)	**Mill Creek+**	PS Aquatic Life / Secondary Recreation	NP	DWQ Watershed Assessment and Restoration Project. DWQ will continue to work with local governments and resource agency staff to reduce NP pollution.
04-04-01	1 (pg 77)	Little Tennessee River +	PS Aquatic Life / Secondary Recreation	NP, P	DWQ will work with GA EPD to address any point source compliance issues. DWQ will continue to work with local governments, citizen groups and resource agency staff to reduce NP pollution.
04-04-02	2 (pg 88)	Beech Flats Prong	PS Aquatic Life / Secondary Recreation	NP	No scientifically and economically defensible way to manage the extensive road cut has been found. Anakeesta rock formations should be avoided in the future.
04-04-04	4 (pg 103)	**Santeetlah Lake (West Buffalo Creek Arm)**	PS Aquatic Life / Secondary & Primary Recreation	P	DWQ will reevaluate existing NPDES permits to trout farms with emphasis placed on total phosphorus effluent reductions. No new sources of nutrients into any arms of Santeetlah Lake will be permitted without rigorous evaluation.

Key: PS = Partially Supporting NP = Nonpoint sources
BMP = Best Management Practice P = Point Sources

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

Bold = 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.

Major water quality problems leading to impairment in the basin include habitat degradation and excess nutrients. The latter is primarily from trout farming operations. Habitat degradation, including sedimentation, loss of riparian vegetation and streambank erosion, is primarily attributed to runoff from developed areas and agricultural activities. Problems from point sources from facilities outside of the state's jurisdiction are also contributing to impairment.

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. Section 303(d) of the federal Clean Water Act requires states to develop a 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 impaired stream miles on the state's 2000 303(d) list in NC. The rigorous and demanding task of developing TMDLs for each listed water during a 13-year time frame will require the focus of many resources. 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.

Strategies for Addressing Notable Water Quality Impacts in Unimpaired Waters

Often during DWQ's use support assessment, water quality concerns are documented for waters that are fully supporting designated uses. While these waters are not considered impaired, they are discussed so that attention and resources can be focused on these waters over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. Waters with notable water quality concerns in the Little Tennessee River basin include Crawford Branch in subbasin 04-04-01, Scotts Creek and Savannah Creek in subbasin 04-04-02, Silvermine Creek and Wine Spring Creek in subbasin 04-04-03, and Sweetwater Creek in subbasin 04-04-04.

Challenges Related to Achieving Water Quality Improvements

To achieve the goal of restoring impaired waters throughout the basin, DWQ will need to work more closely with other state agencies and stakeholders to identify and control pollutants. DWQ plans to notify local agencies and others of water quality concerns for both impaired and unimpaired waters in the Little Tennessee River basin and work with them to conduct further monitoring and to locate sources of water quality protection funding for these unimpaired waters. The costs of restoration will be high, but several programs exist to provide funding for restoration efforts. These programs include the Clean Water Management Trust Fund, the NC Agricultural Cost Share Program, the Wetlands Restoration Program, and the federally funded Environmental Quality Incentives Program.

With increased development occurring, there will be significant challenges ahead in balancing economic growth with the protection of water quality in this mountainous basin. Point source impacts on surface waters can be measured and addressed through the basinwide planning process. Nonpoint sources of pollution can be identified through the basinwide plan, but actions to address these impacts must be taken at the local level. Such actions should include: development and enforcement of local erosion control ordinances; requirement of stormwater best management practices for existing and new development; development and enforcement of buffer ordinances; and land use planning that assesses impacts on natural resources. This basinwide plan presents many water quality initiatives and accomplishments that are underway within the basin. These actions provide a foundation on which future initiatives can be built.

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 (DWQ) 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 water quality plan is a five-year process, which is broken down into three 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 cycle of plans was completed in 1998, but each plan is updated at five-year intervals.

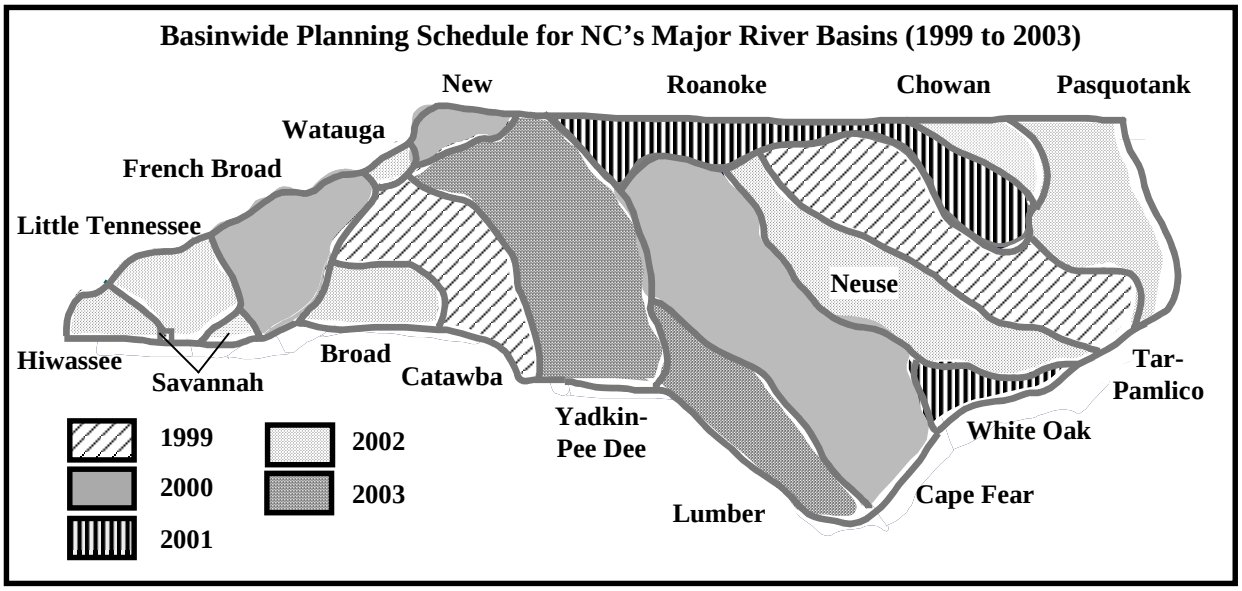

Figure A-1 Basinwide Planning Schedule (1999 to 2003)

1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide planning 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 Cycle of Basinwide Planning (1998 to 2003)

Basin	DWQ 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 2000	6/2001	5/2002	7/2002	1/2003
Lumber	Summer 2001	12/2002	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 97	6/1998	4/1999	7/1999	1/2000
Catawba	Summer 97	2/1999	10/1999	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	7/2001	9/2001	6/2002
Savannah	Summer 99	10/2000	12/2001	3/2002	8/2002
Watauga	Summer 99	10/2000	12/2001	2/2002	9/2002
Little Tennessee	**Summer 99**	**3/2001**	**12/2001**	**4/2002**	**10/2002**
Hiwassee	Summer 99	10/2000	12/2001	3/2002	8/2002
Chowan	Summer 2000	3/2001	3/2002	7/2002	11/2002
Pasquotank	Summer 2000	3/2001	3/2002	7/2002	12/2002
Broad	Summer 2000	11/2001	9/2002	12/2002	7/2003
Yadkin Pee-Dee	Summer 2001	4/2002	12/2002	3/2003	9/2003

Note: A basinwide plan was completed for all 17 basins during the first cycle (1993 to 1998).

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

Years 1 - 2 **Water Quality Data Collection and Identification of Goals and Issues**	• Identify sampling needs • Conduct biological monitoring activities • Conduct special studies and other water quality sampling activities • Coordinate with local stakeholders and other agencies to continue to implement goals within current basinwide plan
Years 2 - 3 **Data Analysis and Public Workshops**	• Gather and analyze data from sampling activities • Develop use support ratings • Conduct special studies and other water quality sampling activities • Conduct public workshops to establish goals and objectives and identify and prioritize issues for the next basin cycle • Develop preliminary pollution control strategies • Coordinate with local stakeholders and other agencies
Years 3 - 5 **Preparation of Draft Basinwide Plan, Public Review, Approval of Plan, Issue NPDES Permits and Begin Implementation of Plan**	• Develop draft basinwide plan based on water quality data, use support ratings, and recommended pollution control strategies • Circulate draft basinwide plan for review and present draft plan at public meetings • Revise plan after public review period • Submit plan to Environmental Management Commission for approval • Issue NPDES permits • Coordinate with other agencies and local interest groups to prioritize implementation actions • Conduct special studies and other water quality sampling activities

1.3 Major Components of the Basinwide Plan

The second cycle 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 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 are focused on one river basin at a time.
- *Increased effectiveness*. The basinwide approach is in agreement with basic ecological principles.
- *Better consistency and equitability*. 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 can be developed to ensure compliance with water quality standards.

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 three 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 basin planner for your river basin.

1.6 Other References

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

- *Little Tennessee River Basinwide Assessment Report*. April 2000. This technical report presents the physical, chemical and biological data available for the Little Tennessee River basin. 60 pp.
- *Little Tennessee River Basinwide Water Quality Management Plan*. May 1997. This first basinwide plan for the Little Tennessee River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 275 pp.
- *A Citizen's Guide to Water Quality Management in North Carolina*. August 2000. This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. 156 pp.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Little Tennessee River Basin*. September 1998. DWQ NC Wetlands Restoration Program. Raleigh, NC. 64 pp.
- *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 Division of Water Quality Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/.

Anyone interested in receiving these documents can contact the DWQ Planning Branch at (919) 733-5083 or by internet http://h2o.enr.state.nc.us/basinwide/.

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. Additional information can be found on the Division of Water Quality website at http://h2o.enr.state.nc.us/.

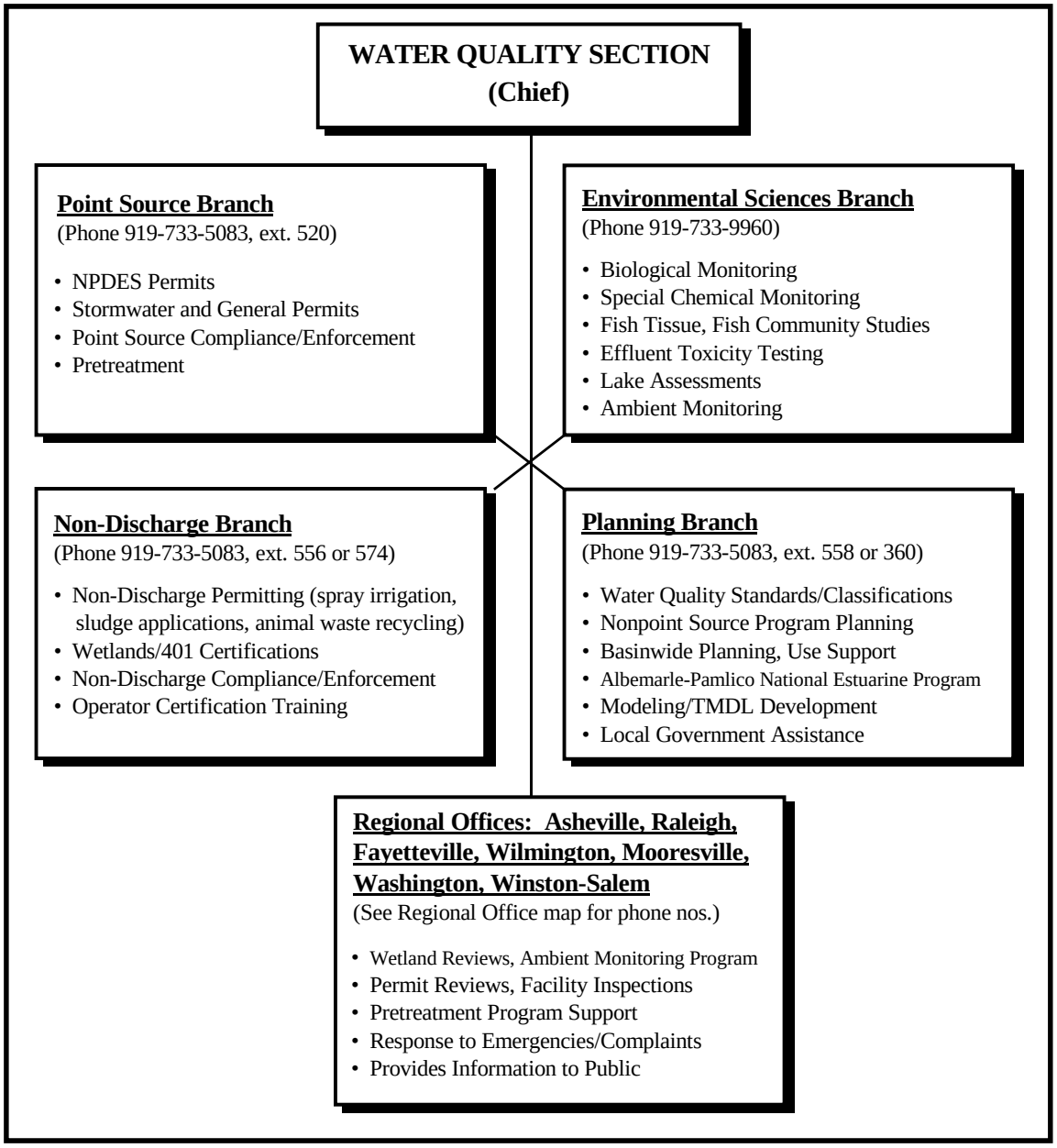

Figure A-2 Water Quality Section Organization Structure

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Figure A-3 Division of Water Quality Regional Offices

Chapter 2 -
Basin Overview

2.1 General Overview

The Little Tennessee River begins in northeastern Georgia and flows for seven miles before reaching the North Carolina state line. In North Carolina, the river flows about 25 miles north and 25 miles northwest between seven large and unique mountain ranges before entering the State of Tennessee where it joins the Tennessee River. Waters from the Tennessee River flow into the Ohio and Mississippi Rivers before emptying into the Gulf of Mexico (Figure A-4). Major tributaries to the Little Tennessee River in North Carolina include the Cullasaja, Nantahala, Tuckasegee and Cheoah Rivers. Major lakes include Fontana, Santeetlah, Nantahala and Glenville. Figure A-5 presents the North Carolina portion of the basin.

Little Tennessee River Basin Statistics

Total Area: 1,797 mi^2
Stream Miles: 2,565
Lake Acres: 21,158.4
No. of Counties: 6
No. of Municipalities: 9
No. of Subbasins: 4
Population (2000): 79,493 *
Estimated Pop. (2020): 104,095 *
% Increase (2000-2020): 31%
Pop. Density (1990): 38 persons/sq. mi.

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

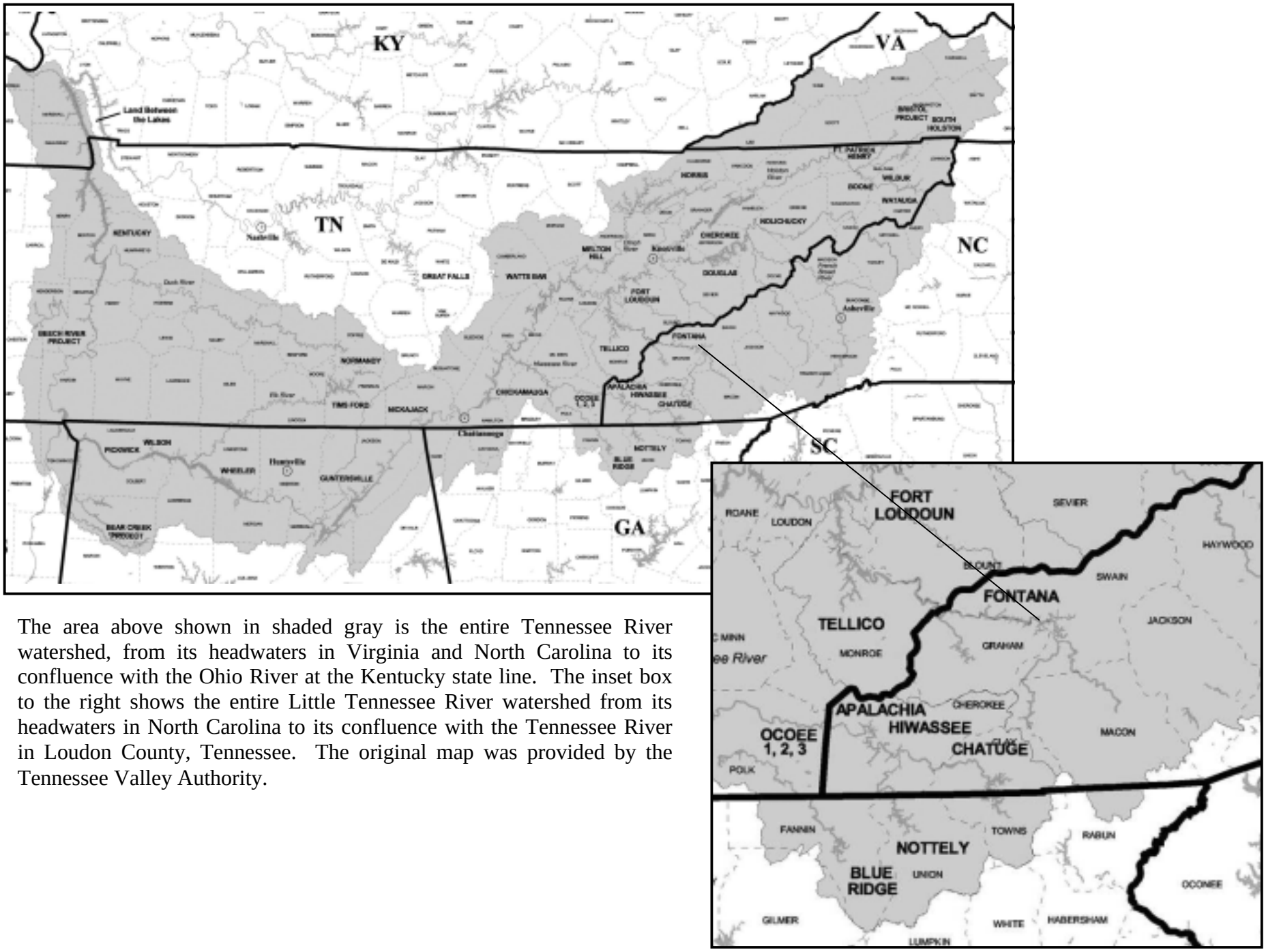
Although the Little Tennessee River basin is barely considered medium-sized when compared with other North Carolina river basins (approximately 1,800 square miles), it contains more than 2,500 miles of streams and rivers and 18,000 acres of lakes. Both the Roanoke and Tar-Pamlico River basins, which are two and three times larger, respectively, have fewer stream miles.

The Little Tennessee River in North Carolina is thought to contain its full assemblage of native aquatic life. Even though the watershed above Fontana Lake represents only one percent of the entire Tennessee River basin, it contains 25 percent of all fish species found in the much larger river system (Kornegay, November 1999). Water quality in the basin is generally excellent. Trout waters are abundant, and many streams are classified High Quality or Outstanding Resource Waters.

The land comprising the Little Tennessee River basin is mountainous and primarily rural. Nearly 89 percent of the land is forested, and less than 5 percent falls into the urban/built-up category. More than half of the land in the basin is publicly owned and lies within the Great Smoky Mountains National Park or the Nantahala National Forest. The basin encompasses parts of six counties and nine municipalities, and the entire reservation of the Eastern Band of Cherokee Indians also lies within its boundaries.

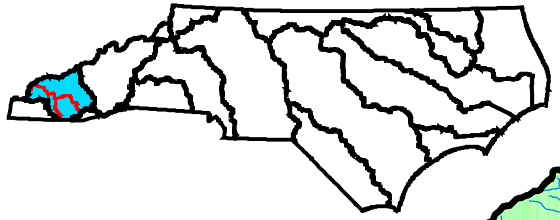
The estimated population of the basin in 2000 was 79,493, and the population is projected to increase 31 percent by 2020. Most of the basin's population is located in and around Franklin, Sylva and Cherokee, and the largest population increases will likely be around these urban areas. The basin also experiences significant seasonal population increases due to recreation and tourism.

Figure A-4 General Map of the Entire Tennessee River Basin



The area above shown in shaded gray is the entire Tennessee River watershed, from its headwaters in Virginia and North Carolina to its confluence with the Ohio River at the Kentucky state line. The inset box to the right shows the entire Little Tennessee River watershed from its headwaters in North Carolina to its confluence with the Tennessee River in Loudon County, Tennessee. The original map was provided by the Tennessee Valley Authority.

Figure A-5 General Map of the Little Tennessee River Basin



SWAIN

HAYWOOD

GRAHAM

CHEROKEE

MACON

JACKSON

CLAY

TRANSYLVANIA

04-04-01

04-04-02

04-04-03

04-04-04

Raven Fork

Oconaluftee River

Deep Creek

Hazel Creek

Little Tennessee River

Cheoah River

Fontana Lake

Santeetlah Lake

Snowbird Creek

Bryson City

Tuckasegee River

Dillsboro

Scott Creek

Sylva

Caney Fork

Tennessee River

Nantahala River

Robbinsville

Franklin

Nantahala Lake

Cartoogechaye Creek

Cullasaja River

Thorpe Lake

Highlands

10 0 10 Miles

NCDENR

Planning Branch
Basinwide & Estuary Planning Unit
July 8, 2002

2.2 Local Governments and Planning Jurisdictions in the Basin

The basin encompasses all or part of the following six counties and nine municipalities (Table A-3). All counties are located in the Southwestern Commission Council of Governments (Region A) located in Bryson City (http://www.regiona.org/).

Table A-3 Local Governments and Planning Units within the Little Tennessee River Basin

County	Council of Government Region	Municipalities
Cherokee	Region A	None
Clay	Region A	None
Graham	Region A	Robbinsville Santeetlah
Jackson	Region A	Dillsboro Forest Hills Highlands ♦ Sylva Webster
Macon	Region A	Franklin Highlands ♦
Swain	Region A	Bryson City

♦ Highlands is located in more than one county and more than one river basin.

Note: Counties adjacent to and sharing a border with a river basin are not included as part of that basin if only a trace amount of the county (<2%) is located in that basin, unless a municipality is located in that county.

The Little Tennessee River basin also encompasses the Qualla Boundary, home of the Eastern Band of Cherokee Indians (EBCI). The EBCI are a self-governing tribe and are treated like a separate state by the United States government. The Cherokee reservation lies at the foot of the Great Smoky Mountains National Park and contains six communities: Big Cove, Birdtown, Painttown, Snowbird, Wolftown and Yellowhill.

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey and the 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 Little Tennessee River basin is made up of three hydrologic areas referred to as hydrologic units: the Upper and Lower Little Tennessee and the Tuckasegee River. DWQ has a two-tiered system in which the state is divided into 17 major river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Little Tennessee River basin in North Carolina is subdivided by DWQ into four subbasins which roughly correspond with the Little Tennessee River, Tuckasegee River, Nantahala River and Cheoah River watersheds (shown on Figure A-5). Maps of each subbasin are included in Section B of this plan.

In this basin, approximately 2,565 miles of freshwater streams drain 1,797 square miles of land. The basin is located entirely within the Blue Ridge Physiographic Province. The Blue Ridge Province is a mountainous area of steep ridges, inter-mountain basins and valleys that intersect at all angles. A larger number of streams drain smaller areas of land in this region compared with the piedmont and coastal plain portions of the state. In fact, the Little Tennessee River basin actually contains more stream miles than the Tar-Pamlico River basin that is three times its size.

Table A-4 Hydrologic Subdivisions in the Little Tennessee River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ 6-digit Subbasin Codes
Upper Little Tennessee River Cullasaja River, Lake Sequoyah Cartoogechaye Creek Nantahala River, Nantahala Lake	06010202	04-04-01 and 04-04-03
Tuckasegee River Lake Glenville, Wolf Creek Reservoir Oconoluftee River, Deep Creek	06010203	04-04-02
Lower Little Tennessee River Santeetlah Lake, Snowbird Creek Tulula Creek, Cheoah River	06010204	04-04-04

The North Carolina portion of the Little Tennessee River basin contains 21,158.4 acres of surface water which includes nine major man-made reservoirs. Table A-5 outlines surface area, average depth, volume and watershed area for each. These lakes are managed for water supply, hydroelectric power production, flood control and recreation.

Table A-5 Statistics for Major Lakes in the Little Tennessee River Basin

Subbasin/Lake	County	Classification	Surface Area (Ac)	Mean Depth (ft)	Volume (X 10^6 m^3)	Watershed (mi^2)
04-04-01						
Lake Sequoyah	Macon	WS-III Tr	150	7	0.1	14
04-04-02						
Wolf Creek Reservoir	Jackson	WS-III B Tr HQW	193	89	2.1	40
Bear Creek Reservoir	Jackson	WS-III B Tr	475	108	5.6	75
Cedar Cliff Lake	Jackson	WS-III B Tr	146	89	7.2	81
Lake Glenville	Jackson	WS-III B HQW	1,462	76	82.6	37
Fontana Lake	Swain/Graham	WS-IV B	10,148	--	--	--
04-04-03						
Nantahala Lake	Macon	B Tr	1,606	125	160.0	108
04-04-04						
Lake Cheoah	Swain/Graham	C Tr	633	131	297.5	1608
Santeetlah Lake	Graham	B Tr	2,849	56	195.0	176

2.4 Land Cover

Land cover information in this section is from the most recent National Resources Inventory (NRI), as developed by the Natural Resources Conservation Service (USDA-NRCS, NRI, updated June 2001). The National Resources Inventory (NRI) is a statistically based longitudinal survey that has been designed and implemented to assess conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. The NRI provides results that are nationally and temporally consistent for four points in time – 1982, 1987, 1992 and 1997.

In general, NRI protocols and definitions remain fixed for each inventory year. However, part of the inventory process is that the previously recorded data are carefully reviewed as determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary Report: 1997 National Resources Inventory* provides guidance for use and interpretation of current NRI data:

> "The 1997 NRI database has been designed for use in detecting significant changes in resource conditions relative to the years 1982, 1987, 1992 and 1997. All comparisons for two points in time should be made using the new 1997 NRI database. Comparisons made using data published for the 1982, 1987 and 1992 NRI may provide erroneous results, because of changes in statistical estimation protocols, and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected."

Table A-6 summarizes acreage and percentage of land cover from the 1997 NRI for the North Carolina portion of the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover.

Table A-6 Land Cover in the Little Tennessee River Basin by Major Watersheds – 1982 vs. 1997 (Source: USDA-NRCS, NRI, updated June 2001)

	MAJOR WATERSHED AREAS										
	Upper Little Tennessee		Tuckasegee River		Lower Little Tennessee		1997 TOTALS		1982 TOTALS		% change
LAND COVER	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	since 1982
Cult. Crop	0.0	0.0	2.5	0.6	0.6	0.3	3.1	0.3	13.8	1.2	-77.5
Uncult. Crop	4.8	0.9	9.1	2.0	0.7	0.4	14.6	1.3	7.7	0.7	89.6
Pasture	12.7	2.4	6.8	1.5	5.9	3.4	25.4	2.2	36.9	3.2	-31.2
Forest	141.0	27.0	177.7	39.2	39.6	22.8	358.3	31.2	381.6	33.2	-6.1
Urban & Built-Up	25.2	4.8	23.5	5.2	3.0	1.7	51.7	4.5	21.5	1.9	140.5
Federal	319.9	61.2	221.2	48.8	119.3	68.7	660.4	57.4	649.4	56.5	1.7
Other	18.8	3.6	12.9	2.8	4.6	2.6	36.3	3.2	38.9	3.4	-6.7
Totals	522.4	100.0	453.7	100.0	173.7	100.0	1149.8	100.0	1149.8	100.0	
% of Total Basin		45.4		39.5		15.1		100.0			
SUBBASINS	04-04-01 04-04-03		04-04-02		04-04-04						
8-Digit Hydraulic Units	06010202		06010203		06010204						

* = Watershed areas as defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.

More than 70 percent of land in the basin is forested, and more than 50 percent is in public ownership. Approximately 4 percent is used for agriculture including cultivated and uncultivated cropland and pastureland. Only 4.5 percent of the land area is developed. A description of land cover types, including the "Other" category, to which 3.2 percent of land in the basin is assigned, can be found in Table A-7.

Table A-7 Description of Land Cover Types (Source: USDA-NRCS, NRI, updated June 2001)

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; 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.

Figure A-6 presents changes in land cover between 1982 and 1997. Comparisons show a significant decrease in private forested land (-23,300 acres) and substantial increases in the urban/developed (+30,200 acres) and federal (+11,000 acres) land use categories. Since most of the federal land in the basin is forested, it is likely that the amount of forested land actually increased over the fifteen-year period (+6,900 acres).

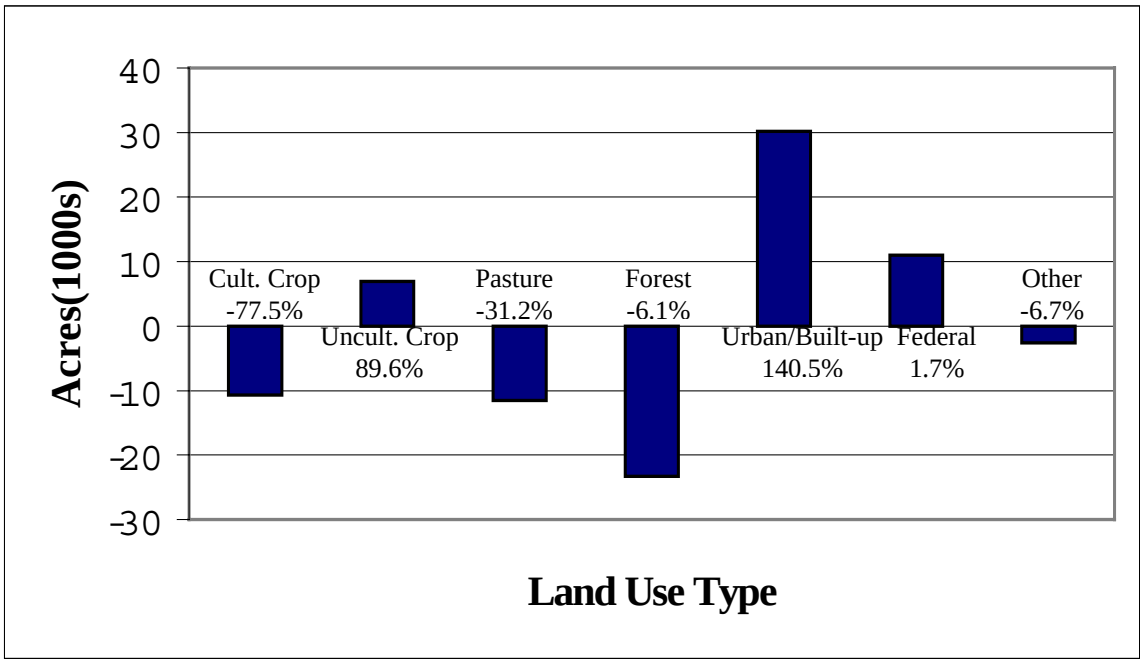


Figure A-6 Land Cover Changes from 1982 to 1997 for the Little Tennessee River Basin (Source: USDA-NRCS, NRI, updated June 2001)

Recent land cover information for the Little Tennessee River basin, based on satellite imagery collected from the North Carolina Corporate Geographic Database, is also available. The state's Center for Geographic Information and Analysis (CGIA) developed statewide land cover information based on this 1993-1995 satellite imagery. These land cover data are divided into 24 categories. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-8. An important distinction between this land cover dataset and that of the NRI is that there is no actual groundtruthing of the satellite-generated data.

Table A-8 Description of Major CGIA 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.

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.

Figure A-7 provides an illustration of the relative amount of land area that falls into each major cover type for the Little Tennessee River basin. Section B of this plan provides land cover data specific to each subbasin.

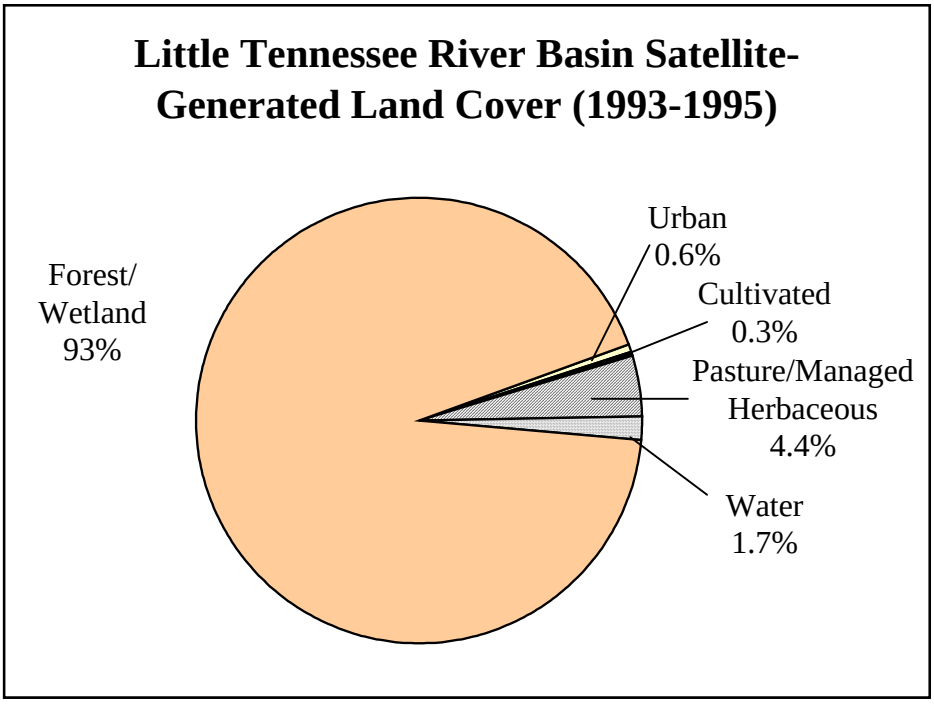


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Little Tennessee River Basin

2.5 Population and Growth Trends

Population

Following the 1990 census, North Carolina population data were compared with subbasin boundaries in an attempt to better estimate actual river basin population. Based on this comparison, the Little Tennessee River basin had an estimated population of 67,083. Table A-9 presents census data, by subbasin, for 1970, 1980 and 1990 census data. Table A-9 also includes population densities (persons/square mile) based on the *land area* (excludes open water) for each subbasin. Most of the basin's population is currently located in the Tuckasegee River watershed (subbasin 04-04-02) in and around the Sylva, Bryson City and Cherokee areas. However, subbasin 04-04-01 (Macon County) is the most densely populated at 57 persons per square mile.

However, this is still a relatively low density compared with the statewide average of 139 persons per square mile.

Table A-9 Little Tennessee River Subbasin Population, Densities (1970, 1980 and 1990) and Land Area Summaries

SUBBASIN	POPULATION [1] (Number of Persons)			POPULATION DENSITY [2] (Persons/Square Mile)			AREA [3]	
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)
04-04-01	14,084	18,291	21,008	38	49	57	237,051	370
04-04-02	29,619	35,964	38,017	29	35	37	666,511	1,021
04-04-03	1,717	1,943	1,918	11	13	12	101,224	155
04-04-04	5,601	6,208	6,140	25	28	28	144,570	221
TOTALS	**51,021**	**62,406**	**67,083**	**29**	**35**	**38**	**1,149,356**	**1,767**

[1] Population estimated based on US Census data and percentage of census block that falls within the subbasin.
[2] Population density based on land area only. Large wetlands (swamps) not included in area used to calculate density.
[3] Information generated by the NC Center for Geographic Information Analysis.

In using these data, it should be noted that 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, an estimate is made on the percentage of the population that is located in the subbasin. This was done by simply determining 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 to the subbasin. Use of this method necessitates assuming 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. This analysis to determine river basin population has not yet been conducted for the recently released 2000 census data.

Growth Trends

Table A-10 presents population data for municipalities that are located wholly or partially within the basin. Franklin, Sylva and Bryson City are the largest municipalities in the North Carolina portion of the Little Tennessee River basin and each grew significantly between 1990 and 2000. Forest Hills became incorporated since the 1997 basin plan. This information was obtained from the Office of State Planning (April and May 2001).

Table A-10 Population (1980, 1990, 2000) and Population Change for Municipalities Located Wholly or Partly in the Little Tennessee River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	% Change (1980-1990)	% Change (1990-2000)
Bryson City	Swain	1,556	1,145	1,411	-26.4	23.2
Dillsboro	Jackson	179	121	205	-32.4	69.4
Forest Hills	Jackson	…	…	330	…	…
Franklin	Macon	2,640	2,873	3,490	8.8	21.5
Highlands *	Jackson, Macon	653	948	909	45.2	-4.1
Robbinsville	Graham	814	709	747	-12.9	5.4
Santeetlah	Graham	80	47	67	-41.3	42.6
Sylva	Jackson	1,699	1,809	2,435	6.5	34.6
Webster	Jackson	200	410	486	105.0	18.5

* The numbers reported reflect municipality population; however, the municipality is not entirely contained within the basin. The intent is to demonstrate growth for municipalities located wholly or partially within the basin.

Table A-11 shows the projected population for 2020 and the change in growth between 2000 and 2020 for counties that are wholly or partly contained within the basin. Since river basin boundaries do not usually coincide with county boundaries, these numbers are not directly applicable to the Little Tennessee River basin. Even though 100 percent of Graham and Swain counties, 94 percent of Macon County, and 88 percent of Jackson County are contained within the basin, only 10 percent of Clay County and 2 percent of Cherokee County are encompassed.

Table A-11 Past and Projected Population (1990, 2000, 2020) and Population Change by County

County	% of County in Basin *	1990	2000	Estimated Population 2020	Pop Change 1990-2000	Estimated Pop Change 2000 - 2020
Cherokee	2	20,170	24,298	31,053	4,128	6,755
Clay	10	7,155	8,775	11,331	1,620	2,556
Graham	100	7,196	7,993	9,102	797	1,109
Jackson	88	26,835	33,121	44,426	6,286	11,305
Macon	94	23,504	29,811	40,773	6,307	10,962
Swain	100	11,268	12,968	15,817	1,700	2,849

* Source: North Carolina Center for Geographic Information and Analysis

Note: The numbers reported reflect county population; however, the county may not be entirely contained within the basin. The intent is to demonstrate growth for counties located wholly or partially within the basin.

Figure A-8 presents population data for the four main counties located within the basin. All four counties experienced steady growth between 1990 and 2000, and significant growth is expected between 2000 and 2020.

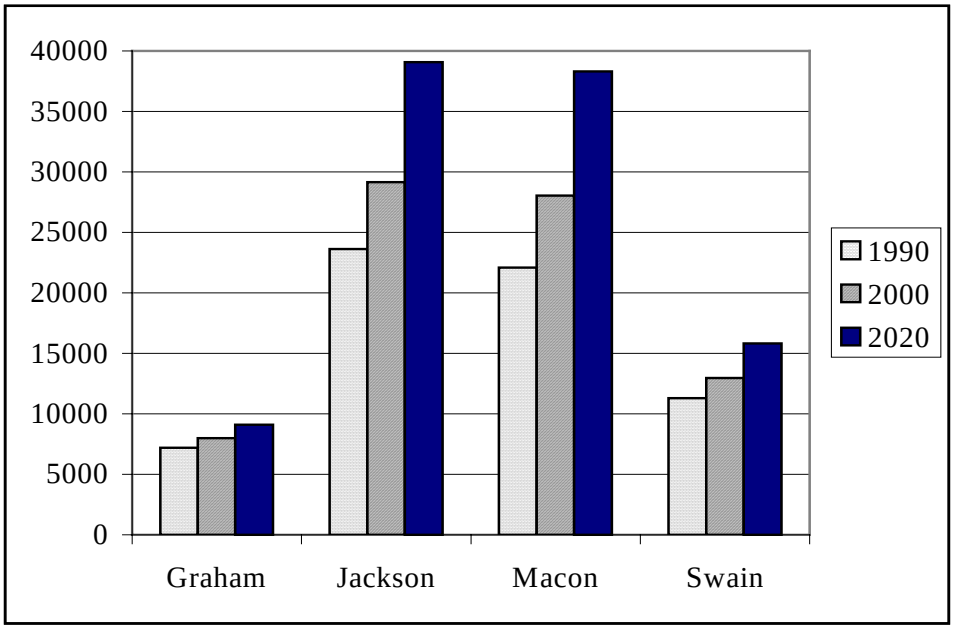


Figure A-8 Population Data for Selected Counties in the North Carolina Portion of the Little Tennessee River Basin

For more information on past, current and projected population estimates, contact the Office of State Planning at (919) 733-4131 or visit their website at http://www.ospl.state.nc.us/demog/.

2.6 Natural Resources

The Little Tennessee River is widely recognized as having one of the most significant assemblages of aquatic species in the state. The basin provides habitat for a large diversity of aquatic life, including a number of rare fish, mussels, insects and several endemic species. One explanation for this diversity may be that, from an ecological perspective, the Little Tennessee River basin is still intact. Scientists believe that this basin continues to support the full assemblage of native aquatic animal life, something perhaps no other river in the Blue Ridge Province, or possibly the Eastern United States, can boast. Many species that have disappeared from other river basins continue to thrive in the Little Tennessee. Perhaps one of the most important reasons why this basin has maintained its aquatic communities is the predominantly forested watersheds on the publicly-owned lands of its tributary streams. Another key factor is that, unlike other Blue Ridge rivers, it remains free flowing for much of its length.

2.6.1 Significant Natural Heritage Areas in the Little Tennessee River Basin

The North Carolina Natural Heritage Program identifies areas that have outstanding conservation value, either because they contain rare or endangered species, or because an area provides an

excellent, intact example of an ecological community which naturally occurs in the state. The Little Tennessee River basin has 54 aquatic and terrestrial natural areas, 20 of which are considered nationally significant and 34 state significant. Four reaches of river are considered Significant Aquatic Habitats (Table A-12 and Figure A-9).

Table A-12 Significant Aquatic Habitats of the Little Tennessee River Basin

Aquatic Habitat	Significance	Length (Miles)
Little Tennessee River	National	26.8
Tuckasegee River	National	81.7
Upper Nantahala (Headwaters)	State	10.4
White Oak Creek	State	6.4

In addition, there are two unique (and rare) wetland community types found within the Little Tennessee River basin: spray cliffs and mountain bogs. Each is discussed below.

Spray Cliffs

In this region, where waterfalls abound, sloping rock faces are bathed in spray from plunging water. The resulting constant humidity and moderate temperatures support a rich plant community dominated by ferns, mosses and liverworts. The presence of species more typical of the tropics than the Southern Appalachian Mountains makes these communities unique. Obviously, the extent of spray cliff communities is quite limited by the conditions that these communities require. Sites where the spray cliff community can be found are few; known from only a few dozen occurrences, most of them are less than one acre in size. Confounding the survival of these communities is the natural appeal of waterfalls, which draws admirers who inadvertently trample flora in their appreciation of the cascades.

Mountain Bogs

Less than 500 acres of mountain bogs exist within North Carolina, and the entire Appalachian Highlands, which includes the Appalachian Plateau, Ridge and Valley, and Blue Ridge provinces of Alabama, Georgia, Tennessee, North Carolina, Virginia and West Virginia, contains less than 6,175 acres (Moorhead and Rossell, 1998). Mountain bogs in North Carolina are generally small, isolated and rare wetlands largely concentrated in two areas: a band between Henderson and Clay counties in the southern mountains (including the Savannah River basin); and in Avery, Watuaga, Ashe and Alleghany counties in the northern mountains (Early, 1989).

North Carolina's mountain bogs host 77 species of rare, threatened or endangered plants such as the bunched arrowhead, swamp pink and Gray's lily. In addition to harboring important plant species, the state's mountain bogs also host five species of rare, threatened or endangered animals (Murdock, 1994), most notably the bog turtle (*Clemmys muhlenbergii*). Of the estimated 500 acres of mountain bogs in North Carolina, less than half support bog turtles (Herman, 1994).

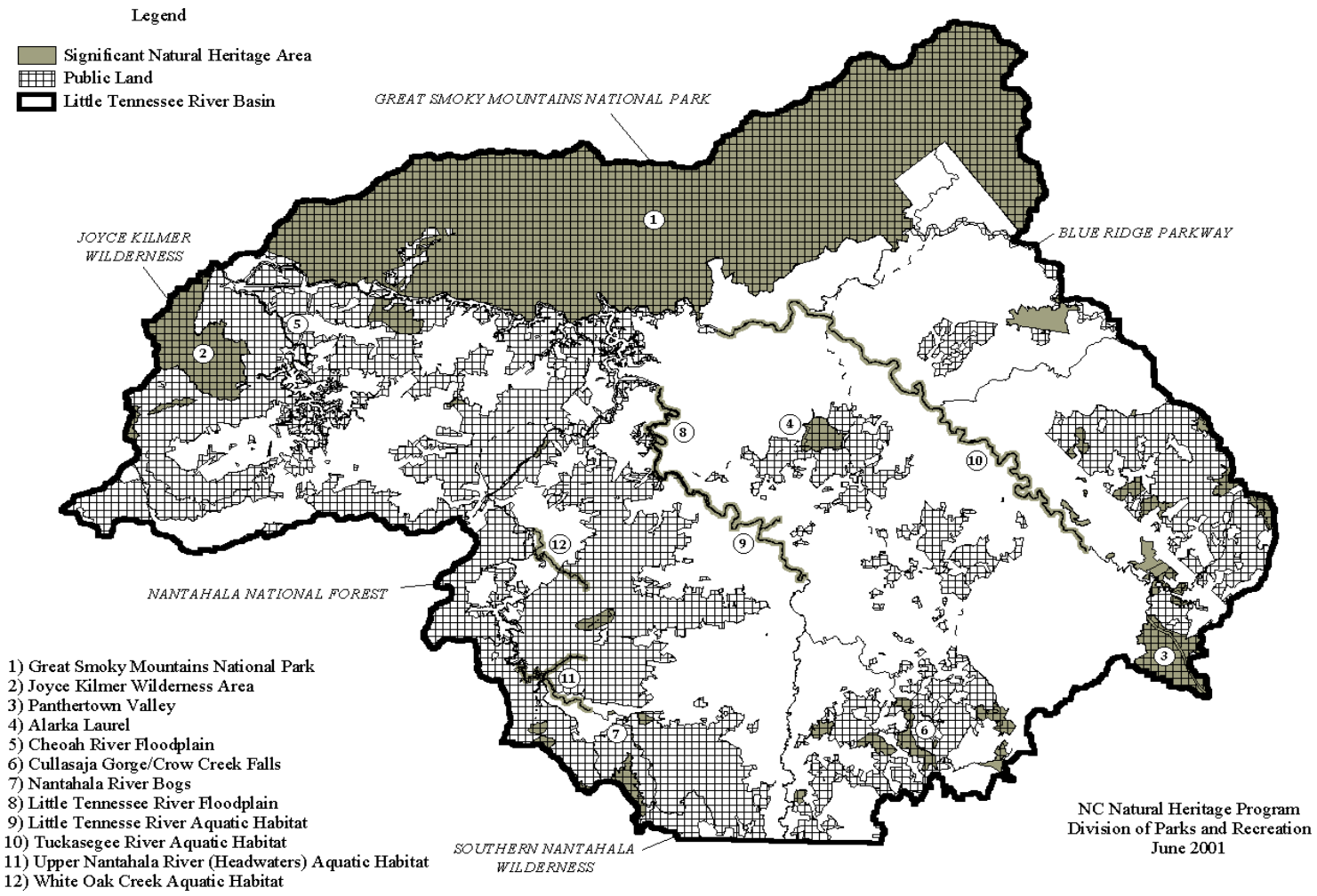


Figure A-9 Public Lands and Significant Natural Heritage Areas in the Little Tennessee River Basin

Little research has investigated the hydrology of these bogs, but they may be found in four principle positions on the landscape: 1) headwater regions of mountain streams; 2) slopes intercepting the water table and subject to constant groundwater seepage; 3) stream valleys no longer subject to flooding; and 4) isolated systems over resistant rock strata (Walbridge, 1994; Weakley and Schafale, 1994). Although these wetlands are groundwater fed, technically called "fens" in classifications based on water source, they are locally known as bogs and have been called that in most publications within the state. The groundwater in fens tends to be acidic and nutrient poor, because of the rock and soil types it flows through. Groundwater in these areas of the Savannah River basin is less rich than is typical of most northern fens; therefore, the vegetation is more "bog-like" (Schafale, 2001).

Historically ditched and drained for farms, ponds and pastures, mountain bogs today are also imperiled by development activities. Active management of some mountain bogs has focused on protecting or enhancing habitat for bog turtles or rare plants (Moorhead and Rossell, 1998). Since many bogs are privately owned and not actively managed or protected (Weakley and Moorhead, 1991), educating landowners on the value and significance of mountain bogs is an important first step in their protection.

Great Smoky Mountains National Park

The Great Smoky Mountains National Park encompasses 800 square miles (of which 95 percent are forested) in the states of North Carolina and Tennessee. The park lies almost entirely within the Little Tennessee River basin. World renowned for the diversity of its plant and animal resources, the beauty of its ancient mountains, the quality of its remnants of Southern Appalachian mountain culture, and the depth and integrity of the wilderness sanctuary within its boundaries, it is one of the largest protected areas in the east. The park was established in 1934, became an International Biosphere Reserve in 1976, and was designated a World Heritage Site in 1983. Currently, an "All Taxa" Biodiversity Information study is being conducted in the park. Interesting ecological discoveries have been already been made, including the discovery of a large number of species new to science which are in the process of being named and described.

Joyce Kilmer Wilderness Area

Another large and nationally significant site is the Joyce Kilmer Wilderness Area. This area includes the watershed of Little Santeetlah Creek and is one of the best examples of old-growth forests in the Southern Appalachians. Cove forests in this area contain massive trees, including tulip poplars and hemlocks. Additional extensive protected acreage of younger forests occurs in the other watersheds in the designated wilderness area.

Panthertown Valley

Granitic domes with steep slopes, rugged gorges, unusual flat-bottomed valleys, sandy, bronze-colored meandering streams with bogs and potholes characterize the remote Panthertown Valley natural area. Wetland communities are present in part of the flat valley bottom, including several examples of the rare Southern Appalachian Bog community and a Swamp Forest-Bog Complex. The bogs have a generally open character with sedges, broomsedge, rushes and sundews growing over a dense mat of peatmoss. An excellent spray cliff occurs near the scenic Schoolhouse Falls and supports several rare plant species. The tract encompasses the headwaters of Tuckasegee

River formed by Panthertown, Greenland and Flat Creeks. Panthertown Creek has excellent water quality and a high diversity of benthic macroinvertebrates.

Alarka Laurel Natural Area

Alarka Laurel Natural Area is a high elevation, flat-bottomed, "hanging" valley. A red spruce forest occurs in the flat bottom of a side valley. This is the southernmost natural occurrence of red spruce and an unusual valley bottom location below hardwood forest. The forest has large trees and is reported to be virgin. A small Southern Appalachian Bog occurs in another area. Other communities include a small, apparently virgin, Canada Hemlock Forest; a small, old-growth Montane White Oak Forest; mature Northern Hardwood Forests; and extensive, mature High Elevation Red Oak Forests. Several rare plant and animal species are reported, and more exploration is needed.

Cheoah River Floodplain

The Cheoah River Floodplain Natural Area is the home of the Junaluska salamander (*Eurycea junaluska*), a rare species endemic to Graham County and neighboring Tennessee; it is a candidate for federal listing. Most of the observations are recorded from the highway (US 129), so it is not certain if the animals actually live or reproduce in the river. One of the best populations of the narrowly endemic Junaluska salamander occurs in the forests near seeps and streams of the Cheoah River system.

Calystegia Gorge and Crow Creek Falls

Calystegia Gorge and Crow Creek Falls are adjacent Significant Natural Heritage Areas. The picturesque Calystegia Gorge includes exemplary Southern Blue Ridge geomorphic landforms – specifically, the gorge and waterfalls. Its significance is due to a cluster of rare plant species and high quality Spray Cliff communities. Crow Creek Falls includes another cluster of rare plant species, including many non-vascular plants, as well as a high quality Spray Cliff community.

Nantahala River Bogs

The Nantahala River Bogs Natural Area includes five of the few remaining high quality montane wetlands, with high diversity of plant species and good examples of two rare mountain bog natural communities. Several of the bogs support bog turtles (*Clemmys muhlenbergii*), and the proximity of sites may be important for dispersal and survival of this species. Several rare plant species occur at the site as well. Beavers are present at the Big Indian Creek Bog and White Oak Bottoms sites and may be an important part of the ecological dynamics of these poorly understood communities.

Little Tennessee River Floodplain

One important state significant natural area is the Little Tennessee River Floodplain. Historically, floodplains of major mountain rivers were the first to be cleared and settled. However, parts of the Little Tennessee River Floodplain still contain intact, mature Montane Alluvial Forest, an extremely rare community type. The Little Tennessee River Floodplain is probably the best representative of the Montane Alluvial Forest natural community in the state.

2.6.2 Rare Aquatic and Wetland-Dwelling Species

Table A-13 presents rare aquatic and wetland-dwelling species found within the basin.

Table A-13 Rare Aquatic and Wetland-Dwelling Species (as of November 2000)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
fish	Stonecat	*Noturus flavus*	E	
fish	Spotfin chub	*Hybopsis monacha*	T	T
fish	Striped shiner	*Luxilus chrysocephalus*	T	
fish	Sicklefin redhorse	*Moxostoma sp1*	SR	FSC
fish	Olive darter	*Percina squamata*	SC	FSC
fish	Yellowfin shiner	*Notropis lutipinnis*	SC	
fish	Little Tennessee River rosyside dace	*Clinostomus funduloides ssp1*	SC	
fish	Wounded darter	*Etheostoma vulneratum*	SC	
mollusk	Appalachian elktoe	*Alasmidonta raveneliana*	E	E
mollusk	Slippershell mussel	*Alasmidonta viridis*	E	
mollusk	Tennessee pigtoe	*Fusconaia barnesiana*	E	
mollusk	Littlewing pearlymussel	*Pegias fabula*	E	E
mollusk	Rainbow	*Villosa iris*	SC	
mollusk	Spike	*Elliptio dilatata*	SC	
mollusk	Wavy-rayed lampmussel	*Lampsilis fasciola*	SC	
invertebrate	Caddisfly	*Goera fuscula*	SR	
invertebrate	Caddisfly	*Matripotila jeanae*	SR	
invertebrate	Caddisfly	*Micrasema burksi*	SR	
invertebrate	Caddisfly	*Psilotreta frontalis*	SR	
invertebrate	Caddisfly	*Psilotreta labida*	SR	
invertebrate	Caddisfly	*Rhyacophila amicis*	SR	
invertebrate	Caddisfly	*Rhyacophila melita*	SR	
invertebrate	Caddisfly	*Rhyacophila mycta*	SR	
invertebrate	Caddisfly	*Rhyacophila vibox*	SR	
invertebrate	Williams' rare winter stonefly	*Megaleuctra williamsae*	SR	
invertebrate	Stonefly	*Diploperla morgani*	SR	
invertebrate	Stonefly	*Isoperla frisoni*	SR	
invertebrate	Stonefly	*Zapada chila*	SR	
invertebrate	Spiculose serratellan mayfly	*Serratella spiculosa*	SR	FSC
invertebrate	Gray petaltail	*Tachopteryx thoreyi*	SR	
invertebrate	Benfield's bearded small minnow mayfly	*Barbaetis benfieldi*	SR	
invertebrate	Mayfly	*Timpanoga lita*	SR	
crustacean	Little Tennessee River crayfish	*Cambarus georgiae*	SR	
crustacean	Carolina skistodiaptomus (copepod)	*Skistodiaptomus carolinensis*	SR	FSC
amphibian	Hellbender	*Cryptobranchus alleganiensis*	SR	FSC
plant	Closter's brook-hypnum	*Hygrohypnum closteri*	SR	
plant	Lichen	*Hydrothyria venosa*	C	

Rare Species Listing Criteria

E = Endangered (in danger of extinction throughout all or a significant portion of its range)
T = Threatened (considered likely to become endangered within the foreseeable future)
C = Candidate (very rare in North Carolina and likely to merit listing as endangered or threatened)
SR = Significantly Rare (rare in North Carolina, but not yet officially listed as threatened or endangered)
SC = Special Concern (have limited numbers in North Carolina and vulnerable populations in need of monitoring)
FSC = Federal Species of Concern (those under consideration for listing under the Federal Endangered Species Act)

Management Strategies for Federally Threatened and Endangered Species in the Little Tennessee River Basin

Because the Appalachian elktoe (*Alasmidonta raveneliana*) and the Littlewing pearlymussel (*Pegias fabula*) are federally-listed endangered mussel species and the Spotfin chub (*Hybopsis monacha*) is a federally-listed threatened fish species, waters within the Little Tennessee River basin are subject to a new rule (Administrative Code: 15A NCAC 02B .0110) requiring the development of site-specific management strategies by DWQ. The intent of these strategies would be to provide for maintenance and recovery of the water quality conditions required to sustain these species.

The Rule specifically states that "these plans shall be developed within the basinwide planning schedule with all plans completed at the end of each watershed's first complete five year cycle following adoption of this Rule". The Rule became effective on August 1, 2000, which was two years into the current five-year basinwide planning cycle for the Little Tennessee River basin. Therefore, these management strategies are not required to be completed until spring of 2007. However, the Rule also allows DWQ to take "other actions within its authority to maintain and restore the quality of these waters" in the interim.

A number of factors can contribute to the decline of mussel populations. Considerable information on these species, as well as the waters in which they are found, is needed for the development of appropriate management strategies as required by the Rule. DWQ currently has neither the resources nor the expertise to gather this information alone. Therefore, it will be necessary for the US Fish & Wildlife Service, the NC Wildlife Resources Commission, Duke Energy and other interested parties to collaborate on a process that will ensure successful development and implementation of appropriate management strategies to protect these species.

At the request of local citizens and the Southern Environmental Law Center, DWQ did consider taking some limited actions during this basinwide planning cycle to protect the threatened and endangered species present in the Little Tennessee River below Lake Emory dam prior to the development of the management strategy required by the Rule for this particular watershed (due to the five year delay before implementation would begin). Specifically, it was requested that these actions "reflect protection measures already in place for waterbodies designated as Outstanding Resources Waters" (SELC, January 11, 2002) and that the actions should include "very specific language in the plan, which prevents point source discharges below Lake Emory" and "impose(s) strict control on storm water management in high density developments" for the same portion of the watershed (Collier, December 31, 2001).

DWQ does not have direct evidence correlating point source discharges (which are in compliance with NPDES permits) with degradation of these endangered species. DWQ rules require that limits be established for permitted discharges in North Carolina which protect aquatic life in the receiving waters. The facilities are inspected regularly for compliance with the terms and conditions of these permits in regards to maintenance, discharge compliance and record keeping. The permits are reviewed every five years on the basinwide planning cycle and revisions can be made if problems develop as a result of point source discharges. Current water quality impacts to the Little Tennessee River below Lake Emory are likely due to nonpoint source pollution from the upstream watershed. However, Macon County is in the process of developing a local Land Use Plan (and revisions to the existing local watershed ordinance) that would implement additional protection for the Little Tennessee River watershed, specifically along a corridor between the Lake Emory dam and the county line.

Excess sediment in streams can significantly affect freshwater mussel and fish populations. Therefore, measures to protect the stream from increased sedimentation and stormwater runoff from of intensive development in this relatively undeveloped corridor are important. Additionally, the population of Macon County is projected to increase 36.8 percent between 2000 and 2020. However, because implementing development restrictions at the state level requires rule-making (typically a 2-3 year period) and because a process (involving other agencies and public input) has not yet been developed for implementing the Rule for protecting federally threatened and endangered species, DWQ does not recommend that rule-making to establish stormwater control and density provisions for the Little Tennessee below Lake Emory be initiated at this time.

DWQ is concerned about ensuring the continued protection of the diversity of aquatic species within the Little Tennessee River, DWQ will request the US Fish & Wildlife Service, the NC Wildlife Resources Commission and others to collaborate on a process that will ensure effective and consistent implementation of the above-referenced rule in all applicable river basins in North Carolina. Once this is process is developed, DWQ would like to move forward with development of management strategies for subject waters within the Little Tennessee River basin. As management strategies are developed for subject waters, rule-making would be initiated, without waiting for the end of the next five-year cycle. Therefore, management strategies for waters within the Little Tennessee River basin could be implemented well before 2007.

2.6.3 Public Lands in the Little Tennessee River Basin

About one half of the Little Tennessee River basin is in public ownership, most of it being in either the Nantahala National Forest or the Great Smoky Mountains National Park (Figure A-9). The forested watersheds of these public lands account for the healthy aquatic ecosystems of the Little Tennessee and other rivers. Also, many of the terrestrial natural areas that the North Carolina Natural Heritage Program has identified as significant are located on public lands. Efforts to identify and protect Significant Natural Heritage Areas through such conservation tools as management agreements and conservation easements are ongoing.

2.7 Permitted Wastewater and Stormwater Discharge Facilities

Discharges that enter surface waters through a pipe, ditch or other well-defined point 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 which serve populations greater than 100,000 and stormwater discharges associated with certain 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.

The primary pollutants associated with point source discharges are:

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

2.7.1 Wastewater Discharges in the Little Tennessee River Basin

Type of Wastewater Discharge

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: Public facilities that serve a municipality. Can treat waste from homes and industries.

Nonmunicipal: Non-public facilities that provide treatment for domestic, industrial or commercial wastewater. This category includes wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

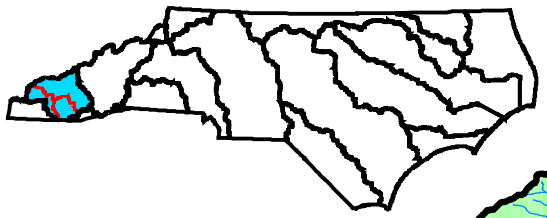
There are 43 permitted discharges in the Little Tennessee River basin. Table A-14 provides summary information (numbers of facilities and permitted flows) regarding the discharges by types and subbasin. Detailed information regarding the dischargers characterized in the table is provided in Appendix I.

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 does not correspond exactly to the number of major facilities listed in Table A-14, because some major facilities have more than one discharge location called an outfall. Each outfall received its own triangle on Figure A-10.

Table A-14 Summary of NPDES Dischargers and Permitted Flows for the Little Tennessee River Basin (as of 2/12/01)

	Subbasin				
Facility Categories	**04-04-01**	**04-04-02**	**04-04-03**	**04-04-04**	**TOTAL**
Total Facilities	14	20	2	7	43
Total Permitted Flow (MGD)	2.5	3.3	0.02	0.6	6.4
Major Discharges	1	1	0	0	2
Total Permitted Flow (MGD)	1.6	1.5	0.0	0.0	3.1
Minor Discharges	13	19	2	7	41
Total Permitted Flow (MGD)	0.9	1.8	0.02	0.6	3.3
100% Domestic Waste	12	16	1	1	30
Total Permitted Flow (MGD)	2.5	3.0	0.002	0.6	6.1
Municipal Facilities	2	3	0	1	6
Total Permitted Flow (MGD)	2.1	2.6	0.0	0.6	5.3
Nonmunicipal Facilities	12	17	1	6	36
Total Permitted Flow (MGD)	0.4	0.7	0.002	Not limited	1.1

Figure A-10 NPDES Discharges in the Little Tennessee River Basin



SWAIN
HAYWOOD
GRAHAM
CHEROKEE
MACON
JACKSON
CLAY
TRANSYLVANIA

04-04-01
04-04-02
04-04-03
04-04-04

Raven Fork
Deep Creek
Ocanaluftee River
Hazel Creek
Little Tuckasegee River
Cheoah River
Fontana Lake
Santeetlah Lake
Snowbird Creek
Tuckasegee River
Scott Creek
Caney Fork River
Tennessee River
Nantahala River
Nantahala Lake
Cartoogechaye Creek
Cullasaja River
Thorpe Lake
Bryson City
Dillsboro
Sylva
Robbinsville
Franklin
Highlands

Legend

- River Basin Boundary
- Subbasin Boundary

NPDES Discharges

- Major
- Minor
- County Boundary
- Hydrography
- Federal Lands
- Municipality

10 0 10 Miles

NCDENR

Planning Branch
Basinwide & Estuary Planning Unit
October 23, 2001

2.7.2 Stormwater Discharges in the Little Tennessee River Basin

Amendments were made to the Clean Water Act in 1990 and most recently in 1999 pertaining to permit requirements for stormwater discharges associated with industrial activities and municipal separate storm sewer systems (MS4s). DWQ administers these regulations in North Carolina through the state's NPDES 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.

EPA Stormwater Rules

Phase I – December 1990

- Requires a NPDES permit for municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more.
- Requires a NPDES stormwater permit for ten categories of industry.
- Requires a NPDES stormwater permit for construction sites that are 5 acres or more.

Phase II – December 1999

- Requires a NPDES permit for some municipal storm sewer systems serving populations under 100,000, located in urbanized areas.
- Provides a "no stormwater exposure" exemption to industrial facilities covered under Phase I.
- Requires a NPDES stormwater permit for construction sites that are 1-5 acres.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. No municipalities in the Little Tennessee River basin were required to obtain a NPDES permit for stormwater sewer systems under the Phase I rules (population >100,000). Additionally, no municipalities in the basin are automatically required (US Census designated Urban Areas) to obtain a NPDES stormwater permit under the Phase II rules. DWQ is currently developing criteria that will be used to determine what local governments should be required to obtain a NPDES stormwater permit.

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 general construction stormwater permits, there are 34 general stormwater permits and one individual permit active within the Little Tennessee River basin.

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 drains 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. Surface waters in the Little Tennessee River basin classified as ORW or HQW are presented on page 43 in Figure A-12.

2.8 Animal Operations

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H.0217) 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. Currently, there are no registered cattle, poultry or swine operations in the Little Tennessee River basin.

Information on animal capacity by subbasin (Table A-15) was provided by the USDA. A negligible percentage of the state's total capacity for swine, dairy and poultry is found in the Little Tennessee River basin. Overall, swine and dairy production in the basin decreased from 1994 to 1998 while poultry production remained unchanged.

Table A-15 Estimated Populations of Swine, Dairy and Poultry in the Little Tennessee River Basin (1998 and 1994)

Subbasin	Total Swine Capacity		Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
04-04-01	80	96	-17	270	820	-67	0	0	0
04-04-02	42	472	-91	73	348	-79	150	150	0
04-04-03	0	0	0	0	0	0	0	0	0
04-04-04	6	5	20	0	0	0	0	0	0
TOTALS	128	573	-78	343	1168	-71	150	150	0
% of State Total	<1	<1		<1	<1		<1	<1	

2.9 Water Quantity Issues

2.9.1 Local Water Supply Planning

The North Carolina General Assembly mandated a local and state water supply planning process in 1989 to assure that communities have an adequate supply of potable 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.

Surface water is used to meet more than 95 percent of overall water needs in the North Carolina portion of the Little Tennessee River basin. In 1997, seven public water systems (Table A-16) used water from the basin, providing 3.7 MGD to 18,397 people. Water demand from these public systems is projected to increase 114 percent to 7.7 MGD by 2020. Two systems reported that their peak demands will exceed their water treatment capacity by 2010. However, none of the systems are projecting a water supply deficit based on current and proposed water supply sources. Section A, Chapter 3 discusses the surface water supply stream classifications in more detail, and these watersheds are presented on page 43 in Figure A-12.

Table A-16 Public Water Systems in the Little Tennessee River Basin (1997)

Water System	Water Source	Average Daily Demand (MGD)	Available Supply (MGD)
Robbinsville	Tulula, Rock, Long and Burgen Creeks	0.42	1.1
Santeetlah	Bedrock wells	0.02	0.12
Tuckaseigee Water & Sewer Authority (TWSA)	Tuckasegee River	0.84	15
Franklin	Cartoogechaye Creek	1.04	3.1
Highlands	Big Creek	0.51	1
Bryson City	Deep Creek	0.72	2
Whittier Sanitary District	Bedrock wells	0.14	0.14

The Town of Franklin is considering expanding their water treatment capacity from 2.0 MGD to a minimum of 4.0 MGD. The town would like to be able to withdraw more water from Cartoogechaye Creek. The Division of Water Resources (DWR) is currently conducting a minimum instream flow study to determine what the allowable maximum withdrawal would be (see discussion below under minimum streamflow).

Not everyone gets water from these public water supply systems. Many households and farms supply their own water from both surface and groundwater sources in the basin. The US Geological Survey estimates that self-supplied users, excluding power-generating facilities, account for only 6 percent of the total water used in the Little Tennessee River basin. Water used for domestic and irrigation purposes comprises the majority of self-supplied water use (Figure A-11).

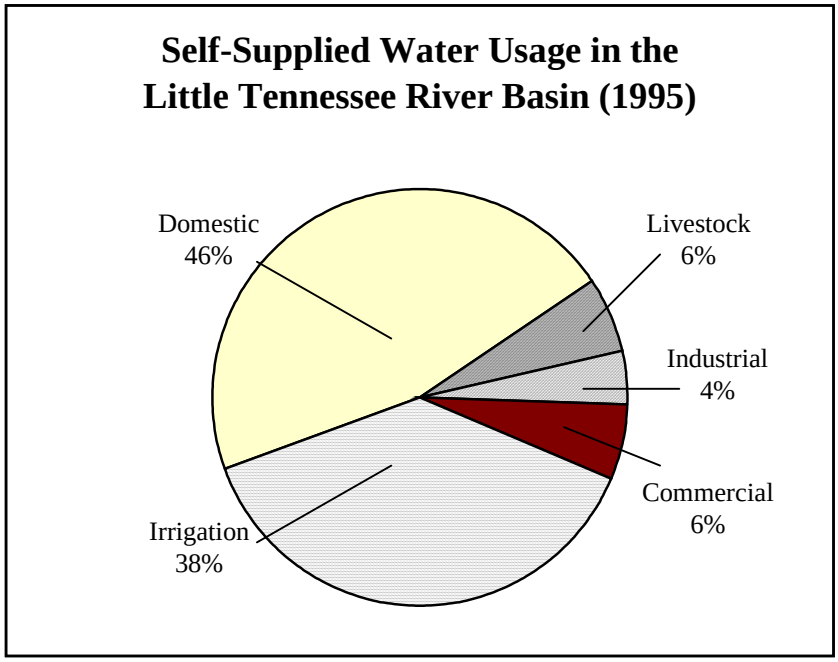


Figure A-11 Estimated Self-Supplied Water Use in the Little Tennessee River Basin (NCDENR-DWR, January 2001)

The information in this section was taken from the State Water Supply Plan (NCDENR-DWR, January 2001). The State Water Supply Plan is a compilation of over 500 LWSPs developed by local government water systems in North Carolina. Detailed information is available in the plan about water supply and water usage in the Little Tennessee River basin. It is available online at the Division of Water Resources website at http://www.dwr.ehnr.state.nc.us or by calling (919) 733-4064.

2.9.2 Water Withdrawals

Prior to 1999, North Carolina required water users to register their water withdrawals with the Division of Water Resources only if the amount was 1,000,000 gallons or more of surface or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 gallons per day. There are 24 registered water withdrawals in the North Carolina portion of the Little Tennessee River basin (Table A-17). All are surface water withdrawals.

Excluding public water systems or power generating facilities, there is a cumulative permitted capacity to withdraw approximately 10.9 million gallons of surface water per day. Power generating facilities may withdraw up to 8,087 million gallons per day; however, these facilities return the water to the basin fairly rapidly.

Table A-17 Registered Water Withdrawals in the Little Tennessee River Basin

County	1999 Average for Days Used (MGD)	1999 Maximum for Days Used (MGD)	Source of Withdrawal	Registered Facility
Jackson	80	185	W. Fork Tuckasegee River	NP&L (Duke Energy) - Hydropower Facility
Jackson	79	133	W. Fork Tuckasegee River	NP&L (Duke Energy) - Hydropower Facility
Jackson	155	394	E. Fork Tuckasegee River	NP&L (Duke Energy) - Hydropower Facility
Jackson	155	364	E. Fork Tuckasegee River	NP&L (Duke Energy) - Hydropower Facility
Jackson	47	80	E. Fork Tuckasegee River	NP&L (Duke Energy) - Hydropower Facility
Jackson	47	80	Wolf Creek	NP&L (Duke Energy) - Hydropower Facility
Macon	184	358	Nantahala River	NP&L (Duke Energy) - Hydropower Facility
Macon	8.416	17	Queens Creek	NP&L (Duke Energy) - Hydropower Facility
Macon	26	52	White Oak Creek	NP&L (Duke Energy) - Hydropower Facility
Macon	0	0	Dicks Creek	NP&L (Duke Energy) - Hydropower Facility
Graham	834	1113	Santeetlah Reservoir	Alcoa Power Generating Inc. - Tapoco Div. – Santeetlah Powerhouse
Graham	3,982	5311	Cheoah Reservoir	Alcoa Power Generating Inc. - Tapoco Div. – Cheoah Powerhouse
TOTAL	**5,597**	**8,087**		**Hydroelectric Power Production**
Graham	0.3	0.35	Fontana Lake	Fontana Village Resort
Graham	1.98	2.232	Little Snow Bird Creek	Hemac Inc.
Graham	Not Reported	2.7	Panther Creek	Tumbling Water Campground & Trout Farm
Macon	1.44	1.44	Otter Creek	Otter Creek Trout Farm
Macon	0.01	0.02	Cartoogechaye Creek	Harrison Construction – Franklin Quarry
Swain	0.38	0.42	Nantahala River	Nantahala Talc & Limestone Co Inc. – Hewitt Quarry
Swain	0.897	3.583	Cooper Creek	Cooper Creek Trout Farm
Swain	0.022	0.022	Spring	Cooper Creek Trout Farm
Swain	0.014	0.014	Springs	Cooper Creek Trout Farm
Swain	0.007	0.007	Spring	Cooper Creek Trout Farm
Jackson	0.01	0.02	Tuckasegee River	Harrison Construction – Dillsboro Quarry
Jackson	0.037	0.037	Ground water	Carolina Water Service Inc. of NC – Forest Hills
TOTAL	**7.78**	**10.85**		**Other Uses**

2.9.3 Interbasin Transfers

In addition to water withdrawals (discussed above), water users in North Carolina are also required to register surface water transfers with the Division of Water Resources (DWR) if the amount is 100,000 gallons per day or more. In addition, persons wishing to transfer two million gallons per day (MGD) or more, or increase an existing transfer by 25 percent or more, must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.22I). The river basin boundaries that apply to these requirements are designated on a map entitled *Major*

River Basins and Sub-Basins in North Carolina, on file in the Office of the Secretary of State. These boundaries differ slightly from the 17 major river basins delineated by DWQ.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. Currently, there are no certified interbasin transfers in the Little Tennessee River basin. However, the Town of Highlands straddles the Little Tennessee and Savannah River basin divide, resulting in a minor transfer estimated to be less than 0.1 MGD.

2.9.4 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. Division of Water Resources, in conjunction with the Wildlife Resources Commission, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The permits are issued by the Division of Land Resources. Table A-18 summarizes minimum flow requirements in the Little Tennessee River basin.

Flow data have been collected and DWR is beginning modeling and analysis to determine the minimum instream flow needed to maintain aquatic life populations in Cartoogechaye Creek. The Town of Franklin is considering an increase in their water treatment capacity from 2.0 MGD to a minimum of 4.0 MGD. The town hopes to use the study to determine what the allowable maximum withdrawal would be from Cartoogechaye Creek.

Hydroelectric Project Relicensing

As presented in Table A-18, there are many dams that contribute to hydroelectric power production in the Little Tennessee River basin. The way these dams are managed affects streamflow and, to some extent, water quality on the corresponding stream or river. All Duke Energy/Nantahala Power and Light Division hydropower projects (East Fork, West Fork, Nantahala and Queens Creek), as well as the Tapoco Project controlled by ALCOA, are currently undergoing relicensing by the Federal Energy Regulatory Commission (FERC). All project licenses, with the exception of the Queens Creek Project, expire in 2005 or 2006. The Queens Creek Project license expired on September 30, 2001.

The FERC relicensing process includes, for each project, an assessment of how current and future project operations will affect environmental resources in the Little Tennessee River basin. Several studies related to instream flow and water quality are at various stages of completion. DWQ will continue to follow these studies and provide assistance and input as appropriate. Any results that become available over the next five-year basinwide planning cycle will be discussed in the revised *Little Tennessee River Basinwide Water Quality Plan* (2007).

Table A-18 Minimum Streamflow Projects in the Little Tennessee River Basin

Name	Subbasin	Waterbody	Drainage Area (sq. mi.)	Min. Streamflow (cubic feet/sec)
East Fork Project				
Tanasee Dam	04-04-02	Tanasee Creek	25	0
Wolf Creek Dam	04-04-02	Wolf Creek	15	0
Bear Creek Dam	04-04-02	Tuckasegee River	75.3	0
Cedar Cliff Dam	04-04-02	Tuckasegee River	80.7	10[1]
West Fork Project				
Thorpe Dam	04-04-02	West Fork Tuckasegee River	36.7	0
Little Glenville Dam	04-04-02	West Fork Tuckasegee River	54.7	20
Tapoco (Tallassee) Project				
Cheoah Dam	04-04-02	Little Tennessee River	1608	Run-of-river[2]
Calderwood Dam	Tennessee	Little Tennessee River	1856	Run-of-river[2]
Chilhowee Dam	Tennessee	Little Tennessee River	1977	Run-of-river[2]
Santeetlah Dam	04-04-04	Cheoah River	176	0
Nantahala Project				
Diamond Valley Dam	04-04-03	UT to Dicks Creek	0.4	Run-of-river[2]
Dicks Creek Dam	04-04-03	Dicks Creek	3.5	Run-of-river[2]
Whiteoak Dam	04-04-03	Whiteoak Creek	13.8	8
Nantahala Dam	04-04-03	Nantahala River	91	606[1]
Queens Creek Project				
Queens Creek Dam	04-04-03	Queens Creek	3.6	2.0 or 1.0[3]
Other Projects				
Franklin (Lake Emory Dam)	04-04-01	Little Tennessee River	310	Run-of-river[2]
Dillsboro Dam	04-04-02	Tuckasegee River	290	Run-of-river[2]
Bryson City	04-04-02	Oconaluftee River	188	Run-of-river[2]

[1] Release made at the powerhouse.

[2] The project generates or dam spills in a run-of-river mode, i.e., inflow equals outflow. Dams with more storage capacity can have a greater effect on streamflow.

[3] Minimum flow of 2.0 cfs from December 1 through May 31 and 1.0 cfs from June 1 through November 30, or inflow, whichever is less.

2.10 Physical Impacts to Wetlands and Streams

DWQ has issued approvals for wetland filling activities since the mid-1980s; however, in 1989, the Environmental Management Commission directed DWQ to begin reviewing wetland fill and stream alteration activities using a review sequence of 1) avoidance; 2) minimization; and 3) mitigation of wetland impacts. Rules finalized in 1996, require that wetland values, such as whether or not the wetland is providing significant uses or whether the filling activity would remove or degrade those uses, be considered. The rules also specify wetland and stream mitigation ratios and type and location of projects to make the mitigation process more predictable and manageable for the regulated community.

DWQ and Division of Land Resources (DLR) regulate construction activities near streams and wetlands. These regulatory programs ensure that construction projects cause minimal damage to

these resources and that unavoidable impacts are addressed through mitigation projects. DWQ's emphasis continues to be on water quality and the essential role that wetlands play in maintaining water quality. The issuance of a 401 Water Quality Certification by DWQ is required before the US Army Corps of Engineers can issue a Section 404 Permit authorizing the fill or alteration of wetlands and/or streams in North Carolina.

Mitigation for wetland losses, particularly those associated with transportation projects, has historically been accomplished by the creation or restoration of small wetlands located near the project site. More recently, wetland losses are offset by the creation of larger mitigation "bank". In 1994, the NC Department of Transportation (NCDOT) purchased land in the floodplain of Tulula Creek in Graham County to create the Tulula Wetlands Mitigation Bank. The mitigation bank was created to compensate for wetland losses associated with highway projects, primarily within the Little Tennessee River basin. Refer to page 116 for details about restoration of the Tulula site by the NCDOT.

Despite efforts to protect and restore wetland and stream functions on the part of DWQ and many other agencies and organizations in North Carolina, there is still an annual net loss of wetlands and streams statewide. DWQ tracks wetland and stream losses that are authorized through the issuance of a 401 Water Quality Certification. In addition to the permitted wetland and stream impacts that are tracked by DWQ, an unknown amount of permanent wetland and stream losses also occurs. Projects that affect less than one-third of an acre of wetland or less than 150 linear feet of stream are not required to receive written confirmation from DWQ, and therefore, might not be reported. Beyond projects that are required for mitigation, other restoration projects are funded through the Clean Water Management Trust Fund and the Wetlands Restoration Program that can help offset stream and wetland losses and impacts.

The *Watershed Restoration Plan for the Little Tennessee River Basin* contains a summary of permitted and unmitigated stream and wetland alterations. To obtain a copy, contact the Wetlands Restoration Program by calling (919) 733-5208 or visit the website at http://h2o.enr.state.nc.us/wrp/.

Chapter 3 -
Summary of Water Quality Information for the Little Tennessee 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

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

- Construction activities
- Roads, parking lots and rooftops
- Agriculture
- Failing septic systems and straight pipes
- Timber harvesting
- Hydrologic modifications

Nonpoint sources include 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, oil and grease, pesticides and any other substance that may be washed off of the ground or deposited from the atmosphere into surface waters.

Unlike point sources of pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given these characteristics, 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.

Cumulative Effects

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.

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.

3.2 Description of Surface Water Classifications and Standards

North Carolina's Water Quality Standards program adopted classifications and water quality standards for all of 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.

Surface Water Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water. 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. Table A-19 briefly describes the best uses of each classification. A full description 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 website: http://h2o.enr.state.nc.us/wqhome.html.

Table A-19 Primary and Supplemental Surface Water Classifications

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.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
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 which 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.

* Primary classifications beginning with "S" are assigned to saltwaters.

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 a 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 waters establish the basic protection level for all state surface waters. With the exception of swamp waters, all of the other primary and supplemental classifications have more stringent standards than for C, 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 designated as HQW or ORW.

Trout Waters

Different water quality standards for some parameters, such as dissolved oxygen, temperature and turbidity, have been developed to protect freshwaters for natural trout propagation and survival of stocked trout. These water quality standards result in more restrictive limits for wastewater discharges to trout waters (Tr). There are no watershed development restrictions associated with the Tr classification. However, the NC Division of Land Resources does require a 25-foot vegetated buffer between Tr waters and graded construction sites.

A state fishery management classification, Designated Public Mountain Trout Waters, is administered by the NC Wildlife Resources Commission. It provides for public access to streams for fishing and regulates fishing activities (seasons, size limits, creel limits, and bait and lure restrictions). Although many of these waters are also classified Tr by DWQ, this is not the same classification.

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.

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 (WRC).
- Waters designated as primary nursery areas by the Division of Marine Fisheries.
- 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.

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 an approved local erosion and

sedimentation control program, and which 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. The low density option requires a 30-foot vegetated buffer between development activities and the stream; whereas, the high density option requires structural stormwater controls. In addition, the Division of Land Resources requires more stringent erosion 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 including one or more of the following:

- an 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;
- within a state or national park or forest; or
- a 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 a 30-foot buffer or 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.

Water Supply Watersheds

The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program, which is based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution.

There are five water supply classifications (WS-I to WS-V) that are defined according to the land use characteristics of the watershed. The WS-I classification carries the greatest protection for water supplies. No development is allowed in these watersheds. Generally WS-I lands are publicly owned. WS-V watersheds have the least amount of protection and do not require development restrictions. These are either former water supply sources or sources used by industry. WS-I and WS-II classifications are also HQW by definition because requirements for these levels of water supply protection are at least as stringent as those for HQWs. Those watersheds classified as WS-II through WS-IV require local governments having jurisdiction within the watersheds to adopt and implement land use ordinances for development that are at least as stringent as the state's minimum requirements. A 30-foot vegetated setback is required on perennial streams in these watersheds.

Classifications and Standards in the Little Tennessee River Basin

There are a large number of trout waters (Tr) and High Quality Waters (HQW) in the Little Tennessee River basin. In subbasin 04-04-01, the Big Creek watershed and a portion of Rattlesnake Branch, both located near Highlands in the Cullasaja River watershed, are (respectively) WS-II and WS-I watersheds, which are, by definition, HQW.

Some of the most famous trout streams in North Carolina are found in subbasin 04-04-02, including Hazel Creek, Forney Creek, Deep Creek and Noland Creek in the Great Smoky Mountains National Park. A large number of streams throughout the subbasin carry the supplemental classification of HQW. The Tuckasegee River and its tributaries (including Pathertown Creek) from the source to Tennessee Creek are classified Outstanding Resource Waters (ORW). The Nantahala River watershed, from its source to the confluence with Roaring Fork, in subbasin 04-04-03 is currently classified as ORW.

In subbasin 04-04-04, the upper half of the Snowbird Creek watershed, along with several tributaries to Long Creek, is classified HQW. Other portions of the Long Creek watershed (Town of Robbinsville's water supply) are classified WS-I, which are by definition, HQW.

Figure A-12 presents water supply watersheds, HQWs and ORWs for the Little Tennessee River basin. Classification and standards for the entire basin can be found in a separate document entitled *Classifications and Water Quality Standards Assigned to the Waters of the Little Tennessee River Basin*. This document may be obtained by calling the Planning Branch of DWQ at (919) 733-5083. It can also be accessed through the DWQ Water Quality Section website at http://h2o.enr.state.nc.us/wqhome.html.

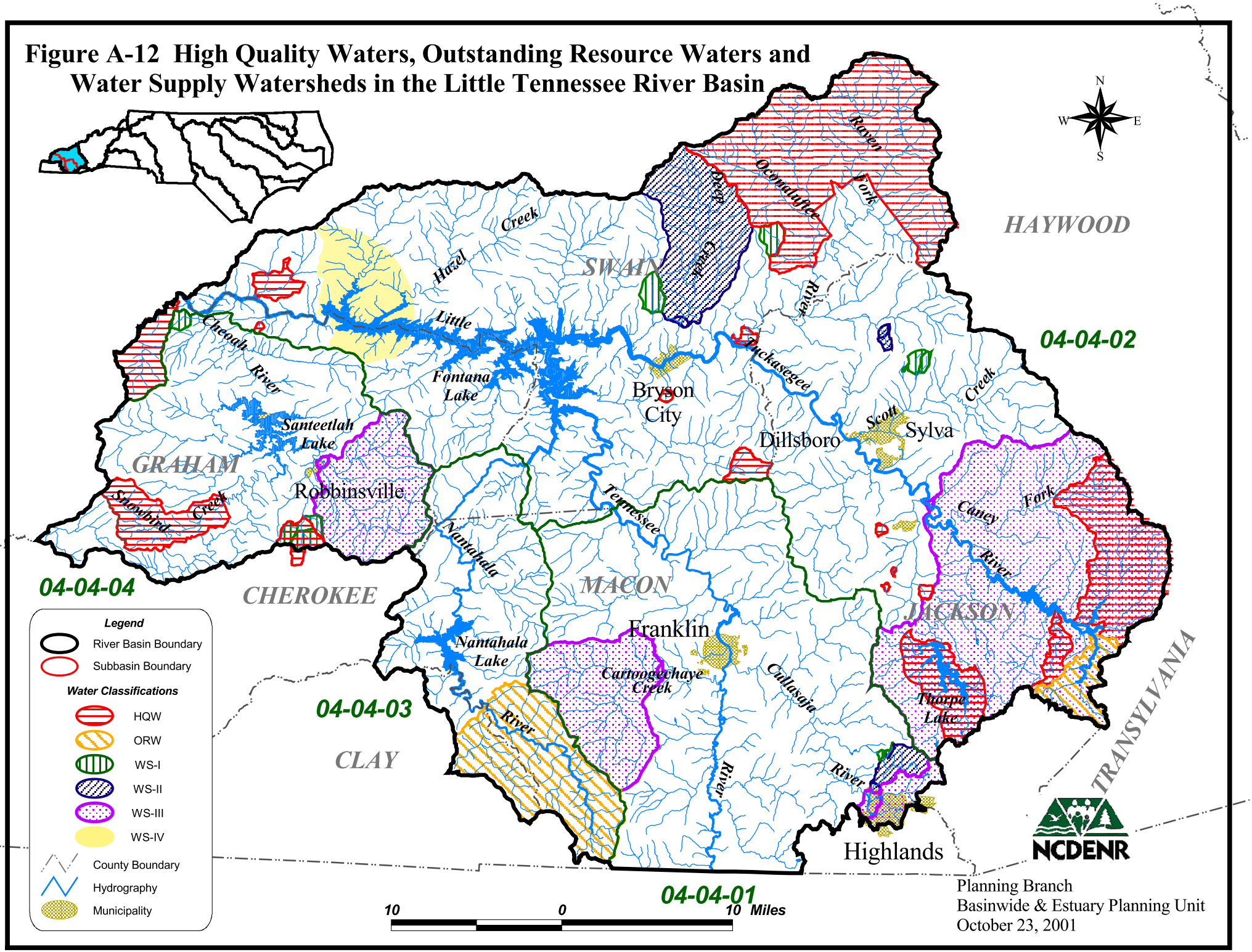
Pending and Recent Reclassifications in the Little Tennessee River Basin

The Little Tennessee River from 0.4 miles above the NC 28 bridge near Iotla to Fontana Lake is currently being considered for reclassification from Class C to Class B. Data have been collected, and DWQ staff support this reclassification. Public hearings will be held in spring of 2002 to obtain public input. This reclassification would affect permit limits for NPDES discharges into the Little Tennessee River.

A request was received in July 2000 from the Watershed Association for the Tuckasegee River (WATR) for reclassification of a portion of the Tuckasegee River from Class C to Class B Tr. This request has been submitted to the Environmental Sciences Branch for data collection.

Several streams in subbasin 04-04-04 would likely meet criteria for reclassification to HQW or ORW. These streams include Snowbird Creek, Little Snowbird Creek and West Buffalo Creek.

Figure A-12 High Quality Waters, Outstanding Resource Waters and Water Supply Watersheds in the Little Tennessee River Basin



3.3 DWQ Water Quality Monitoring Programs in the Little Tennessee River Basin

Staff in the Environmental Sciences Branch and Regional Offices of DWQ collect 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 Little Tennessee River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Little Tennessee River basin, available from the Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

DWQ monitoring programs for the Little Tennessee River Basin include:

- Benthic Macroinvertebrates (Section 3.3.1)
- Fish Assessments (Section 3.3.2)
- Aquatic Toxicity Monitoring (Section 3.3.3)
- Lake 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), commonly referred to as EPTs, and a Biotic Index value, which gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. Bioclassifications fall into five categories ranging from Poor to Excellent.

Overview of Benthic Macroinvertebrate Data

Appendix II lists all the benthic macroinvertebrate collections in the Little Tennessee River basin between 1983 and 1999, giving site location, collection date, taxa richness, biotic index values and bioclassifications. More than 200 benthic macroinvertebrate samples have been collected from 111 sites in the Little Tennessee River basin. Approximately 77 percent of all samples collected since 1983 received Excellent or Good bioclassifications. Table A-20 lists the most recent bioclassifications (by subbasin) for all benthos sites in the Little Tennessee River basin. Of these most recent bioclassifications, 85 percent were Excellent or Good.

Table A-20 Summary of Benthic Macroinvertebrate Ratings for All Freshwater Benthos Sites (using the most recent rating for each site) in the Little Tennessee River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Total
04-04-01	14	5	5	4	0	28
04-04-02	34	15	3	1	0	53
04-04-03	5	10	3	1	0	19
04-04-04	8	3	0	0	0	11
Total (#)	**61**	**33**	**11**	**6**	**0**	**111**
Total (%)	**55%**	**30%**	**10%**	**5%**	**0%**	**100%**

In 1999, 34 sites were sampled during basinwide surveys (not including special study sites). For these most recent collections, Figure A-13 presents the following bioclassifications: Excellent – 23 (67%), Good – 8 (24%), Good-Fair – 2 (6%), Fair – 1 (3%), Poor – 0. In 1994, 31 of these same sites were sampled. Only 87 percent received Excellent or Good bioclassifications, compared with 91 percent in 1999. However, many of these short-term changes were likely related to differences in flow regimes between 1994 and 1999, rather than actual improvements in water quality.

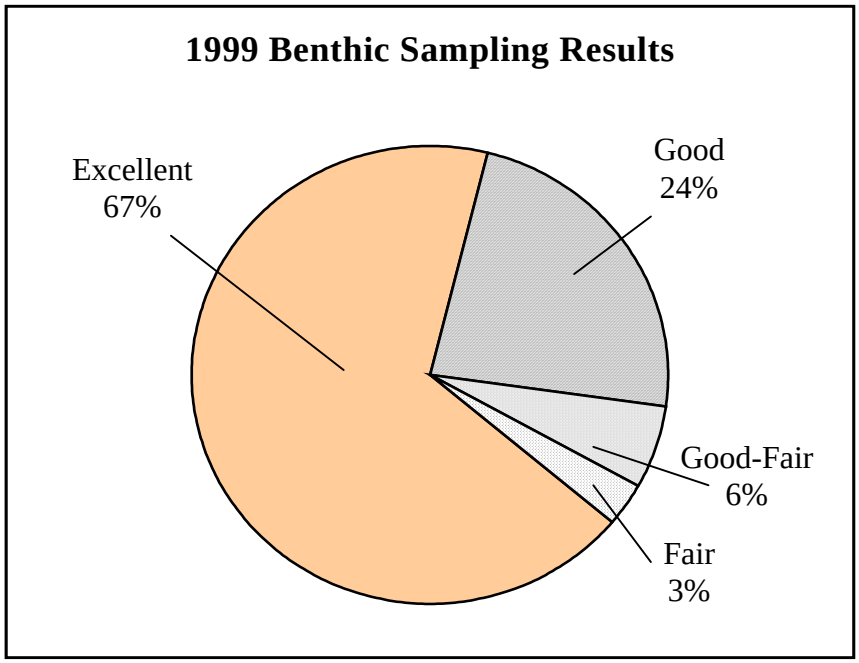


Figure A-13 Bioclassifications for 34 Little Tennessee River Basin Benthic Macroinvertebrate Sites Sampled by DWQ in 1999

Long-term (greater than 5 years of data) changes in bioclassification were evaluated at 13 sites in the Little Tennessee River basin. These data indicated a positive change in bioclassification at

three of the 13 sites (23%). Water quality did not decline at any of the long-term monitoring sites. Improvements in water quality were likely related to upgraded or better performing wastewater treatment plants. Examples include Scotts Creek below the Town of Sylva's WWTP and the Cheoah River below the Robbinsville WWTP.

3.3.2 Fish Assessments

Sixty-eight fish species have been collected from the Little Tennessee River basin in North Carolina. Special status has been granted to eight of these species by the US Department of the Interior, the NC Wildlife Resources Commission or the NC Natural Heritage Program under the North Carolina State Endangered Species Act (G.S. 113-311 to 113-337).

The North Carolina Index of Biotic Integrity is one of the tools DWQ uses to summarize all classes of factors such as water and habitat quality, flow regime and energy sources which influence the freshwater fish communities of wadeable streams throughout the state. No stream fish community basinwide monitoring was conducted by DWQ during 1999 in the Little Tennessee River basin because of recent revisions and a reexamination of the criteria and metrics.

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 or by administrative letter. Other facilities may be tested by DWQ's Aquatic Toxicology Laboratory.

The Aquatic Toxicology Unit maintains a compliance summary (Figure A-14) 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.

Three facilities in the Little Tennessee River basin have NPDES permits which require whole effluent toxicity (WET) monitoring. These facilities are the Franklin, Bryson City and Tuckasegee Water and Sewer Authority Plant 1 wastewater treatment plants.

The number of facilities conducting WET testing increased from one in 1987 (first year that whole effluent toxicity limits were written into permits in North Carolina) to three by 1992. The compliance rate of these three facilities has been greater than 96 percent since 1990.

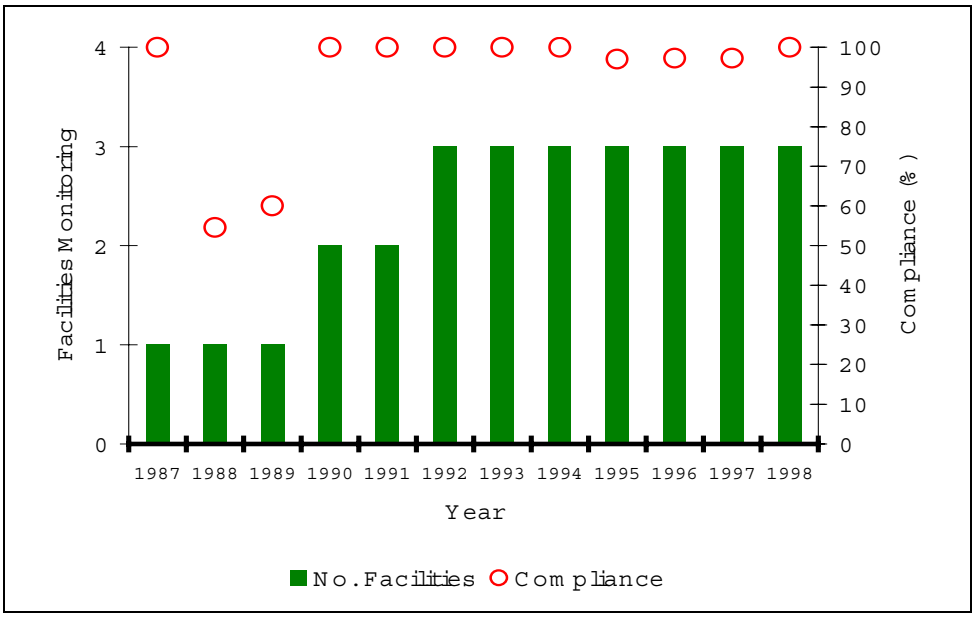


Figure A-14 Summary of Compliance with Aquatic Toxicity Tests in the Little Tennessee River Basin

3.3.4 Lake Assessment

Eight lakes in the basin were sampled as part of the Lake Assessment Program in the summer of 1999: Lake Sequoyah on the Cullasaja River; Wolf Creek; Bear Creek and Cedar Cliff Reservoirs on the Tuckasegee River; Thorpe Reservoir on the West Fork Tuckasegee River; Nantahala Reservoir on the Nantahala River; Cheoah Reservoir on the Little Tennessee River; and Sanateetlah Lake on the Cheoah River. NC Trophic State Index scores are presented in Figure A-15. Refer to Appendix II for more information about how these scores are calculated.

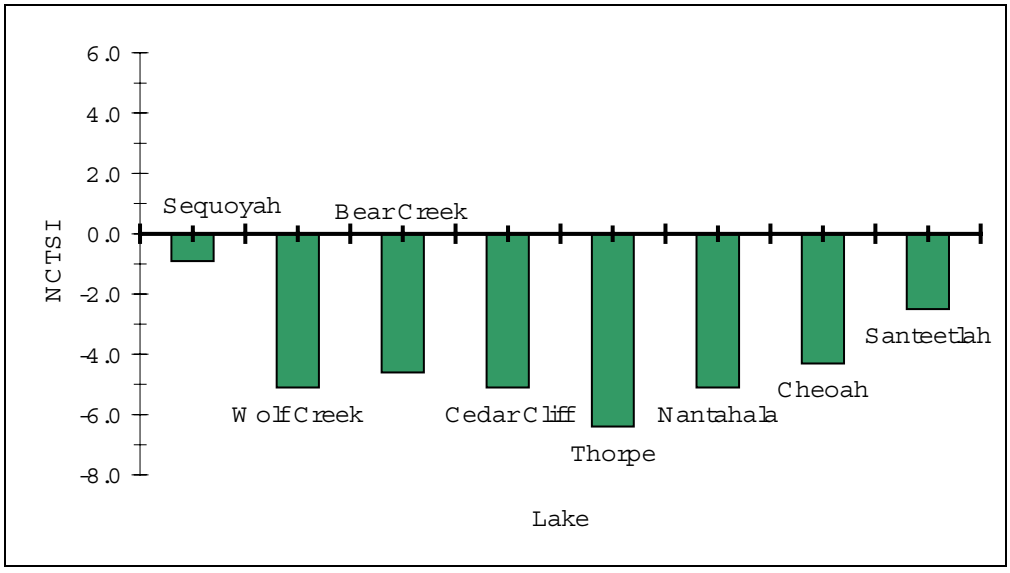


Figure A-15 North Carolina Trophic State Index Scores for Monitored Lakes in the Little Tennessee River Basin (1999)

Six of the eight lakes had exceptional water clarity and low biological productivity resulting in oligotrophic conditions, as is expected in the mountain region. Two lakes demonstrated water quality conditions which are of concern. Lake Sequoyah near the Town of Highlands was moderately productive (mesotrophic) and had chlorophyll *a* values which were greater than the state water quality standard of 15 ug/l for lakes classified as Trout Waters. Seven species of algae collected from this lake are known to contribute taste and odor problems in drinking water. Please refer to Section B, Chapter 1 (page 77) for a discussion of causes and sources of degradation and recommendations for improving water quality in Lake Sequoyah.

The West Buffalo and Snowbird Creek arms of Santeetlah Lake have been exhibiting symptoms of accelerated eutrophication such as algae blooms and elevated dissolved oxygen saturation levels. A second special study (first was in 1993) was conducted from April through October 1999. This study determined that the mainstem of Santeetlah Lake was continuing to support its designated uses. The West Buffalo Creek arm was determined to be impaired and only partially supporting the aquatic life/secondary recreation and primary recreation designated uses. The Snowbird Creek arm was found to be experiencing accelerated eutrophication and cannot tolerate additional nutrient loading. Please refer to Section B, Chapter 4 (page 103) for an in-depth discussion of causes and sources of pollution and management strategies for Santeetlah Lake.

3.3.5 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collection of physical and chemical water quality data. North Carolina has more than 400 water chemistry monitoring stations statewide, including seven stations in the Little Tennessee River basin. Table A-21 lists the stations in the Little Tennessee River basin where samples are collected monthly and analyzed for 27 different parameters. The location of these stations is shown on individual subbasin maps in Section B.

Table A-21 Ambient Monitoring System Stations within the Little Tennessee River Basin

Subbasin/ Station code	Station	County	Classification*
04-04-01			
G0035000	Little Tennessee River at SR 1651 near Prentiss NC	Macon	C
G0130000	Cartoogechaye Creek at SR 1152 near Franklin NC	Macon	B Tr
G2000000	Little Tennessee River at NC Hwy 28 at Iotla NC	Macon	C
04-04-02			
G8550000	Oconaluftee River at SR 1359 at Birdtown NC	Swain	C Tr
G8600000	Tuckasegee River at SR 1364 at Bryson City	Jackson	C
04-04-03			
G3510000	Nantahala River near Rainbow Springs NC	Swain	B Tr ORW
04-04-04			
G9550000	Cheoah River at SR 1138 at Robbinsville NC	Graham	C Tr

* An index for DWQ freshwater classifications can be found in Part 3.2 of this Section (Table A-18).

Generally, water quality at all locations is good. Fecal coliform bacteria (a pathogen indicator) concentrations have decreased significantly over time (Table A-22).

Table A-22 Summary of Fecal Coliform Bacteria Collections from the Little Tennessee River Basin Ambient Monitoring Stations (1973-1999)

Site	Collection Range (Date)	No. of Samples	Geometric Mean	No. of Samples >200 col/100ml	% of Samples >200 col/100 ml
Little Tennessee River at Prentiss	4/29/81 – 6/22/89	72	274.0	45	62.5%
	9/6/89 – 8/26/94	14	18.7	2	14.3%
	9/28/94 – 8/26/99	**49**	**11.5**	**4**	**8.2%**
Little Tennessee River at Iotla	7/29/68 – 8/24/89	150	254.8	84	56.0%
	9/6/89 – 8/26/94	17	24.4	2	11.8%
	9/28/94 – 8/26/99	**49**	**14.4**	**4**	**8.2%**
Cartoogechaye Creek	8/23/71 – 8/24/89	42	120.3	18	42.9%
	9/6/89 – 8/26/94	20	23.1	3	15.0%
	9/28/94 – 8/26/99	**49**	**13.7**	**2**	**4.1%**
Nantahala River	4/29/81 – 8/24/89	94	13.4	2	2.1%
	9/6/89 – 8/26/94	48	2.3	0	0.0%
	9/28/94 – 8/26/99	**48**	**1.2**	**0**	**0.0%**
Oconaluftee River	1/31/85 – 8/24/89	36	75.4	9	25.0%
	9/6/89 – 8/4/94	17	4.0	0	0.0%
	9/20/94 – 8/4/99	**50**	**3.2**	**1**	**2.0%**
Tuckasegee River	8/13/74 – 8/24/89	139	294.3	91	65.5%
	9/6/89 – 8/4/94	15	7.9	1	6.7%
	9/20/94 – 8/4/99	**50**	**6.6**	**4**	**8.0%**
Cheoah River	4/2/74 – 6/15/89	142	278.6	78	54.9%
	9/6/89 – 8/4/94	17	11.5	0	0.0%
	9/20/94 – 8/4/99	**50**	**13.2**	**2**	**4.0%**

Note: Rows in bold represent the current basinwide assessment period.

Dissolved oxygen concentrations continued to remain above 7.0 mg/l, and high turbidity values were only associated with large precipitation events. No temporal patterns could be observed for nutrients, and concentrations were not considered indicative of water quality problems.

3.4 Other Water Quality Research

North Carolina actively solicits "existing and readily available" data and information for each basin as part of the basinwide planning process. Data meeting DWQ quality assurance objectives are used in making use support determinations. Data and information indicating possible water quality problems are investigated further. Both quantitative and qualitative information are accepted during the solicitation period. High levels of confidence must be present in order for outside quantitative information to carry the same weight as information collected from within DWQ. This is particularly the case when considering waters for the 303(d) list. Methodology for soliciting and evaluating outside data is presented in *North Carolina's 2000 § 303(d) List* (NCDENR-DWQ, October 2000).

DWQ data solicitation includes the following:

- Information, letters and photographs regarding the uses of surface waters for boating, drinking water, swimming, aesthetics and fishing.
- Raw data submitted electronically and accompanied by documentation of quality assurance methods used to collect and analyze the samples. Maps showing sampling locations must also be included.
- Summary reports and memos, including distribution statistics and accompanied by documentation of quality assurance methods used to collect and analyze the data.
- Contact information must accompany all data and information submitted.

Tennessee Valley Authority

During March 1999, Tennessee Valley Authority (TVA) biologists collected information on fish, benthic macroinvertebrates and habitat characteristics at four sites on streams in the North Carolina portion of the Little Tennessee River basin. These currently unpublished data are presented in Table A-23.

The benthic data collections were limited to the number of EPT families, with a maximum of about 25 families/site. TVA's EPT rating is not equivalent to DWQ's benthic bioclassification. TVA's IBI score is not equivalent to DWQ's fish community IBI score. TVA uses IBI information as a watershed screening tool, and the criteria have not been calibrated using regional reference data. The TVA habitat assessment score has a maximum value of 52.

Table A-23 Biological and Habitat Data Collected by the Tennessee Valley Authority from the Little Tennessee River Basin, March 1999

Stream	Location	Subbasin	County	# EPT Families	TVA EPT Rating*	# Fish Species	Total # Fish	TVA IBI	Habitat Score
Little Tennessee River	NC 28	04-04-02	Macon	15	Good	33	523	56	39
Caney Fork Creek	Off SR 1737	04-04-02	Jackson	22	Excellent	15	421	34	39
Cullowhee Creek	Off SR 1001	04-04-02	Jackson	21	Excellent	19	799	40	35
Tuckasegee River	Off SR 1001	04-05-02	Jackson	22	Excellent	11	144	26	44

* TVA EPT ratings are not equivalent to DWQ bioclassifications.

TVA also monitors the ecological health of its reservoirs annually. The TVA reservoir rating system is based on the assignment of a numerical score which is then used to define each of five reservoir indicators (algae, dissolved oxygen, fish, benthic macroinvertebrates and sediment) as Poor, Fair or Good. Fontana received Fair reservoir ratings in 1999 and 2000. Details are provided on TVA's website at http://www.tva.gov/environment/ecohealth/fontana.htm.

US Army Corps of Engineers and US Geological Survey

The Corps of Engineers (COE) in conjunction with Macon County is conducting a feasibility study of potential ecosystem restoration measures in the upper Little Tennessee River. The primary goals are protection and enhancement of threatened and endangered species populations and wetland restoration. The focus of the study is to directly address both the existing sedimentation problem in Lake Emory and the continued inflow of sediment from the upstream watershed. In November 2000, COE partnered with the US Geological Survey to characterize both suspended and bedload sediment transport into Lake Emory from three major tributaries: Cartoogechaye Creek, Cullasaja River and Little Tennessee River. The suspended sediment concentration in water leaving Lake Emory will also be measured. Further information about the COE ecosystem restoration will be provided in the next Little Tennessee River Basinwide Water Quality Plan (2007).

3.5 Use Support Summary

3.5.1 Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality. Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met.

For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, having inconclusive data, or for which assessment criteria have not yet been developed, are listed as not rated (NR). More specific methods are presented in Appendix III.

Use support ratings for surface waters:

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

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that

demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997).

Impaired waters categories:

- Partially Supporting
- Not Supporting

Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., water supply is only applied to Class WS waters). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water. For more detailed information regarding use support methodology, refer to Appendix III.

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

Section 303(d) of the Clean Water Act requires states to identify waters not meeting standards. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. See Appendix IV for a description of 303(d) listing methodology.

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 standard 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 and TMDLs are developed. 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 standards are being met.

3.5.3 Use Support Ratings for the Little Tennessee River Basin

Aquatic Life/Secondary Recreation

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (2564.6) and lake acres (21,158.4) in the North Carolina portion of the Little Tennessee River basin. Table A-24 presents use support ratings by subbasin for both monitored and evaluated waters in the aquatic life/secondary recreation category.

Approximately 20 percent of stream miles (524.7) and 33 percent of lake acres (6,881) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle (Table A-25). Impaired waters account for 2.4 percent of monitored stream miles and 4.1 percent of monitored lake acres. Refer to page 57 for details regarding impaired waters in all use support categories.

Table A-24 Aquatic Life/Secondary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin (1995-1999)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
04-04-01	406.0 mi 150 ac	6.7 mi 0.0 ac	0.0 mi 0.0 ac	121.0 mi 548 ac	533.7 mi 748.0 ac
04-04-02	1183.7 mi 12,424.2 ac	2.3 mi 0.0 ac	0.0 mi 0.0 ac	234.7 mi 3,193.3 ac	1420.7 mi 15,617.5 ac
04-04-03	183.9 mi 1,606 ac	1.0 mi 0.0 ac	0.0 mi 0.0 ac	72.5 mi 120.6 ac	257.4 mi 1,726.6 ac
04-04-04	253.8 mi 2,569 ac	2.9 mi 280 ac	0.0 mi 0.0 ac	96.0 mi 497.3 ac	352.7 mi 3,066.3 ac
TOTAL	**2027.4 mi 16,749.2 ac**	**12.9 mi 280 ac**	**0.0 mi 0.0 ac**	**524.2 mi 4,359.2 ac**	**2564.5 mi 21,158.4 ac**
Percent Miles	79.1%	0.5%	0%	20.4%	100%
Percent Acres	79.2%	1.3%	0%	20.6%	100%

Table A-25 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Little Tennessee River Basin (1999)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**2027.4 mi 16,749.2 ac**	**79.1% 79.2%**		**508.7 mi 6,601 ac**	**97.0% 96.0%**
Impaired	**12.9 mi 280 ac**	**0.5% 1.3%**		**12.9 mi 280 ac**	**2.4% 4.1%**
Partially Supporting	*12.9 mi 280 ac*	*0.5% 1.3%*		*12.9 mi 280 ac*	*2.4% 4.1%*
Not Supporting	*0.0 mi 0.0 ac*	*0.0%*		*0.0 mi 0.0 ac*	*0.0% 0.0%*
Not Rated	**524.2 mi 4,359.2 ac**	**20.4% 10.6%**		**3.1 mi 0.0 ac**	**0.6% 0.0%**
TOTAL	**2564.5 mi 21,158.4 ac**			**524.7 mi 6,881 ac**	

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

Fish Consumption

Like the aquatic life/secondary recreation use support category, fish consumption is also applied to all waters in the state. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there are no fish consumption advisories specific to the NC portion of the basin. Therefore, all waters are considered to be fully supporting the fish consumption category. No waters were monitored for fish consumption during this basinwide cycle because of the lack of any significant contaminant concerns in the Little Tennessee River basin.

Primary Recreation

There are 237.3 stream miles and 16,879.2 lake acres currently classified for primary recreation in the Little Tennessee River basin. Table A-26 presents use support ratings by subbasin for monitored and evaluated waters in the primary recreation category.

Approximately 58 percent of stream miles (136.8) and 40 percent of lake acres (6,731) were monitored for the protection of primary recreation by DWQ over the past five years (Table A-27). Impaired waters account for 4.2 percent of monitored lake acres. Primary recreation use support ratings are based on swimming advisories issued by the NC Department of Health and Human Services (DHHS).

Table A-26 Primary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin in Miles (1995-1999)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total (Class B waters)
04-04-01	24.0 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	41.3 mi 0.0 ac	65.3 mi 0.0 ac
04-04-02	69.8 mi 12,424.2 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	37.0 mi 0.0 ac	106.8 mi 12,424.2 ac
04-04-03	36.0 mi 1,606 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	36.0 mi 1,606 ac
04-04-04	7.0 mi 2,569 ac	0.0 mi 280 ac	0.0 mi 0.0 ac	22.2 mi 0.0 ac	29.2 mi 2,849.0 ac
TOTAL	**136.8 mi 16,599.2 ac**	**0.0 mi 280 ac**	**0.0 mi 0.0 ac**	**100.5 mi 0.0 ac**	**237.3 mi 16,879.2 ac**
Percent Miles	57.6%	0%	0%	42.4%	100%
Percent Acres	98.3%	1.7%	0%	0%	100%

Table A-27 Primary Recreation Use Support Summary Information for Waters in the Little Tennessee River Basin (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**136.8 mi 16,599.2 ac**	**57.6% 98.3%**		**136.8 mi 6,451 ac**	**100% 95.8%**
Impaired	0.0 mi 280 ac	**0.0% 1.7%**		**0.0 mi 280 ac**	**0.0% 4.2%**
Partially Supporting	*0.0 mi 280 ac*	*0.0% 1.7%*		*0.0 mi 280 ac*	*0.0% 0.0%*
Not Supporting	*0.0 mi 0.0 ac*	*0.0% 0.0%*		*0.0 mi 0.0 ac*	*0.0% 0.0%*
Not Rated	**100.5 mi 0.0 ac**	**42.4% 0.0%**		**0.0 mi 0.0 ac**	**0.0% 0.0%**
TOTAL	**237.3 mi 16,879.2 ac**			**136.8 mi 6,731 ac**	

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

Water Supply

There are 530.6 stream miles and 2,426 lake acres currently classified for water supply in the Little Tennessee River basin. All were evaluated within the past five years; all are fully supporting. A basinwide summary of current water supply use support ratings is presented in Table A-28.

Table A-28 Water Supply Use Support Summary Information for Waters in the Little Tennessee River Basin (1999)

Water Supply Use Support Ratings	Evaluated Waters	
	Miles	**%**
Fully Supporting	**530.6 mi** **2,426 ac**	**100%**
Impaired	**0.0 mi** **0.0 ac**	**0%** **0%**
Not Rated	**0.0 mi** **0.0 ac**	**0%** **0%**
TOTAL	**530.6 mi** **2,426 ac**	

Use Support Summary

Table A-29 presents impaired waters (in all categories), listed by subbasin, in the Little Tennessee River basin that were monitored by DWQ within the last five years. Ratings for each applicable use support category are shown, even though only one use may be impaired. Impaired ratings are shown in bold followed by the number of miles (streams or rivers) or acres (lakes) where the corresponding use is impaired. Descriptions of impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each water are discussed in detail in the appropriate subbasin chapter.

Color maps showing current use support ratings for monitored waters in the Little Tennessee River basin are presented in Figure A-16. When use support ratings have been assigned to more than one category for a particular water, the rating that represents the most severe impairment is shown on the map (e.g., The Cullasaja River is fully supporting water supply, but is partially supporting aquatic life/secondary recreation. The river is shown as partially supporting.)

Table A-29 Monitored Impaired Waters within the Little Tennessee River Basin (as of 2000)[1]

				Use Support Categories/Rating– Impaired Miles (or Acres)				
Impaired Water	**Subbasin**	**Chapter in Section B**	**Classification[2]**	**Aquatic Life/ Secondary Recreation**	**Fish Consumption**	**Primary Recreation**	**Water Supply**	**Potential Sources**
Cullasaja River	04-04-01	1 (pg 77)	WS-III Tr	PS – 3.2 mi	FS	*N/A*	FS	NP
Mill Creek	04-04-01	1 (pg 77)	WS-III Tr	PS – 1.3 mi	FS	*N/A*	FS	NP
Little Tennessee River	04-04-01	1 (pg 77)	C	PS – 2.2 mi	FS	*N/A*	*N/A*	P, NP
Beech Flats Prong	04-04-02	2 (pg 88)	C Tr HQW	PS – 2.4 mi	FS	*N/A*	*N/A*	NP
Santeetlah Lake (West Buffalo Creek Arm)	04-04-04	4 (pg 103)	B Tr	PS – 280 ac	FS	PS – 280 ac	*N/A*	P

FS	Fully Supporting	P	Point Sources	N/A	Not Applicable
PS	Partially Supporting	NP	Nonpoint Sources		

Notes

[1] These waters are currently, or will be placed, on the 303(d) list, and a TMDL and/or management strategy will be developed to address causes and sources of impairment. Refer to Appendix IV for further information regarding 303(d) listing methodology.

[2] An index for DWQ freshwater classifications can be found in Part 3.2 of this section on page 39 in Table A-19.

PLEASE INSERT COLOR MAP (Fig A-16) HERE!!

Figure A-16 Use Support Ratings for the Little Tennessee River Basin

Chapter 4 -
Water Quality Issues Related to the Entire Little Tennessee River Basin

4.1 Overview

The 1997 Little Tennessee River Basinwide Water Quality Management Plan included several recommendations to address water quality issues in the basin. Most of these recommendations were for specific stream segments and are discussed separately in the individual subbasin chapters in Section B. This chapter discusses water quality issues that relate to the entire Little Tennessee River basin. Habitat degradation, including sedimentation (resulting primarily from land clearing activities and rural roads), loss of riparian vegetation, loss of instream microhabitats, and urban runoff, are the main water quality issues in the basin. Water quality and aquatic life impacts from dams and golf courses have also been identified.

4.2 Habitat Degradation

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a discharge quantity that is much greater than the natural flow in the stream often have degraded habitat as well.

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. 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 need to be addressed to further improve water quality in North Carolina's streams and rivers.

4.2.1 Sedimentation

Introduction

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 timber harvesting 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 (NCDENR-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 aquatic insects that fish feed upon and buries fish habitat that is vital to reproduction. Sediment filling rivers and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998).

Major Causes of Sedimentation in the Little Tennessee River Basin

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

Suspended sediment can decrease primary productivity (photosynthesis) by shading sunlight from aquatic plants, affecting the overall productivity of a stream system. Suspended sediment also has several effects on various fish species including avoidance and redistribution, reduced feeding efficiency, and therefore, reduced growth by some species, respiratory impairment, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, June 1999). Suspended sediment also increases the cost of treating municipal drinking water.

During 1999 basinwide monitoring, DWQ aquatic biologists reported streambank erosion and sedimentation throughout the Little Tennessee River basin that was moderate to severe. Lower bioclassification ratings were assigned because of sedimentation; bottom substrate was embedded by silt and/or pools were partially filled with sediment. Unstable and/or undercut (eroding) streambanks were also noted in explanation of lower ratings (NCDENR-DWQ, April 2000).

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 Roanoke River basin include: construction of homes and subdivisions as well as commercial and public buildings; plowing of soil to plant crops; site preparation and harvest on timberlands; 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 to protect

water quality. Where programs are not effective, as evidenced by a violation of instream water quality standards, and where DWQ can identify a source, then appropriate enforcement action can be taken. Generally, this entails requiring the landowner or responsible party to install acceptable BMPs.

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 page 30). An erosion and sediment control plan must also be developed and approved 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.

Forestry activities in North Carolina are subject to regulation under the SPCA. However, a forestry operation in the Little Tennessee River basin may be exempt from the permitting requirements if compliance with performance standards outlined in *Forest Practice Guidelines Related to Water Quality* (15NCAC 1I .201-.209) and General Statutes regarding stream obstruction (77-13 and 77-14) are maintained. Extensive information regarding these performance standards and rules as they apply to forestry operations can be found on the NC Division of Forest Resources website at http://www.dfr.state.nc.us/managing/water_qual.htm.

For agricultural activities which are not subject to the SPCA, sediment controls are carried out on a voluntary basis through programs administered by several different agencies (see Appendix VI for further information).

Some Best Management Practices

Agriculture

- Using no till or conservation tillage practices
- Fencing livestock out of streams and rivers
- Leaving natural buffer areas around small streams and rivers

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
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

Unpaved Roads and Eroding Road Grades

As is typical of settlement in mountainous areas, many roads in the Little Tennessee 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. Road grades of 12 percent or less are desirable. Unpaved roads with grades in excess of 12 percent erode easily and are difficult to maintain (WNCT, 1999). 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 for forestry activities in the Little Tennessee River 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 (NRCD-DFR, September 1989).

Stronger Rules For Sediment Control

The Division of Land Resources (DLR) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced. 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.

For information on North Carolina's Erosion and Sedimentation Control Program or to report erosion and sedimentation problems, visit the new website at http://www.dlr.enr.state.nc.us/ or you may call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

Recent Review of Sediment Control Research

The two most popular sediment control devices are silt fences and sediment basins. In 2001, DWQ staff conducted a review of peer-reviewed research publications and consulted with

experts at NC State University (NCSU) to investigate the effectiveness of current sediment and erosion control practices. In addition, engineering calculations have been conducted to obtain theoretical effectiveness of sediment basins and silt fences. Research conducted in North Carolina showed that construction sites in North Carolina produce 10-188 tons per acre per year of sediment. Such wide variation might be attributed to the significant spatial and temporal differences in rainfall intensity and duration, soil characteristics, slope, and the type of soil cover. DLR currently uses the assumption that (on average) construction sites produce 84 tons/acre-year. For comparison, erosion in undisturbed natural systems is only 0.1-0.2 tons/acre-year.

Currently, sediment basins are designed to have 1,800 cubic feet of storage space for each acre of disturbed land. Based on the reference review and consultation, DWQ has concluded that these basins have numerous deficiencies, including:

1. Insufficient volume. [Pennsylvania requires 5,000 cubic feet; Maryland and Virginia require 3,600 cubic feet.]
2. Inadequate cleaning frequency. [Basins are cleared only once a year, which significantly reduces their effectiveness.]
3. Short-circuiting. [In many cases, inlet and outlet in basins are constructed in very close proximity, which results in a shorter than predicted retention time.]
4. Water is not being removed from the surface where concentration of the sediment is the lowest.
5. Basins are designed with consideration of only cleared land. [In many cases, basins are treating runoff from the entire drainage area, which is significantly larger than that of cleared land.]

A sedimentation basin that is ideally designed and constructed is only able to capture 55 percent of all sediment in runoff. As a result, each acre of cleared land will deliver 38 tons of sediment to the waterways each year. After six months of operation, the effectiveness of the sediment basin will be reduced to 33 percent and the loss of sediment will approach 56 tons/acre-year.

Silt fences are even less effective. A typical silt fence can capture only 22 percent of all particles in runoff. Very often, they are improperly installed and receive inadequate maintenance that results in further reduction in their effectiveness.

New research indicates that use of new technologies such as installation of baffles in the sediment basins, application of flocculants, and use of skimmers can significantly increase efficiency of sedimentation basins. Experiments conducted at NCSU demonstrated that the current turbidity standard of 50 NTU (for waters not classified Tr) can be achieved in runoff if these devices are used. However, the fact that is most important factor in reducing sedimentation is timely cover of cleared land with mulches or use of the flocculent solutions to prevent erosion. It has been conclusively proven that use of ground cover (temporary or permanent) dramatically reduces erosion rates.

4.2.2 Loss of Riparian Vegetation

During 1999 basinwide sampling, DWQ biologists reported degradation of aquatic communities at numerous sites throughout the Little Tennessee 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 areas (NCDENR-DWQ, April 2000).

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) 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. Some fish require cooler water temperatures as well as the higher levels of dissolved oxygen cooler water provides. 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 (EPA, 1999).

Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, October 2001). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

4.2.3 Loss of Instream Organic Microhabitats

Organic microhabitat (leafpacks, sticks and large wood) and edge habitat (root banks and undercut banks) play very important roles in a stream ecosystem. Organic matter in the form of leaves, sticks and other materials serve as the base of the food web for small streams. Additionally, these microhabitats serve as special niches for different species of benthic macroinvertebrates, providing food and/or habitat. For example, many stoneflies are found almost exclusively in leafpacks and on small sticks. Some beetle species prefer edge habitat, such as undercut banks. If these microhabitat types are not present, there is no place for these specialized macroinvertebrates to live and feed. The absence of these microhabitats in some streams in the Little Tennessee River basin is directly related to the absence of riparian vegetation (refer to Part 4.2.2 above). Organic microhabitats are critical to headwater streams, the health of which is linked to the health of the entire downstream watershed, as discussed in Part 4.6.

4.2.4 Channelization

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Typical modifications are described in the text box. Although increased flooding, bank erosion

and channel instability often occur in downstream areas after channelization has occurred, flood control, reduced erosion, increased usable land area, greater navigability and more efficient drainage are frequently cited as the objectives of channelization projects (McGarvey, 1996).

Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat (McGarvey, 1996).

Typical Channel Modifications

- Removal of any obstructions, natural or artificial, that inhibit a stream's capacity to convey water (clearing and snagging).
- Widening, deepening or straightening of the channel to maximize conveyance of water.
- Lining the bed or banks with rock or other resistant materials.

Restoration or recovery of channelized streams may occur through processes, both naturally and artificially induced. In general, streams that have not been excessively stressed by the channelization process can be expected to return to their original forms. However, streams that have been extensively altered may establish a new, artificial equilibrium (especially when the channelized streambed has been hardened). In such cases, the stream may enter a vicious cycle of erosion and continuous down cutting. Once the benefits of a channelization project become outweighed by the costs, both in money and environmental integrity, channel restoration efforts are likely to be taken (McGarvey, 1996).

Channelization of streams within the continental United States is extensive and promises to become even more so as urban development continues. Overall estimates of lost or altered riparian habitats within US streams are as high as 70 percent. Unfortunately, the dynamic nature of stream ecosystems makes it difficult (if not impossible) to quantitatively predict the effects of channelization (McGarvey, 1996). Channelization has occurred historically throughout the Little Tennessee River basin and continues to occur in some watersheds, especially in small headwater streams.

4.2.5 Recommendations for Reducing Habitat Degradation

Sedimentation

In March 2002, Environmental Management Commission (EMC) sent a letter to the Sedimentation Control Commission (SCC) expressing seven recommendations for improving erosion and sedimentation control, based on a comprehensive performance review of the turbidity standard conducted in 2001 by DWQ staff (refer to page 62 for a summary). Specifically the recommendations are that the EMC and SCC:

1. Evaluate, in consultation with the Attorney General's Office, whether statutory authority is adequate to mandate temporary ground cover over a percentage of the uncovered area at a construction site within a specific time after the initial disturbance of the area. If it is found that statutory authority does not exist, then the EMC and SCC should prepare resolutions for the General Assembly supporting new legislation to this effect.

2. Prepare resolutions supporting new legislation to increase the maximum penalty allowed in the Sedimentation Pollution Control Act from $5,000 to $25,000 for the initial response to a non-compliant site.
3. Jointly support a review of the existing Erosion and Sediment Control Planning and Design Manual by DLR. This review should include, but not be limited to, a redesign of the minimum specifications for sedimentation basins.
4. Evaluate, in consultation with the Attorney General's Office, whether the statutory authority is adequate for effective use of the "Stop Work Order" tool, and, if found not to be adequate, to prepare resolutions for the General Assembly supporting new legislation that will enable staff to more effectively use the "Stop Work Order" tool.
5. Support increased research into and experimentation with the use of polyacrylamides (PAMs) and other innovative soil stabilization and turbidity reduction techniques.
6. Jointly support and encourage the awarding of significant monetary penalties for all activities found to be in violation of their Stormwater Construction General Permit, their Erosion and Sediment Control Plan, or the turbidity standard.
7. Hold those individuals who cause serious degradation of the environment through excessive turbidity and sedimentation ultimately responsible for restoration of the area.

The EMC and the SCC have agreed to hold a joint meeting of the two Commissions for the purpose of exploring the recommendations made by DWQ staff.

In addition, DWQ will continue to work cooperatively with DLR and local programs that administer sediment control 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 Little Tennessee River basin.

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 percent 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. Jackson County, Swain County, Macon County and the Town of Highlands currently have locally-delegated erosion and sediment control programs (refer to page 125 for further details) in the Little Tennessee River basin. It is recommended that other local governments draft and implement local erosion and sedimentation control programs.

The Department of Transportation should take special care when constructing and maintaining (including mowing) roads along streams in the Little Tennessee River basin. The lack of riparian vegetation and streambank erosion is well documented and will lead to increased instream habitat degradation if these problems remain unchecked. Vegetation along streams should remain as undisturbed as possible when conducting these construction and maintenance activities, keeping in mind that most of these streams are trout waters. Additionally, more public education is needed basinwide to educate landowners about the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life.

Funding is available through numerous federal and state programs for landowners to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources for livestock, and fence animals out of streams (refer to Section C). EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines some of 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 or by visiting the website at http://www.epa.gov/OWOW/watershed/wacademy/fund.html. Local contacts for various state and local agencies are listed in Appendix VI.

4.3 Urban Runoff

Runoff from built-upon (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. The volume and speed of runoff are greatly increased in these areas as well, causing erosion of streambanks, temperature and salinity alterations, and scouring of the streambed. Generally, there are also a larger number of point source discharges in these areas. Cumulative impacts from habitat and floodplain alterations, as well as point and nonpoint source pollution can cause severe impairment to streams.

Proactive planning efforts at the local level are needed across the entire western portion of the basin in order to assure that development is done in a manner that minimizes impacts to water quality. A lack of good environmental planning was identified by participants at the public workshops as a threat to water quality in the Little Tennessee River basin. Additionally, there are many things that individuals can do to reduce the quantity and improve the quality of stormwater runoff.

4.3.1 Rural Development

More than three-quarters of the land in western North Carolina has a slope in excess of 30 percent. 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 percent or less are desirable. Unpaved roads with grades in excess of 12 percent erode easily and are difficult to maintain (WNCT, 1999). This terrain presents a challenge for environmentally sensitive development. 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 accelerating erosion during construction. In addition, chronic problems with failing septic systems and eroding road grades are more likely.

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 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 developed areas in the Little Tennessee River basin, 1999 DWQ biological assessments revealed that streams are being impacted by urban stormwater runoff. Most of the impacts are in terms of habitat degradation (refer to page 59), but runoff from developed and developing areas can also carry toxic pollutants to a stream (NCDENR-DWQ, May 2000).

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 several programs aimed at controlling stormwater runoff in the Little Tennessee River basin. They are: 1) programs for the control of development activities within designated water supply (WS) watersheds; 2) NPDES stormwater permit requirements for construction or land development activities on one acre of land or more; and 3) NPDES stormwater requirements for certain industrial activities. For more detailed information on current and proposed stormwater rules, refer to page 30.

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. These actions are critical to water quality management and the quality of life for the residents of the basin.

Planning Recommendations for Little Tennessee 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.

Action should be taken at the local level to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box, refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection.

Additional public education is also needed in the Little Tennessee River basin in order for citizens to understand the value of urban planning and stormwater management. DWQ recently developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water Quality In Your Own Backyard*. To obtain a free copy, call (919) 733-5083, ext. 558.

4.4 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, degradation of headwater streams can (and does) impact the larger stream or river.

In smaller headwater streams, fish communities are not well developed and benthic macroinvertebrates dominate aquatic life. Benthic macroinvertebrates are often thought of as "fish food" and, in mid-sized streams and rivers, they are critical to a healthy fish community. However, these insects, both in larval and adult stages, are also food for small mammals, such as river otter and raccoons, birds and amphibians (Erman, 1996). Benthic macroinvertebrates in headwater streams also perform the important function of breaking down coarse organic matter, such as leaves and twigs, and releasing fine organic matter. In larger rivers, where coarse organic matter is not as abundant, this fine organic matter is a primary food source for benthic macroinvertebrates and other organisms in the system (CALFED, 1999). When the benthic macroinvertebrate community is changed or extinguished in an area, even temporarily, it can have repercussions in many parts of both the terrestrial and aquatic food web.

Headwaters also provide a source of insects for repopulating downstream waters where benthic macroinvertebrate communities have been eliminated due to human alterations and pollution. Adult insects have short life spans and generally live in the riparian areas surrounding the streams from which they emerge (Erman, 1996). Because there is little upstream or stream-to-

stream migration of benthic macroinvertebrates, once headwater populations are eliminated, there is little hope for restoring a functioning aquatic community.

Recommendations

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, minimizing stream channel alterations, 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, refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

4.5 Impact of Dams

By altering the flow of water in a river or stream, dams have the ability to change the chemical, physical and biological processes of the river downstream. Dams block free-flowing rivers and reduce the flow of nutrients and sediments, including heavy gravel and cobble, and organic matter that are important to the health of the stream and its biological communities. The river downstream of the dam becomes deprived of its sediment load, and, depending on the type of river, can begin to generate its own sediment by eroding its banks and channel undermining bridges and other riverbank structures. This bank erosion and channel entrenchment can extend for up to fifty miles below the dam. The reduction of gravel, cobble and organic matter inputs also reduces the habitat and food source of many fish and macroinvertebrates (IRN, 2000).

The operation of the dam itself can also lead to accelerated erosion in downstream segments as it alters the timing of flows. Instead of providing a constant flow, some dams cause a withholding and then releasing of water which causes the downstream stretches to alternate between no water and powerful surges. This drastic fluctuation in flow can erode soil and vegetation, flood lands and change the natural seasonal flow variations that trigger natural growth and reproduction cycles in many plant, fish and benthic macroinvertebrates (IRN, 2000).

Dams are also barriers to downstream drift. When benthic macroinvertebrates in a particular section of stream are severely impacted by storm events or toxic conditions, the primary method by which the community is reestablished (re-colonization) is by natural drift of benthic macroinvertebrates from upstream areas. In pond or lake environments, flow is greatly reduced and many benthic macroinvertebrates sink to the bottom where habitat conditions are not suitable for survival. Additionally, water is warmer in these larger bodies of water and predators (primarily fish) have the advantage. Dams can also represent a barrier to fish movement in a stream or river (DWQ, February 2002).

Water temperature and dissolved oxygen (DO) levels are significantly different when rivers are impounded. By slowing water flow, most dams increase the temperature of the water flowing over the dam. Others decrease water temperature by releasing cooled water from the bottom of

the reservoir. Fish and other species, especially native trout populations, are extremely sensitive to these temperature irregularities which can change the structure of the communities from native and rare species to less desirable species more tolerant of fluctuating water temperatures. Dissolved oxygen is also decreased in the waters held by the dam and when released can have severe impacts, including death, on the fish, benthic macroinvertebrates and vegetation downstream (IRN, 2000).

Recommendations

Situations exist in which it is economically and environmentally feasible to remove dams, restoring free movement of water, sediment, nutrients and aquatic life throughout the river system. However, this recommendation is usually costly, difficult and impractical. Another effective solution involves relocating streams to flow around dams. This solution is particularly valid when populations of aquatic life are thriving upstream of the impoundment, and there are concerns about releasing excess sediment and other pollutants within the existing reservoir (from behind the dam).

Requirement of minimum flow releases and management of dam operations to provide more consistent flow is a solution for streams and rivers that are primarily affected by flow-related problems. Flow management does not usually solve problems with recolonization of benthic macroinvertebrates, but can substantially improve conditions for existing populations below dams. Additionally, there are a variety of engineering solutions to improve temperature and dissolved oxygen both within the reservoir and below the dam.

Due to the impacts of dams on aquatic communities, the construction of most instream ponds and reservoirs, particular in headwater streams, should be prohibited. The Department of Environment and Natural Resources should reexamine its policy related to dams that are less than 15 feet in height or impounding less than ten-acre feet of water. DWQ should continue to actively participate in the FERC relicensing process.

4.6 Golf Course Impacts

There were 17,108 golf courses in the United States in 2000; and in that year, 524 new courses were built; 707 were under construction; and 1,049 were being planned (NGF, 2001). In North Carolina, 150,000 acres of new turf areas, including athletic fields, recreational areas, home lawns and golf courses, are developed each year, and the rate of development continues to grow (NCCES, 1995). Without proper site design, construction practices and maintenance, all turf areas can serve as source of sediment, nutrients and other contaminants that can impact water quality. Golf courses, because of their size, location and historical design practices, can cause significant impacts to small streams. In order to insure water quality protection, BMPs should be implemented throughout the life of a golf course from design to construction to daily maintenance.

Proper site design works with the landscape. The design should designate environmentally sensitive areas throughout the course and strive to protect them with minimal disturbance. The design can prevent or minimize erosion and stormwater runoff by maintaining natural vegetated riparian areas near streams, wetlands and lake shorelines as much as possible. Good design also

minimizes the development of gullies, avoids channelization (straightening) of streams, and prohibits the unnecessary disruption of stream banks and lake shorelines (NCCES, 1995).

During golf course construction, the exposed soils and steep slopes are highly susceptible to erosion and sedimentation. In order to reduce erosion and sedimentation from the site, strategies to effectively control sediment, minimize the loss of topsoil, and protect water resources need to be implemented throughout the construction of the course (CRM, 1996). One most effective BMPs to use during construction activities on large sites is to minimize the duration of exposed soils and to establish ground cover as soon as possible after soil disturbance.

Maintenance of the golf course also has the potential to impact water quality through improper fertilization, mowing and irrigation. Fertilizer applications should be based on a soil test to determine the appropriate timing, level and type of fertilizer necessary for the type of grass on particular areas of the course. Fertilizers should also not be applied on the steep slopes near surface waters or directly to lakes, streams and drainage areas. It is a good practice to maintain a buffer of low-maintenance grasses or natural vegetation between areas of the highly maintained portions of the golf course and surface waters (NCCES, 1995).

The appropriate level of irrigation for a golf course is vital to the health of the grasses and the preservation of water quality. Under-watering may harm the grasses while over-watering increases the potential for leaching fertilizers and nutrients from the soil and increasing runoff. A properly designed irrigation system will apply a uniform level of water at the desired rate and time. The amount and frequency of watering should be based on the type of grass and soil and weather conditions.

Golfers can also play a role in protecting water quality on the golf course. Players should respect designated environmentally sensitive areas within the course and recognize that golf courses are managed areas that complement the natural environment. Golfers should also support and encourage maintenance practices that protect and enhance the environment and encourage the development of environmental conservation plans for the course. In addition, golfers can choose to patronize courses that are designed, constructed and maintained with protection of natural resources in mind.

4.7 Trout Production Facilities

North Carolina ranks second only to Idaho in commercial production of rainbow trout in the United States, producing four to six million pounds per year. In 2000, there were 61 trout production facilities licensed by the NC Department of Agriculture (NCDA) and about 80 percent of the trout produced (5,703,000 pounds) were sold to local processors. The estimated value of the industry in 2000 was $7,137,240 (NCDA, 2000).

A Notice of Intent is required by DWQ prior to construction of a trout farm for those facilities designed to produce more than 20,000 pounds or using more than 5,000 pounds of feed in any month. Most trout production facilities are covered under a general permit and are considered “operations with limited impacts”. However, DWQ may (and has in the Little Tennessee River basin for those operations noted below) require an individual permit if there are already documented impacts to the receiving waters from excess nutrients or pathogens or if there is

potential for water quality impacts to specific site conditions (i.e. lake or pond downstream). The US Army Corps of Engineers may also require a Section 404 Permit for construction of an intake and/or a structure to divert water from a stream to the trout farm. In addition, trout farm site analysis is required to determine if wetlands will be impacted (NCCES, 1999).

There are 40 permitted trout production facilities in North Carolina, which represents 65 percent of the total number licensed. In the Little Tennessee River basin, six facilities are covered under a general permit and five hold individual permits. Facilities with an individual permit are listed in Appendix I and are inspected annually as are other NPDES-permitted facilities (WWTPs). All five facilities with individual permits are located within subbasin 04-04-04 and discharge to streams that flow into Santeetlah Lake. Water quality impacts to Santeetlah Lake are discussed in more detail in Section B, Chapter 4 (beginning on page 103).

Currently, there is no written protocol for an NPDES permit inspection of trout farms because most facilities have limited "treatment" operations. The extent of water quality impact from a particular trout farm is directly linked to management practices at the facility, therefore the focus of a DWQ inspection includes a review of: feeding practices, how waste is stored and moved out of the active production facilities (the raceway areas), and generally how the farm is operated. For facilities that discharge into a stream with good flow and few existing impacts from excess nutrients or pathogens, water quality problems are immediately downstream from the facility and are typically minor in nature. Downstream problems can also be minimized by implementing waste management BMPs such as maintaining a rigorous raceway cleaning schedule, appropriate disposal of waste from raceways and utilizing settling ponds before discharge. Hand feeding, rather than using an automated system, is also a good BMP for reducing nutrient inputs to the receiving waters and recently, trout growers in Graham County have shown that low-phosphorus feed may result in a significant reduction of phosphorus from facility discharges.

In locations where there are limitations to the ability of a receiving water to assimilate the residual trout waste (i.e. flow is reduced downstream as in a lake situation or the receiving stream is already affected by excess nutrients or pathogens), facilities can easily cause water quality impacts leading to impairment of designated uses, even when BMPs are implemented. After water quality problems develop, a facility can generally can only address them by reducing trout production. Technologies available to "treat" the large volumes of water flowing through trout farms (typically 1,000 gallons per minute) are not operationally effective or economically viable.

Recommendations

Any proposed (new) trout production facility should work closely with the NC Cooperative Extension Service, NCDA, and DWQ to make sure a stream site is appropriate for the planned production operation.

DWQ should continue to:

- scrutinize any request for a new trout production facility to ensure that site conditions and mass production are such that receiving waters can assimilate the proposed discharge;
- conduct special studies when problems with trout farms are suspected and work with facilities to implement nutrient reduction measures if problems are documented as part of those studies;

- respond to water quality complaints related to trout farming operations; and
- coordinate with the NC Cooperative Extension Service, Aquaculture Specialist in the Haywood County Extension Center who works with facilities to reduce water quality impacts from trout production facilities in western North Carolina.

4.8 Priority Issues for the Next Five Years

Clean water is crucial to the health, economic and ecological 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 Little Tennessee 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.

4.8.1 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. These waters are summarized by subbasin in Table A-29 (page 57) and indicated on Figure A-16. The impaired waters are also discussed individually in the subbasin chapters in Section B.

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. Due to these restraints, this plan has no NPS management strategies for two of the streams with NPS problems.

DWQ plans to further evaluate the impaired waters in the Little Tennessee River basin in conjunction with other NPS agencies and develop management strategies for a portion of these impaired waters for the next Little Tennessee River Basinwide Water Quality Plan, in accordance with the requirements of Section 303(d) (see Part 4.8.2 below).

4.8.2 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 Little Tennessee River basin that are on this list are presented in the individual subbasin descriptions in Section B. For information on listing requirements and approaches, refer to Appendix IV.

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 2000 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.

4.8.3 Strategies for Addressing Notable Water Quality Concerns in Unimpaired Waters

Often during DWQ's use support assessment, water quality concerns are documented for waters that are fully supporting designated uses. While these waters are not considered impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. Waters with notable water quality concerns are discussed individually in the subbasin chapter in Section B.

Water quality problems in the Little Tennessee River basin are varied and complex. Inevitably, many of the water quality impacts noted are associated with 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. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding.

Section B

Water Quality Data
and
Information by Subbasin

Chapter 1 -
Little Tennessee River Subbasin 04-04-01
Includes the Little Tennessee and Cullasaja River Watersheds

1.1 Water Quality Overview

Subbasin 04-04-01 at a Glance

Land and Water

Land area:	370 mi^2
Stream miles:	533.7
Lake acres:	150

Population Statistics

1990 Est. pop.:	21,008 people
Pop. density:	57 persons / mi^2

Land Cover (%)

Forest / Wetland:	89.1
Surface Water:	0.3
Urban:	0.9
Cultivated Crop:	0.9
Pasture / Managed Herbaceous:	8.8

The Little Tennessee River flows into North Carolina from Georgia in this subbasin. After passing through Franklin and Lake Emory, the river flows through a steep gorge and eventually into Fontana Lake (Subbasin 04-04-02). Major tributaries to the Little Tennessee River in this 35-mile reach include Cartoogechaye Creek and the Cullasaja River. Other streams include Coweeta, Iotla, Burningtown and Tellico Creeks. A map of this subbasin including water quality sampling locations is presented as Figure B-1.

Bioclassifications for sample locations are presented in Table B-1. Use support ratings for each applicable category in this subbasin are summarized in Tables B-2 and B-3. Refer to Appendix III for a complete listing of monitored waters and further information about use support ratings.

Most of the land within this subbasin is forested (89 percent) and lies within the Nantahala National Forest. There are several major mountain ranges and most streams are high gradient and capable of supporting trout populations in the upper reaches. Lower reaches of many tributaries are in agriculture (primarily pastureland) or developed and are impacted to some extent by habitat degradation. The towns of Franklin and Highlands are the only large population centers in this subbasin.

Water quality in this subbasin is generally good and many streams are classified as trout waters. There are no High Quality Waters (HQW) or Outstanding Resources Waters (ORW). However, the Big Creek watershed and a portion of Rattlesnake Branch, both located near Highlands in the Cullasaja River watershed, are (respectively) WS-II and WS-I watersheds, which are, by definition, HQW. The Little Tennessee River, from Lake Emory dam to Fontana Lake, is one of four significant aquatic habitats in the basin, and the Cullasaja Gorge/Crow Creek Falls is a significant natural heritage area. Refer to Section A, Chapter 2 (page 43) for further information about these designations.

There are 14 permitted dischargers in this subbasin; the largest of which is the Franklin WWTP. Franklin WWTP is the only facility in this subbasin that is required to monitor the toxicity of its discharge. No significant compliance or toxicity problems were noted during the most recent review period.

Figure B-1 Upper Little Tennessee River Subbasin 04-04-01

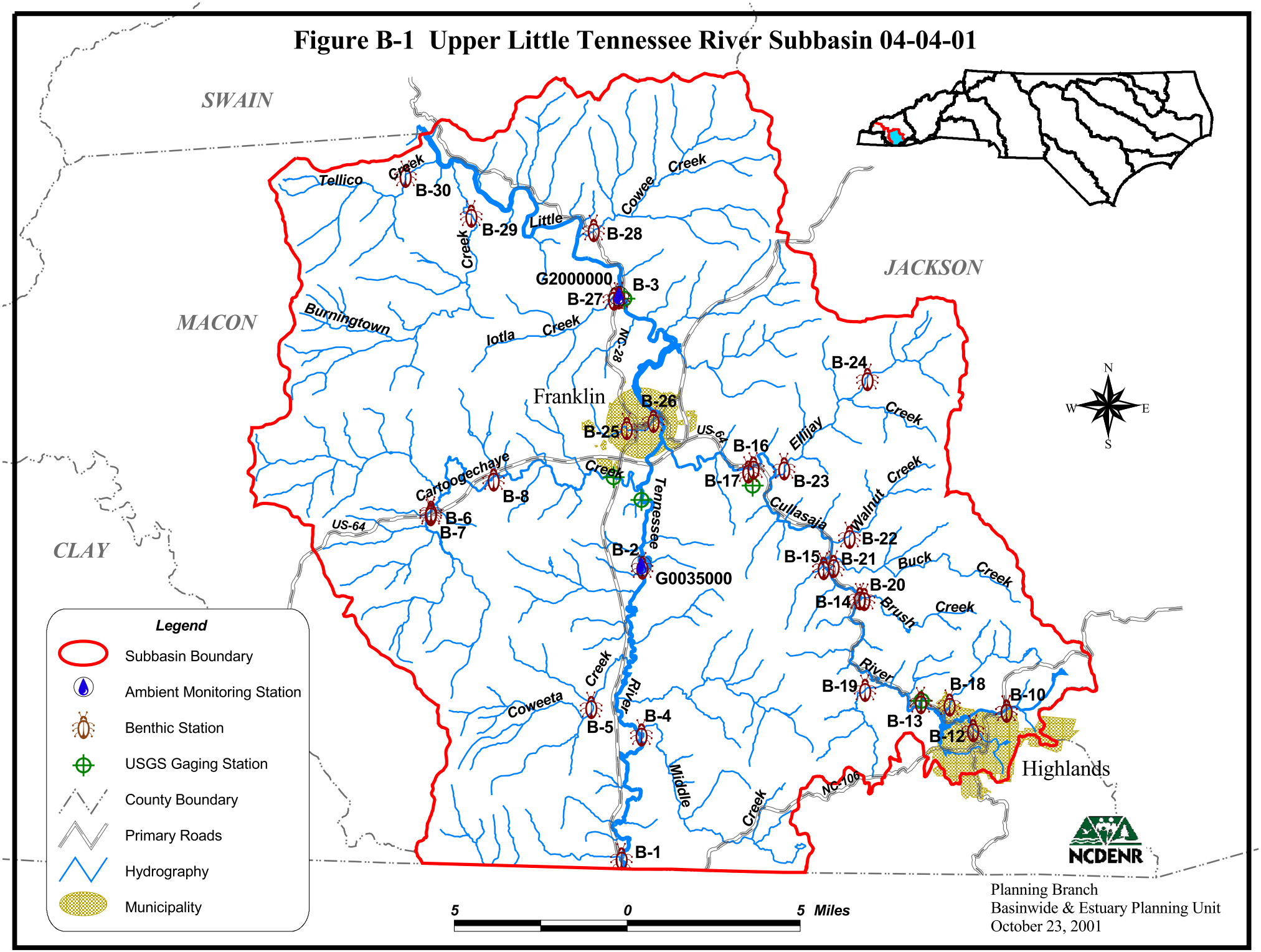


Table B-1 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (1999) for Little Tennessee River Subbasin 04-04-01

Site(s)	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1*	Little Tennessee River	Macon	Off SR 1629	Fair
B-1*	Little Tennessee River (2000)	Macon	Off SR 1629	Fair
B-2*	Little Tennessee River	Macon	SR 1651	Good-Fair
B-3*	Little Tennessee River	Macon	NC 28	Good-Fair
B-4	Middle Creek	Macon	SR 1635	Good-Fair
B-5*	Coweeta Creek	Macon	SR 1115	Excellent
B-6	Cartoogechaye Creek (1996)	Macon	SR 1307	Excellent
B-7	Cartoogechaye Creek (1996)	Macon	SR 1307 – downstream	Good
B-8*	Cartoogechaye Creek	Macon	SR 1146	Excellent
B-10*	Cullasaja River	Macon	US 64 (above Mirror Lake)	Fair
B-13	Cullasaja River (1996)	Macon	Off US 64 (below Lake Sequoyah)	Good-Fair
B-14	Cullasaja River	Macon	Off US 64 (at Jackson Hole)	Excellent
B-15*	Cullasaja River	Macon	SR 1678	Excellent
B-16	Cullasaja River (1996)	Macon	US 64/SR 1524	Good
B-17	Cullasaja River	Macon	US 64/SR 1668	Excellent
B-12*	Mill Creek	Macon	Below old WWTP	Fair
B-18	Big Creek	Macon	Above Highlands WTP	Excellent
B-19	Turtle Pond Creek	Macon	SR 1620	Excellent
B-20	Brush Creek	Macon	Near mouth/US 64	Excellent
B-21	Buck Creek	Macon	NC 28	Excellent
B-22	Walnut Creek	Macon	SR 1533	Good
B-23	Ellijay Creek	Macon	SR 1524	Excellent
B-24	North Prong Ellijay Creek	Macon	SR 1001	Excellent
B-25	Crawford Branch	Macon	Franklin Memorial Park	Not Rated
B-26	Crawford Branch	Macon	E. Main Street	Not Rated
B-27*	Iotla Creek	Macon	SR 1372	Good
B-28*	Cowee Creek	Macon	NC 28	Good
B-29*	Burningtown Creek	Macon	SR 1371	Excellent
B-30*	Tellico Creek	Macon	SR 1367	Excellent
Ambient Monitoring				
G0130000	Cartoogechaye Creek	Macon		N/A
G2000000	Little Tennessee River	Macon	At Iotla	N/A

* Historical data are available; refer to Appendix II.

Benthic Macroinvertebrates

Water quality of rivers and streams in this subbasin is generally good; however, benthic macroinvertebrate monitoring did reveal impacts to aquatic life in some streams. Sixteen of the 24 sites (67 percent) sampled by DWQ in 1999 were assigned a Good or an Excellent benthic macroinvertebrate bioclassification. The Little Tennessee River near the Georgia state line received a Fair bioclassification, both in 1999 and during a resampling event in 2000. Special studies in 1999 also found Fair water quality in the Cullasaja River above Mirror Lake and Mill Creek in the Town of Highlands and water quality impacts in Crawford Branch in the Town of Franklin. Portions of the Little Tennessee River, Cullasaja River and Mill Creek are impaired and are discussed in greater detail below.

The Fair bioclassification for the Little Tennessee River near the NC/GA state line represents a decline from the Good-Fair found in 1994. The next site (downstream) at Prentiss was assigned a Good-Fair bioclassification in 1999. Benthic macroinvertebrates had not been sampled at this site by DWQ since 1987 (Good-Fair). The Little Tennessee River at Iotla is below Franklin and Lake Emory. This site was also assigned a Good-Fair bioclassification in 1999. This portion of the Little Tennessee River has consistently received a Good-Fair since 1983.

Of the six tributary streams sampled for benthic macroinvertebrates during this basin monitoring cycle, four showed considerable improvement from 1994 ratings. Cowee Creek and Iotla Creek improved from Good-Fair to Good, while Burningtown Creek and Cartoogechaye Creek improved from Good to Excellent. Extremely high flows in 1994 prior to sample collection, and the increased nonpoint source pollution that accompanies them, most likely caused the lower bioclassifications. Coweeta Creek and Tellico Creek were both Excellent in 1994 and 1999.

The Cullasaja River watershed was given special attention in 1999 at the request of DWQ Asheville Regional Office staff. Benthic macroinvertebrates were sampled at four mainstem river sites and seven tributaries. All Cullasaja River sites downstream of Highlands were Excellent, as were Big Creek, Brush Creek, Buck Creek, Ellijay and North Prong Ellijay Creeks, and Turtle Pond Creek. Walnut Creek received a Good bioclassification. These tributaries were all sampled by DWQ for the first time. Prior data have been collected from the Cullasaja River, and no substantial changes in water quality have been observed since the river was first sampled in 1990.

Ambient Monitoring

Water chemistry samples are collected monthly from three locations in this subbasin: the Little Tennessee River at Prentiss (near Middle Creek); the Little Tennessee River at Iotla; and Cartoogechaye Creek. Turbidity, fecal coliform, copper and iron occasionally exceeded reference levels. These data are primarily associated with large rainfall events and represent relatively minor water quality concerns.

Lakes Assessment

Lake Sequoyah, an impoundment of the upper Cullasaja River near the Town of Highlands, is the only lake sampled by DWQ in this subbasin between 1994 and 1999. Much of the lake's

watershed is developed; however, an upstream impoundment, Mirror Lake, traps some sediment (and associated pollutants) before it reaches Lake Sequoyah. Samples collected in 1999 reflected mesotrophic to eutrophic lake conditions. Seven algal species found in the samples are known to contribute to taste and odor problems in drinking water. There have been no recently reported problems with low dissolved oxygen, nuisance aquatic macrophytes or algal blooms in the lake.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report – Little Tennessee River Basin* (NCDENR-DWQ, April 2000), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-2 Use Support Ratings Summary (2000) for Monitored Lakes (acres) in Little Tennessee River Subbasin 04-04-01

Use Support Category	FS	PS	NS	Total[1]
Aquatic Life/Secondary Recreation	150	0	0	150
Fish Consumption	150	0	0	150
Primary Recreation	0	0	0	0
Water Supply	0	0	0	150

Table B-3 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) in Little Tennessee River Subbasin 04-04-01

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/Secondary Recreation	406.0	6.7	0	121.0	533.7
Fish Consumption	533.7	0	0	0	533.7
Primary Recreation	24.0	0	0	41.3	65.3
Water Supply	85.5	0	0	0	85.5

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

1.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1997 basin plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each water. The 1997 Little Tennessee River Basin Plan identified two impaired waters in this subbasin: Cullasaja River and Mill Creek. These stream segments are discussed in further detail below.

1.2.1 **Cullasaja River** (4.8 miles from the source to SR 1545)
Mill Creek (1.4 miles from the source to Mirror Lake)

1997 Recommendations

Poor and Fair benthic macroinvertebrate bioclassifications were found in the Cullasaja River upstream of Lake Sequoyah and Mill Creek during the 1990s. The 1997 Little Tennessee River Basin Plan identified nonpoint source pollution from a combination of urban land uses in the Highlands area including roads, residences, golf courses, construction sites and commercial businesses, many of which are directly adjacent to the river, as the primary cause of impairment. Recommendations were for local, long-term urban planning and installation of best management practices to control erosion and impacts from stormwater runoff. The Town of Highlands' Soil and Erosion Control Ordinance and Subdivision Regulations, passed in 1995, were applauded. Implementation and enforcement of these and other rules, including a local water supply watershed ordinance, designed to minimize the impacts of future growth were encouraged. The 1997 basin plan also recognized that restoration efforts may be needed to return full use to this segment of stream.

Status of Progress

The Cullasaja River watershed was given special attention by DWQ biologists in 1999. Benthic macroinvertebrates were sampled at four mainstem river sites and seven tributaries. All Cullasaja River sites downstream of Highlands were Excellent. [One site downstream of Lake Sequoyah that received a Good-Fair bioclassification, indicating impacts to the benthic macroinvertebrate community, was not re-sampled in 1999.] Big Creek, Brush Creek, Buck Creek, Ellijay and North Prong Ellijay Creeks, and Turtle Pond Creek also received Excellent bioclassifications. Walnut Creek received a Good bioclassification. Both the Cullasaja River and Mill Creek upstream of Lake Sequoyah again received Fair benthic macroinvertebrate bioclassifications and are only partially supporting aquatic life. DWQ biologists concluded that no substantial changes in water quality have been observed since the river was first sampled in 1990.

In 1999, the Asheville Regional Water Quality Supervisor initiated an outreach effort in the Cullasaja River watershed as part of a project for the Natural Resource Leadership Institute. The objective of the effort was to assemble various stakeholders within the watershed to share water quality concerns and to develop recommendations that could be incorporated into the revised basinwide plan for the Little Tennessee River basin. Four workgroups formed as part of this process and recommendations from each group were presented to the Little Tennessee River basin planner in March 2001 prior to the initial drafting of this document (Appendix V).

Between 2000 and 2002, DWQ conducted, with financing from the Clean Water Management Trust Fund, a water quality assessment of the upper Cullasaja River watershed (includes Mill Creek). The goal of the assessment was to provide the foundation for future water quality restoration activities in the watershed by: identifying the most likely causes of biological impairment; identifying the major watershed activities and pollution sources contributing to those causes; and outlining a general watershed strategy that recommends restoration activities and BMPs to address the identified problems.

The assessment determined that prevention of downstream colonization of benthic macroinvertebrates and fish by dams on the Cullasaja River and its tributaries is the key component of impairment in the upper Cullasaja River. A secondary problem contributing to impairment is the lack of organic microhabitat in the form of leafpacks, sticks and large wood. Lower flow below dams during dry months and increased temperature and lower dissolved oxygen of water flowing out of the impoundments are also impacting the aquatic communities during dry periods or for localized areas.

For Mill Creek, no primary or "key" contributor could be identified over the two-year period; however, toxicants from urban runoff, including metals, pesticides and other organic pollutants, are likely important. In addition, the lack of organic microhabitat (upstream of the Town of Highlands' center), scour from storm flows (downstream of the Town of Highlands' center), and the lack of colonization sources for benthic macroinvertebrates were also documented.

2002 Recommendations

For the upper Cullasaja River, a strategy to reduce the impacts of dams in the Wildcat Cliffs Country Club, the Cullasaja Club and the Highlands Falls Country Club should be developed, including a plan for access to unimpounded sources of benthic macroinvertebrate communities. If this recommendation is not addressed, the recovery potential for the upper Cullasaja River is limited and other strategies discussed will have minimal impacts. Golf course communities (residential areas and golf courses) should plant wooded buffers along cleared streams where practical, and large woody debris and rock clusters should be placed in the stream channel where wooded buffers are not planted. Nutrient and pesticide management should be reexamined for the three golf course communities and a management plan that supports conservative use of these substances should be developed. Developers of roads and home sites should be encouraged to implement and strictly maintain BMPs that control erosion in steep areas, quickly stabilizing bare areas with vegetation and limiting development of steeper slopes. Refer to Section A, Chapter 4 for further information about mountain development, impacts of dams and impacts from golf courses.

For Mill Creek, further monitoring of toxicants and sources of toxicants should be conducted in the Mill Creek watershed. In addition, the source of high levels of semi-volatile organic contaminants in the main stormwater tributary to Mill Creek should be determined and remediated; the underground storage tank sites at the Town of Highlands' maintenance facility should be reevaluated to determine impacts on local tributaries and remediated as necessary; illicit connections to the stormwater system of Mill Creek should be pinpointed and eliminated; stormwater retrofits should be constructed to control the quantity and quality of stormwater delivered to Mill Creek; and DWQ should consider designating the Town of Highlands as a jurisdiction to which the Phase II stormwater rules apply. For details about these and other recommendations for the Mill Creek watershed, refer to *Assessment Report: Biological Impairment in the Upper Cullasaja River Watershed* (DWQ-WARP, 2002).

Current Water Quality Improvement Projects

Formed in 1999 as a local, citizen-based watershed organization for the upper Cullasaja River watershed on the Highlands Plateau, the Upper Cullasaja Watershed Association (UCWA) has successfully initiated a wide range of water resource quantity and quality projects. Refer to page 122 for more information. Additionally, the Town of Highlands adopted an erosion and

sediment control ordinance in 1992 and a watershed buffer plan and ordinance in 1994. Section C (page 125) contains details.

1.3 Status and Recommendations for Newly Impaired Waters

One additional stream segment in this subbasin was rated as impaired based on recent DWQ monitoring (1994-1999): Little Tennessee River from the NC/GA state line to the confluence with Mulberry Creek. Impacts to many streams from narrow riparian buffer zones, sedimentation and moderate to severe bank erosion were observed. Part 1.5 below discusses specific streams where these impacts were observed.

1.3.1 Little Tennessee River (2.2 miles from the NC/GA state line to Mulberry Creek)

1997 Recommendations

The Little Tennessee River near the NC/GA state line was first sampled by DWQ in 1994. The stream received a Good-Fair benthic macroinvertebrate bioclassification and was rated support threatened. The watershed above this sample site in Georgia contains several NPDES permitted discharges; however, the land use is primarily agricultural. Many streams have been channelized historically and have little riparian vegetation. The 1997 basinwide plan recommended better communication between the NC Department of Environment and Natural Resources (NCDENR) and the Georgia Environmental Protection Division (EPD) to assure that appropriate NPDES limits are established and enforced in order to maintain water quality and improve water quality in this portion of the Little Tennessee River.

Current Status

In August 1999 and September 2000, samples from this site resulted in a Fair bioclassification. Specific conductivity values ranged from 350-427 umhos/cm suggesting impacts from point sources upstream. Biologists also reported eroding streambanks, heavily embedded substrate, few riffle areas and little mature riparian vegetation. Data indicated possible toxicity problems and low dissolved oxygen conditions, but not severe organic loading. DWQ suspects that the source of these problems is the Fruit of the Loom facility just over the state line in Georgia. Currently, this portion of the Little Tennessee River is only partially supporting aquatic life/secondary recreation.

2002 Recommendations

DWQ has been working to establish a better relationship with Georgia EPD. The Little Tennessee River from Dillard to the GA/NC state line is on the Georgia 303(d) list. The "action to alleviate" water quality problems in the stream in Georgia is for EPD to "address nonpoint sources (urban runoff) through a watershed protection strategy". In 1993, Georgia began a River Basin Management Planning approach. River Basin Watershed Protection Plans have been developed for five of Georgia's fourteen river basins (http://www.state.ga.us/dnr/environ/ scroll down and click on "Georgia's Environment"). However, the draft "Tennessee River Basin Management Plan" that would cover streams flowing into NC will not be available until mid-2004.

DWQ has recently requested information from the Georgia EPD regarding NPDES permit limits and compliance records for facilities in the Little Tennessee River basin upstream of this site (specifically Fruit of the Loom). DWQ will follow-up with GA EPD until this information is received and the facility is in compliance with its NPDES permit. However, local implementation of nonpoint source pollution BMPs is also needed throughout the Little Tennessee River watershed, both in North Carolina and Georgia.

1.4 303(d) Listed Waters

There are two stream segments (6.2 stream miles) in this subbasin that are impaired and on the state's year 2000 303(d) list. Segments of the Cullasaja River and Mill Creek are discussed above. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

1.5 Other Water Quality Concerns and Recommendations

Based on DWQ's most recent use support assessment, the surface waters discussed in this section are not impaired. However, notable water quality impacts were documented during this process. While these waters are not considered impaired, attention and resources should be focused on them over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 51.

Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source agency contacts are listed in Appendix VI.

1.5.1 Crawford Branch

Crawford Branch is a relatively small tributary of the Little Tennessee River that flows through downtown Franklin. Based on 1988-1989 aerial photography, urban residential land use comprised 41 percent of the watershed; 29 percent was forest; commercial/industrial uses made up 14 percent; and 10 percent was pastureland. Much growth has occurred in the more recent ten-year period, and additional forest and pasturelands have been converted to residential and commercial land uses. Approximately 55 percent of the watershed is within the corporate limits of Franklin, and 75 percent is under the jurisdiction of the town's zoning ordinance. Much of the remaining 25 percent, under Macon County's land use jurisdiction (not zoned), is already platted for mountain subdivision development (Land-of-Sky, January 2001).

DWQ biologists sampled benthic macroinvertebrates at two sites on Crawford Branch in 1999. The stream is too small to assign a bioclassification using current criteria; however, the community clearly indicated severe stress at the most downstream site on East Main Street (only seven of the pollution intolerant indicator species). The stream is in better condition upstream at

Franklin Memorial Park (24 pollution intolerant indicator species). There are no permitted discharges to Crawford Branch. Nonpoint sources of pollution include underground storage tanks, urban runoff and sedimentation from construction sites.

Even though this stream is not rated by DWQ, there are obvious impacts to water quality in Crawford Branch. The Little Tennessee Nonpoint Source Team (refer to page 39 for further information) allocated $23,000 of a $100,000 grant toward the development of a watershed management plan to improve water quality in Crawford Branch. Eight potential sites for installation of nonpoint source pollution BMPs were identified as part of the management options outlined in the *Crawford Branch Watershed Management Plan* (Land-of-Sky, January 2001). The Little Tennessee Nonpoint Source Team, with cooperation from Macon County, is currently working to construct a stormwater demonstration project on one of the eight sites. DWQ encourages local governments, the Little Tennessee Watershed Association, local nonpoint source pollution agencies and citizens to implement the entire *Crawford Branch Watershed Management Plan* to improve water quality in Crawford Branch and the Little Tennessee River.

1.6 Additional Issues within this Subbasin

The previous part discussed water quality concerns for specific stream segments. This section discusses water quality issues related to multiple watersheds within subbasin 04-04-01.

1.6.1 Projected Population Growth

From 2000 to 2020, estimated population growth for Macon County is 37. Growth management within the next five years will be imperative in order to maintain good water quality in this subbasin. Growth management can be defined as the application of strategies and practices that help achieve sustainable development in harmony with the conservation of environmental qualities and features of an area. On a local level, growth management often involves planning and development review requirements that are designed to maintain or improve water quality.

Local Ordinances

The Town of Highlands adopted an erosion and sediment control ordinance in 1992 and a watershed buffer plan and ordinance in 1994. The erosion and sediment control ordinance applies to any land-disturbing activities of one acre or greater and sets rules to reduce site erosion, limits the slope of land that can be disturbed, and stipulates revegetation of exposed slopes. Highlands is a locally delegated program, and therefore, has the ability to enforce the ordinance on behalf of the state. Sediment control within riparian buffers are required for any land-disturbing activity adjacent to streams and lakes and a buffer width of 25 feet is established for disturbance adjacent to classified trout waters (Tr). The ordinances also provide requirements for stormwater outlet protection, borrow and waste areas, access and haul roads, operations in lakes or natural watercourses, existing uncovered areas, and design and performance standards for activities adjacent to classified high quality waters (HQW).

Macon County recently adopted an erosion and sediment control ordinance also, which builds on the current program administered by the State. An Erosion and Sediment Control Plan must be

submitted if one half of an acre of land (or more) is disturbed, rather than the one acre minimum set by the state program. The Macon County ordinance also includes incentives for contractors that attend a Clear Water Contractor training course. The county has also proposed a general Land Use Ordinance.

Chapter 2 -
Little Tennessee River Subbasin 04-04-02
Includes Fontana Lake and the Tuckasegee River Watershed

2.1 Water Quality Overview

Subbasin 04-04-02 at a Glance

Land and Water

Land area:	1,021 mi^2
Stream miles:	1,420.7
Lake acres:	2,276

Population Statistics

1990 Est. pop.:	38,017 people
Pop. density:	37 persons / mi^2

Land Cover (%)

Forest / Wetland:	93.5
Surface Water:	2.3
Urban:	0.6
Cultivated Crop:	0.3
Pasture / Managed Herbaceous:	3.3

This subbasin contains the northern and eastern portion of the Little Tennessee River basin and consists primarily of the Tuckasegee River watershed. The Tuckasegee River begins in southeastern part of Jackson County and flows in a northwesterly direction into the Little Tennessee River at Fontanta Lake. The largest tributary of the Tuckasegee is the Oconoluftee River. The Oconoluftee River watershed includes part of the Great Smoky Mountains National Park (GSMNP) and the Eastern Band of Cherokee Indians' (EBCI) Reservation. Other waters include Cullowhee, Savannah and Scotts Creeks, and Lake Glenville. A map of this subbasin including water quality sampling locations is presented as Figure B-2.

Bioclassifications for sample locations are presented in Table B-4. Use support ratings for each applicable category in this subbasin are summarized in Tables B-5 and B-6. Refer to Appendix III for a complete listing of monitored waters and further information about use support ratings.

Approximately 60 percent (330,000 acres) of the GSMNP is located in North Carolina and the majority is contained within this subbasin. The subbasin also contains several thousand acres of the Nantahala National Forest. Therefore, nearly 94 percent of the subbasin is forested. The largest urban areas are Bryson City, Sylva and Cherokee. More than two percent of this subbasin is open water reflecting six major lakes including the more than 10,000 acres of Fontana reservoir.

Water quality in this subbasin is excellent. Some of the most famous trout streams in North Carolina are found here, including Hazel Creek, Forney Creek, Deep Creek and Noland Creek. A large number of streams throughout the subbasin carry the supplemental classification of High Quality Waters. The Tuckasegee River and its tributaries (including Pathertown Creek) from its source to Tennessee Creek are designated Outstanding Resource Waters.

There are 18 permitted dischargers in this subbasin; the largest of which are two Tuckaseigee Water and Sewer Authority (TWSA) WWTPs discharging to the Tuckasegee River and Scotts Creek and the Bryson City WWTP. TWSA Plant 1 and the Bryson City WWTP are required to monitor the toxicity of their discharges. No significant compliance or toxicity problems were noted for any facility in this subbasin during the most recent review period.

Figure B-2 Little Tennessee River Subbasin 04-04-02

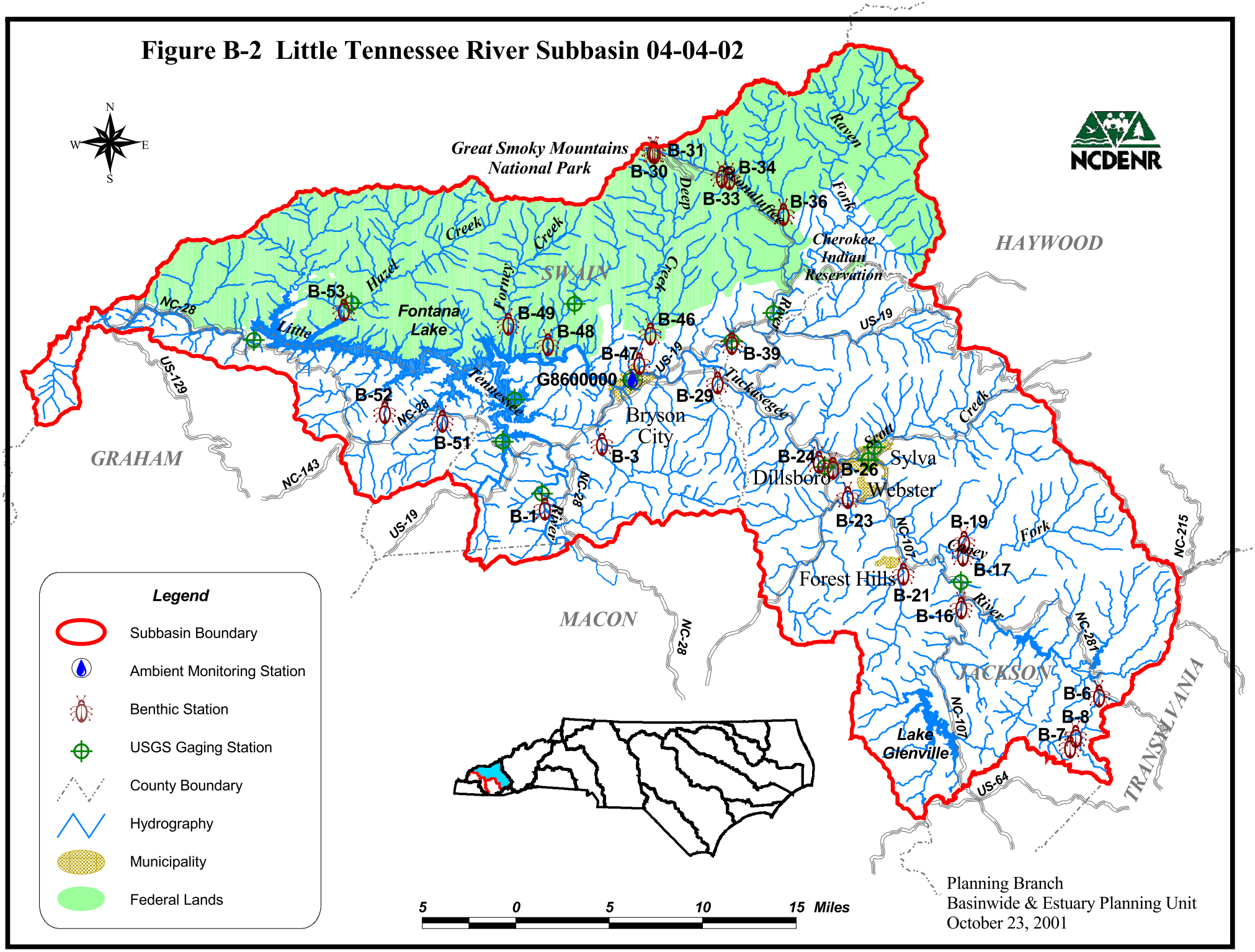


Table B-4 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (1999) for Little Tennessee River Subbasin 04-04-02

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1*	Little Tennessee River	Swain	Off SR 1113	Good
B-3*	Alarka Creek	Swain	SR 1185	Excellent
B-6*	Tuckasegee River	Jackson	SR 1140	Excellent
B-16	West Fork Tuckasegee River	Jackson	SR 1133	Good
B-24	Tuckasegee River	Jackson	Off SR 1377	Good
B-7	UT Panthertown Creek	Jackson		Excellent
B-8	Panthertown Creek	Jackson		Good
B-17*	Caney Fork	Jackson	SR 1740	Excellent
B-19*	Moses Creek	Jackson	SR 1739	Excellent
B-21*	Cullowhee Creek	Jackson	SR 1001	Excellent
B-23*	Savannah Creek	Jackson	SR 1367	Good
B-26*	Scotts Creek	Jackson	SR 1556	Good
B-29*	Conley Creek	Swain	SR 1177	Excellent
B-30	Beech Flats Prong (1995)	Swain	Headwaters (above)	Excellent
B-31	Beech Flats Prong (1995)	Swain	US 441 (below)	Fair
B-33	Beech Flats Prong (1995)	Swain	Above Kephart Prong	Excellent
B-34	Kephart Prong (1995)	Swain	Near mouth	Excellent
B-36*	Bradley Fork (1999 & 1995)	Swain	Off US 441	Excellent
B-39*	Oconoluftee River	Swain	SR 1359 at Birdtown	Excellent
B-46*	Deep Creek	Swain	Above campground	Excellent
B-47*	Deep Creek	Swain	SR 1340	Excellent
B-48	Noland Creek	Swain	Near mouth	Excellent
B-49*	Forney Creek	Swain	Near mouth	Excellent
B-51*	Panther Creek	Swain	SR 1233	Excellent
B-52*	Stecoah Creek	Swain	SR 1237	Excellent
B-53*	Hazel Creek	Swain	Near mouth	Excellent
Ambient Monitoring				
G8600000	Tuckasegee River	Jackson	SR 1364 at Bryson City	N/A
G8550000	Oconaluftee River	Swain	SR 1359 at Birdtown	N/A

* Historical data are available; refer to Appendix II.

Benthic Macroinvertebrates

All streams in this subbasin received Good or Excellent benthic macroinvertebrate bioclassifications in 1999. Bioclassifications for Moses Creek, Cullowhee Creek, Tuckasegee River, Oconaluftee River and Stecoah Creek improved from Good to Excellent. Extremely high

flows prior to sample collection, and the increased nonpoint source pollution that accompanies them, most likely caused the lower bioclassifications in 1994. Nine sites were Excellent in both 1994 and 1999. The benthic macroinvertebrate community in Scotts Creek improved from Good-Fair in 1994 to Good in 1999. Declining water quality was observed only at Savannah Creek (Excellent to Good).

In 1995, DWQ worked with the National Park Service and the National Biological Survey to sample several streams in the Great Smoky Mountains National Park. These streams included Beech Flats Prong, Kephart Prong and Bradley Fork in the Oconaluftee River watershed. All sites sampled received Excellent bioclassifications with the exception of one site on Beech Flats Prong below US Highway 441 where the stream comes in contact with Anakeesta Rock formations. This site received a Fair bioclassification and that portion of stream is considered impaired.

Ambient Monitoring

Water chemistry samples are collected monthly from two locations in this subbasin: the Tuckasegee River at Bryson City and the Oconaluftee River at Birdtown. Data collected over the past five years (1995-1999) indicated excellent water quality at both locations.

Lake Assessment

Four reservoirs in this subbasin were monitored by DWQ in 1999: Wolf Creek, Bear Creek (known locally as Bear Lake), Cedar Cliff and Thorpe (known locally as Lake Glenville). As is expected for mountain reservoirs, all were found to be oligotrophic with no reported algal blooms or nuisance aquatic plants. All are fully supporting all designated uses.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report – Little Tennessee River Basin* (NCDENR-DWQ, April 2000), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-5 Use Support Ratings Summary (2000) for Monitored Lakes (acres) in Little Tennessee River Subbasin 04-04-02

Use Support Category	FS	PS	NS	Total[1]
Aquatic Life/Secondary Recreation	2,276	0	0	2,276
Fish Consumption	2,276	0	0	2,276
Primary Recreation	2,276	0	0	2,276
Water Supply	2,276	0	0	2,276

Table B-6 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) in Little Tennessee River Subbasin 04-04-02

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/Secondary Recreation	1183.7	2.3	0	234.7	1420.7
Fish Consumption	1420.7	0	0	0	1420.7
Primary Recreation	69.8	0	0	37.0	106.8
Water Supply	362.6	0	0	0	362.6

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

2.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each water. The 1997 Little Tennessee River Basinwide Plan did not identify any impaired stream segments in this subbasin.

2.3 Status and Recommendations for Newly Impaired Waters

One additional stream segment in this subbasin was rated as impaired based on recent DWQ monitoring (1994-1999): Beech Flats Prong from US Highway 441 to Aden Branch. Impacts to other streams from narrow riparian buffer zones, sedimentation and moderate to severe bank erosion are discussed in Part 2.5 below.

2.3.1 **Beech Flats Prong** (2.3 miles from US Highway 441 to Aden Brach)

Current Status

Beech Flats Prong, located in the GSMNP, is partially supporting the aquatic life/secondary recreation designated use due to acidic conditions resulting from exposure of Anakeesta rock formations in the vicinity of Newfound Gap as a result of US Highway 441 construction. Anakeesta rock contains elements that, when exposed to water, produce low pH levels and high concentrations of heavy metals in adjacent streams. It is fairly common throughout the southwestern Appalachian Mountains for road cuts or landslides, mining activities or the use of fill material containing this rock to cause water quality impacts.

2002 Recommendations

The National Park Service has been studying ways of addressing the water quality problems in Beech Flats Prong (and other streams that are likely impacted by roads running through the GSMNP). No scientifically and economically defensible way to manage the extensive road cut has been found. Disturbance of Anakeesta materials should be avoided in the GSMNP and other areas in the southern Appalachian Mountains in the future to prevent these impacts.

2.4 303(d) Listed Waters

There are currently no impaired waters in this subbasin on the state's year 2000 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

2.5 Other Water Quality Impacts and Recommendations

Based on DWQ's most recent use support assessment, the surface waters discussed in this section are not impaired. However, notable water quality impacts were documented during this process. While these waters are not considered impaired, attention and resources should be focused on them over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 51.

Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source agency contacts are listed in Appendix VI.

2.5.1 Scotts Creek

Scotts Creek flows west and south from the Plott Balsam Mountains, which form the divide between the Little Tennessee and French Broad River basins (also separating Jackson and Haywood counties), down through Sylva and into the Tuckasegee River. The watershed contains a variety of land uses including agriculture and timber harvesting as well as residential areas. Stormwater runoff from the towns of Sylva and Dillsboro and a major four-lane highway (23/74) likely impact this stream. Some residential areas are suspected to contain straight pipes and failing septic systems.

In 1994, Scotts Creek received a Good-Fair benthic macroinvertebrate bioclassification reflecting impacts from primarily nonpoint source pollution in the watershed. The stream was given a fully supporting but threatened rating. The 1997 Little Tennessee River Basinwide Plan recommended that local governments and agencies, and possibly the Little Tennessee Nonpoint Source Team, identify specific causes and sources of these impacts to aquatic life.

There are three permitted discharges in the Scotts Creek watershed: Tuckaseigee Water and Sewer Authority (TWSA) WWTP 2 in Sylva, Ensley Adult Home Care, and the Scotts Creek Elementary School. No significant compliance or toxicity problems were noted for any of these facilities during the most recent review period. Jackson County recently completed a new elementary school, however, the old facility is still being used.

In 1999, the benthic macroinvertebrate bioclassification improved to Good, reflecting a water quality improvement. This change is not considered to be related to differences in flow regimes between sampling years. TWSA has been working to eliminate leaks in the sewer collection

system, and an increased percentage of Jackson County's wastewater has been routed to WWTP 1, which discharges directly into the Tuckasegee River. Despite the Good bioclassification, Scotts Creek received a low habitat evaluation. The stream channel lacks diversity of habitat, and there has been significant loss of riparian vegetation throughout the watershed. Much of the channel has been modified with riprap lining the banks. For general recommendations on habitat degradation and best management practices for minimizing nonpoint source pollution, please refer to Section A, Chapter 4 (page 59).

2.5.2 Savannah Creek

Savannah Creek flows in a northeasterly direction into the Tuckasegee River near Webster. The benthic macroinvertebrate community declined from Excellent in 1994 to Good in 1999. The sampling site received a low habitat score due in part to stream alterations in the lower portion of the watershed. Potential impacts to water quality in this watershed include runoff from Jackson County Road 99, which follows the stream for most of its length. Jackson County should evaluate drainage from and maintenance of this road and make improvements to prevent further habitat degradation. However, more investigation is needed to determine potential impacts to water quality from nonpoint source pollution in the watershed. DWQ will sample this stream again during the next basinwide cycle.

2.5.3 Cullowhee Creek

The Cullowhee Creek watershed parallels the Savannah Creek watershed through Forest Hills and along NC 107 before merging with the Tuckasegee River. Although benthic macroinvertebrate sampling above NC 107 revealed an excellent biological community, impacts are evident below the highway as the stream flows through Western Carolina University's (WCU) campus. As resources allow, DWQ will sample this stream below NC 107 during the next basinwide cycle. Citizens and local natural resource agencies should consider approaching WCU about stream restoration work and instream habitat enhancement projects on this portion of Cullowhee Creek.

2.6 Additional Issues within this Subbasin

The previous part discussed water quality concerns for specific stream segments. This section discusses water quality issues related to multiple watersheds within subbasin 04-04-02.

2.6.1 Projected Population Growth

From 2000 to 2020, estimated population growth for Jackson County is 34 percent and Swain County is 22 percent. Growth management within the next five years will be imperative in order to maintain good water quality in this subbasin. Growth management can be defined as the application of strategies and practices that help achieve sustainable development in harmony with the conservation of environmental qualities and features of an area. On a local level, growth management often involves planning and development review requirements that are designed to maintain or improve water quality.

Local Erosion and Sediment Control Ordinances

Jackson and Swain counties have locally-delegated erosion and sediment control programs. Jackson County's program began in November 2000. Like the statewide program administered by the Division of Land Resources, the county requires an erosion and sediment control plan for development activities disturbing more than one acre of land. The county attempts to inspect all projects weekly. Land disturbing activities that occur on sites less than one acre in size are inspected only when a complaint is received.

Chapter 3 -
Little Tennessee River Subbasin 04-04-03
Includes Nantahala River Watershed

3.1 Water Quality Overview

Subbasin 04-04-03 at a Glance

Land and Water

Land area:	155 mi^2
Stream miles:	257.4
Lake acres:	1,606

Population Statistics

1990 Est. pop.:	1,943 people
Pop. density:	12 persons / mi^2

Land Cover (%)

Forest / Wetland:	96.2
Surface Water:	1.7
Urban:	0.2
Cultivated Crop:	0.1
Pasture / Managed Herbaceous:	1.8

The Cherokee people called the Nantahala River gorge Land of the Middle Sun because it is so deep and the sides are so sheer that only the noonday sun penetrates its depths (Sakowski, 1990). The majority of the Nantahala River watershed, including Nantahala Lake, is contained within this Little Tennessee River subbasin. Tributaries include Whiteoak, Dicks, Silvermine and Queens Creeks. There are no municipalities. A map including water quality sampling locations is presented as Figure B-3.

Bioclassifications for sample locations are presented in Table B-7. Use support ratings for each applicable category in this subbasin are summarized in Tables B-8 and B-9. Refer to Appendix III for a complete listing of monitored waters and further information about use support ratings.

More than 96 percent of the land within this subbasin is forested. There are approximately 1,800 acres of pastureland and 1,700 acres of surface water, representing approximately 3.5 percent of the subbasin area. Less than 300 acres fall into the urban land use category.

The Nantahala River watershed, from its source to the confluence with Roaring Fork, is currently classified as Outstanding Resource Waters. The headwaters of this river system lie entirely within the Nantahala National Forest. However, much of the land adjacent to this reach is privately owned by the Rainbow Springs Corporation. The river and most tributaries are high gradient systems capable of supporting wild trout populations.

Nantahala Power and Light Company (currently Duke Energy) impounded the river in 1956 creating the 1,606-acre Nantahala Lake. Flow is diverted to downstream generators at Beechertown, bypassing a seven-mile reach of the river prior to discharging back into the original channel above the Nantahala Gorge. The regulated reach of the river below the powerhouse is very popular for rafting and canoeing.

There are two NPDES permitted dischargers in this subbasin: Macon County Schools-Nantahala WWTP and the Nantahala Outdoor Center. No significant compliance problems were noted during the most recent review period.

Figure B-3 Upper Little Tennessee Subbasin 04-04-03

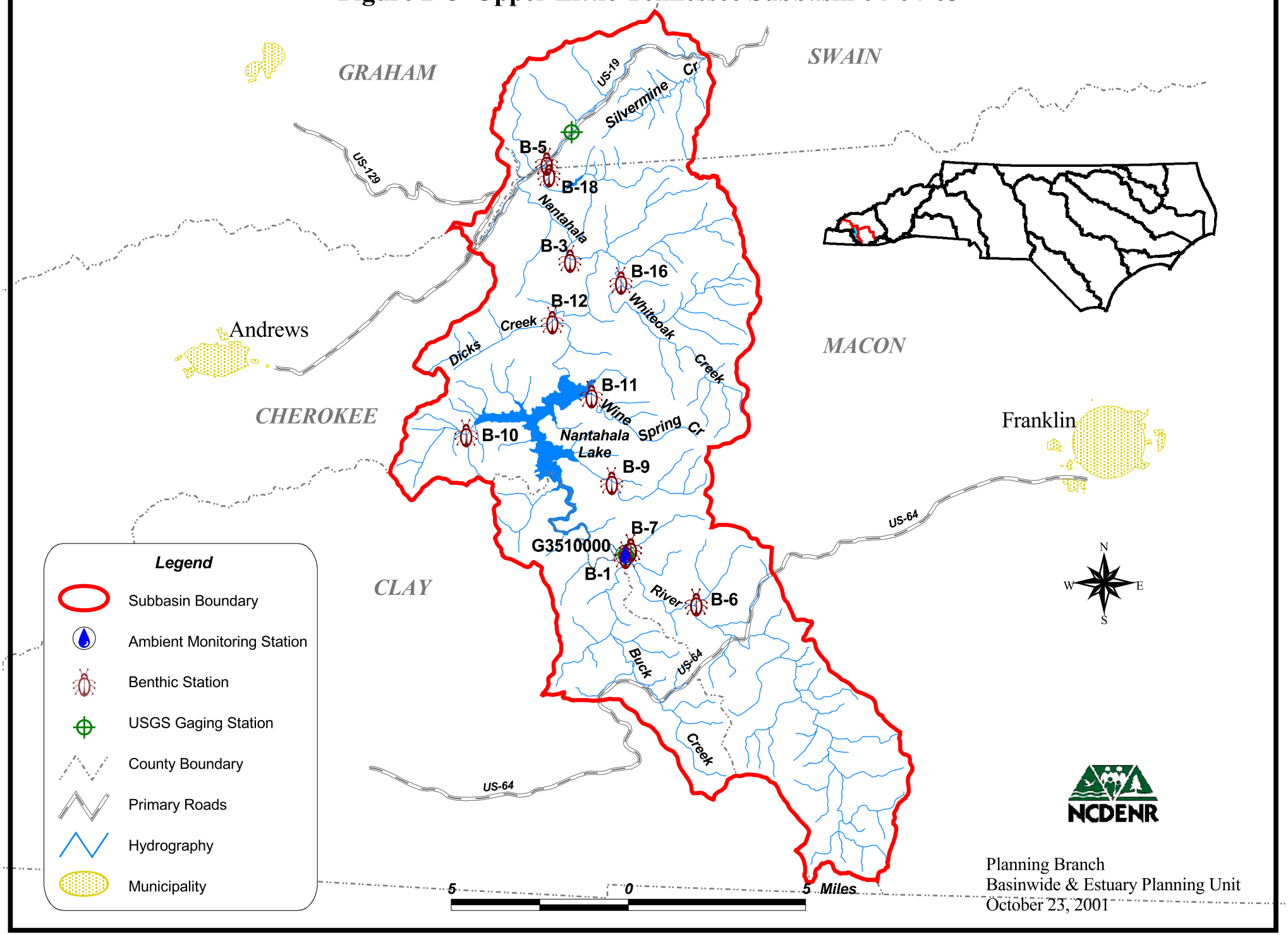


Table B-7 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (1999) for Little Tennessee Subbasin 04-04-03

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1*	Nantahala River (near Rainbow Springs)	Macon	USFS 437	Excellent
B-3*	Nantahala River	Macon	USFS 308	Excellent
B-5*	Nantahala River	Swain	US 19/74	Good
B-6	Bryson Branch (1998)	Macon	USFS 437	Good
B-7	Roaring Fork (1998)	Macon	USFS 437	Good
	Silvermine Creek (1995)	Swain	NC 28 near Wesser	Good-Fair
B-9	Jarrett Creek (1995)	Macon	USFS 437	Good
B-10	Big Choga Creek (1995)	Macon	USFS 440	Excellent
B-11	Wine Spring Creek (1995)	Macon	SR 1310	Good-Fair
B-12*	Dicks Creek	Macon	Off SR 1401	Good
B-16*	Whiteoak Creek (above dam)	Macon	Off SR 1310	Good
B-18*	Queens Creek	Macon	SR 1412	Excellent
Ambient Monitoring				
G3510000	Nantahala River	Macon	Near Rainbow Springs	N/A

* Historical data are available; refer to Appendix II.

Benthic Macroinvertebrates

Benthic macroinvertebrate samples have been collected from the Nantahala River site near Rainbow Springs since 1984. Excellent bioclassifications have been found during all surveys, including the most recent collection in 1999. The portion of the Nantahala River where the majority of streamflow is being diverted to generate power (commonly referred to as the bypass reach) along US Forest Service Road 308 was sampled as part of a special study and also received an Excellent bioclassification. This represented an improvement from November 1993 when DWQ sampling resulted in a Good rating. Although the minimum flow release from Nantahala Lake and/or tributary flow in the bypass reach allowed development of a diverse and abundant fauna, the aquatic community is not quite as good as that found in the natural section of the Nantahala River above the lake.

A third Nantahala River site, located in the portion of the river regulated for recreational activities and power production (off US 19/74 at a private campground just above the old gage site), was sampled in the evening when water levels were fairly low. This site, as in 1994, was rated Good.

Three sites were sampled by DWQ as part of a larger study to gather information from streams that currently have or will have minimum flow releases from upstream impoundments. Dicks

Creek improved noticeably from a Good-Fair bioclassification in November 1993 to Good in 1999. Queens Creeks is a very small stream (two meters wide) with an impoundment that does not yet have a minimum flow release requirement. However, with corrections for small stream size, sampling resulted in an Excellent bioclassification for the site. Whiteoak Creek was sampled below a large trout farm and above an old dam off SR 1310. The stream at this site is medium size (seven meters wide) with swift flow over primarily boulder and rubble substrate. This stream received a Good bioclassification.

A special study was conducted in 1995 and 1998 to evaluate the impact of timber harvesting on the benthic invertebrate community in Bryson Branch. This stream is a tributary to the Nantahala River in the river's ORW headwaters area. Post-harvest samples collected in 1998 resulted in a decline from Excellent to Good in both the logged and reference (Roaring Fork) streams, suggesting that observed impacts were more related to flow differences than timber harvesting practices.

Four tributaries to the Nantahala River and Nantahala Lake were sampled in 1995 as part of the Lower Nantahala River Watershed ORW Investigation (NCDENR-DWQ, September 1996). Big Choga Creek received an Excellent bioclassification, and benthic macroinvertebrates in Jarrett Creek fell right on the borderline of Good and Excellent. Wine Spring and Silvermine Creeks both received Good-Fair bioclassifications and are discussed in further detail in Part 3.5 of this chapter.

Ambient Monitoring

Water chemistry samples are collected monthly from the Nantahala River near Rainbow Springs on the Macon/Clay county line. Data collected over the past five years (1995-1999) showed the lowest variability for total suspended solids, hardness, fecal coliform and nutrients of any ambient monitoring site in the Little Tennessee River basin. Overall, these data indicate excellent water quality at this location.

Lake Assessment

Nantahala Lake was monitored by DWQ in 1999. As is expected for a mountain reservoir, the lake was found to be oligotrophic, with no reported algal blooms or nuisance aquatic plants. It is currently fully supporting all designated uses.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report – Little Tennessee River Basin* (NCDENR-DWQ, April 2000), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-8 Use Support Ratings Summary (2000) for Monitored Lakes (acres) in Little Tennessee River Subbasin 04-04-03

Use Support Category	FS	PS	NS	Total[1]
Aquatic Life/Secondary Recreation	1,606	0	0	1,606
Fish Consumption	1,606	0	0	1,606
Primary Recreation	1,606	0	0	1,606
Water Supply	0	0	0	0

Table B-9 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) in Little Tennessee River Subbasin 04-04-03

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/Secondary Recreation	183.9	1.0	0	72.5	257.4
Fish Consumption	257.4	0	0	0	257.4
Primary Recreation	36.0	0	0	0	36.0
Water Supply	0	0	0	0	0

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

3.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each water. The 1997 Little Tennessee River Basinwide Plan identified one impaired water in this subbasin: Whiteoak Creek.

3.2.1 Whiteoak Creek (1.0 mile from SR 1397 to SR 1423)

1997 Recommendations

Whiteoak Creek was sampled upstream and downstream of a large trout farm operation in 1990. The stream received an Excellent benthic macroinvertebrate bioclassification above the operation and a Fair bioclassification below it. The stream was rated partially supporting, and the recommendation was for DWQ to monitor the stream again to evaluate the implementation of best management practices by the trout farm operator.

Status of Progress

Although DWQ did sample Whiteoak Creek in 1999, the collection occurred much further downstream of the trout farm in a location that has historically received Good bioclassifications and does not accurately represent the impaired reach of stream. Therefore, this portion of Whiteoak Creek remains partially supporting the aquatic life/secondary recreation use category.

2002 Recommendations
DWQ will sample benthic macroinvertebrates at the SR 1397 location below the trout farm on Whiteoak Creek during the next basinwide cycle.

3.3 Status and Recommendations for Newly Impaired Waters

No stream segments in this subbasin were rated as impaired based on recent DWQ monitoring (1994-1999). However, impacts to many streams from narrow riparian buffer zones, sedimentation and moderate to severe bank erosion were documented. Part 1.5 below discusses specific streams where these impacts were observed.

3.4 303(d) Listed Waters

Whiteoak Creek (discussed above) is the only water listed on the state's year 2000 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

3.5 Other Water Quality Impacts and Recommendations

Based on DWQ's most recent use support assessment, the surface waters discussed in this section are not impaired. However, notable water quality impacts were documented during this process. While these waters are not considered impaired, attention and resources should be focused on them over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 51.

Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source agency contacts are listed in Appendix VI.

3.5.1 Silvermine Creek

Silvermine Creek flows north and east into the Nantahala River in Swain County. At the time of the 1997 basinwide plan, Silvermine Creek was rated support threatened based on a Good-Fair benthic macroinvertebrate bioclassification when the stream was sampled in 1993. Silvermine Creek also received a Good-Fair when the stream was sampled in 1995 during the Lower Nantahala River Watershed ORW Investigation. Biologists felt that the majority of the impacts to water quality in this watershed were due to runoff from SR 1103 which follows the stream for most of its length (NCDENR-DWQ, September 1996). The NC Department of Transportation should evaluate drainage from this road and make improvements to prevent further habitat degradation. DWQ will plan, resources permitting, to sample this stream during the next basinwide cycle.

3.5.2 Wine Spring Creek

Wine Spring Creek flows east into Nantahala Lake in Macon County. As was mentioned previously, this stream was sampled in 1995 during the Lower Nantahala River Watershed ORW Investigation. Biologists could not determine impacts to water quality at that time. Precipitation data indicated heavy rain events in several months prior to sampling that might have led to scouring of the stream channel (NCDENR-DWQ, September 1996). More investigation is needed to determine potential impacts to water quality from nonpoint source pollution in the watershed. DWQ will plan, resources permitting, to sample this stream during the next basinwide cycle.

Chapter 4 -
Little Tennessee River Subbasin 04-04-04
Includes the Cheoah River Watershed and Santeetlah Lake

4.1 Water Quality Overview

Subbasin 04-04-04 at a Glance

Land and Water

Land area:	221 mi^2
Stream miles:	352.7
Lake acres:	2,849

Population Statistics

1990 Est. pop.:	6,140 people
Pop. density:	28 persons / mi^2

Land Cover (%)

Forest / Wetland:	94.0
Surface Water:	2.1
Urban:	0.5
Cultivated Crop:	0.2
Pasture / Managed Herbaceous:	3.2

The Cheoah River watershed, including Santeetlah Lake, makes up this Little Tennessee River subbasin. The Cheoah River begins in the central portion of Graham County and flows in a northwesterly direction toward its confluence with the Little Tennessee River near the NC/TN state line. Major tributaries include Tulula, Snowbird, West Buffalo, Santeetlah and Yellow Creeks. A map including water quality sampling locations is presented as Figure B-4.

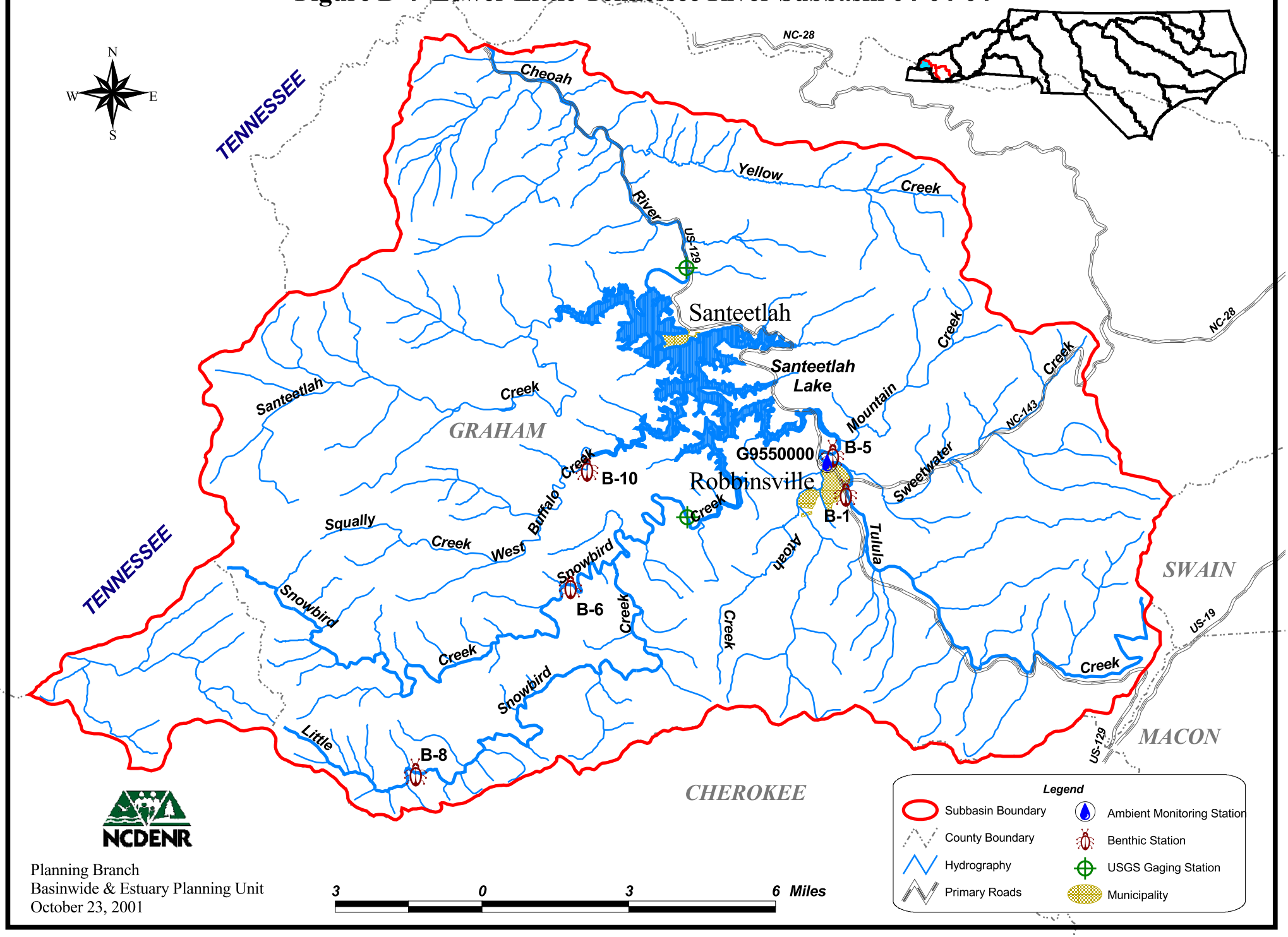
Bioclassifications for sample locations are presented in Table B-10. Use support ratings for each applicable category in this subbasin are summarized in Tables B-11 and B-12. Refer to Appendix III for a complete listing of monitored waters and further information about use support ratings.

Most of the land within this subbasin is forested (94 percent) and lies within the Nantahala National Forest. The Joyce Kilmer National Wilderness Area is also located in this subbasin. The lower reaches of many tributaries are in agriculture, primarily pastureland. The small towns of Robbinsville and Santeetlah are the only municipalities and less than 800 acres of land fall into the urban category in this subbasin.

Water quality in this subbasin is generally excellent. Most streams are high gradient and capable of supporting trout populations. The upper half of the Snowbird Creek watershed, along with several tributaries to Long Creek, is classified High Quality Waters (HQW). Other portions of the Long Creek watershed (Town of Robbinsville's water supply) are classified WS-I, which are by definition, HQW. Several other streams would likely meet the criteria for reclassification to HQW or Outstanding Resource Waters. Refer to Section A, Part 3.2 (page 39) for further information. Additionally, the Cheoah River floodplain is considered a significant natural heritage area by the state because of the rare and endangered species it contains.

There are seven permitted dischargers in this subbasin: five trout farm operations and the Robbinsville water and wastewater treatment facilities. No significant compliance problems were noted during the most recent review period for the two Robbinsville treatment plants. Nutrients from trout farming operations are causing impairment in the West Buffalo Creek arm of Santeetlah Lake. These facilities are discussed in more detail in following sections.

Figure B-4 Lower Little Tennessee River Subbasin 04-04-04



NCDENR

Planning Branch
Basinwide & Estuary Planning Unit
October 23, 2001

Table B-10 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (1999) for Little Tennessee River Subbasin 04-04-04

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1*	Tulula Creek	Graham	SR 1275	Good
B-5	Cheoah River	Graham	Off SR 1138	Excellent
B-6*	Snowbird Creek	Graham	SR 1120	Excellent
B-8	Little Snowbird Creek	Graham	SR 1115	Excellent
B-10*	West Buffalo Creek	Graham	SR 1123	Excellent
Ambient Monitoring				
G9550000	Cheoah River	Graham	Below Robbinsville	N/A

* Historical data are available; refer to Appendix II.

Benthic Macroinvertebrates

All five streams sampled for benthic macroinvertebrates during the last basinwide cycle received Good or Excellent bioclassifications. Although there are still many streams that have not been sampled by DWQ, no stream in this subbasin thus far has ever received a bioclassification lower than Good. DWQ will attempt, resources permitting, to sample additional streams in this subbasin including Sweetwater Creek, Long Creek and Yellow Creek during the next five-year basinwide planning cycle.

Ambient Monitoring

Water chemistry samples are collected monthly from the Cheoah River between the Town of Robbinsville and Santeetlah Lake. Fecal coliform (an indicator of pathogens harmful to human health) concentrations were slightly elevated compared with previous years. There were no other notable trends, and concentrations of all parameters, including fecal coliform, fell within an acceptable range when compared with water quality standards.

Santeetlah Lake was monitored by DWQ in both 1998 and 1999. The mainstem of the lake is oligotrophic, as is typical of a mountain reservoir. However, the West Buffalo Creek and Snowbird Creek arms of the lake continued to experience (first study was conducted in 1993) accelerated eutrophication. Chlorophyll *a* concentrations in these arms were frequently higher than the 15 ug/l water quality standard that is applied to lakes that are classified trout waters. The West Buffalo Creek arm of the lake is only partially supporting its aquatic life/secondary recreation and primary recreation uses and is discussed in more detail in the following sections.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report – Little Tennessee River Basin* (NCDENR-DWQ, April 2000), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-11 Use Support Ratings Summary (2000) for Monitored Lakes (acres) in Little Tennessee River Subbasin 04-04-04

Use Support Category	FS	PS	NS	Total[1]
Aquatic Life/Secondary Recreation	2,569	280	0	2,849
Fish Consumption	2,849	0	0	2,849
Primary Recreation	2,569	280	0	2,849
Water Supply	0	0	0	0

Table B-12 Use Support Ratings Summary (2000) for Monitored and Evaluated[2] Freshwater Streams (miles) in Little Tennessee River Subbasin 04-04-04

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/Secondary Recreation	253.8	2.9[2]	0	96.0	352.7
Fish Consumption	352.7	0	0	0	352.7
Primary Recreation	7.0	2.9[2]	0	22.2	32.1
Water Supply	82.5	0	0	0	82.5

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

[2] Represents 280 acres of the West Buffalo Creek arm of Santeetlah Lake.

4.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each water. The 1997 Little Tennessee River Basinwide Plan did not identify any impaired stream segments in this subbasin.

4.3 Status and Recommendations for Newly Impaired Waters

One additional waterbody in this subbasin was rated as impaired based on recent DWQ monitoring (1994-1999): West Buffalo Creek Arm of Santeetlah Lake.

1.4.1 **Santeetlah Lake, West Buffalo Creek Arm** (280 acres beginning at SR 1148)

1997 Recommendations

The 1997 basinwide plan noted problems with nuisance algal blooms in the West Buffalo Creek arm of Santeetlah Lake that appeared to result from excessive nutrient loading from upstream trout farms. Recommendations were to examine these operations and determine what cost-effective measures could be put into place to reduce the input of nutrients to both West Buffalo

and Snowbird Creeks. The plan also recommended that DWQ consider denying NPDES permits for new trout farms on these streams.

Current Status

A special study of Santeetlah Lake, specifically the West Buffalo and Snowbird Creek arms of the lake, was conducted by DWQ in 1998 and 1999. The study concluded that the assimilative capacity for nutrients in the West Buffalo Creek arm has been exceeded due to NPDES permitted trout farm discharges. Further conclusions were that the Snowbird Creek arm of the lake has reached its capacity to assimilate nutrients without violations of water quality standards (NCDENR-DWQ, June 2000). As a result of this study report, DWQ placed a moratorium on new trout farms in the Santeetlah Lake watershed and on expansion of existing operations. DWQ also notified trout farm permit holders and the public of potential management strategies that included lowering nutrient (especially phosphorus) permit limits, placing limitations on production, and possible non-renewal of NPDES permits for trout farming operations in the watershed.

In early 2001, the Graham County Trout Growers Association began discussing with DWQ ways to reduce the input of nutrients from trout farming operations that included feed and manure handling improvements; an evaluation of the use of medicated feed for sick fish; a fish stocking rotation that would move fish out of the West Buffalo Creek farms during times of the year when algae blooms were more likely; and the possibility of farm buy-outs.

2002 Recommendations

Existing NPDES permits on the West Buffalo Creek arm of Santeetlah Lake will be reevaluated with emphasis placed on total phosphorus effluent reductions. Modeling of nutrient/production limits will be conducted based on this most recent DWQ study. No new sources of nutrients into any arms of Santeetlah Lake will be permitted without a rigorous evaluation of nutrient impacts.

Current Water Quality Improvement Projects

The Southwestern NC Resource Conservation and Development Council (Southwestern RC&D) applied for a $1.25 million grant from the Clean Water Management Trust Fund to buy four trout farms that currently discharge into West Buffalo Creek. In addition to removal of the nutrient-laden discharges, the project would also restore functional riparian buffers and establish permanent conservation easements of the restored trout farm properties.

4.4 303(d) Listed Waters

The West Buffalo Creek Arm of Santeetlah Lake, discussed above, is impaired and on the state's year 2000 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

4.5 Other Water Quality Impacts and Recommendations

Based on DWQ's most recent use support assessment, the surface waters discussed in this section are not impaired. However, notable water quality impacts were documented during this process. While these waters are not considered impaired, attention and resources should be

focused on them over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 51.

Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source agency contacts are listed in Appendix VI.

4.5.1 Sweetwater Creek

The headwaters of Sweetwater Creek begin near the Graham/Swain county line and drain the eastern side of the Cheoah Mountains. The Sweetwater Creek watershed is almost entirely in private ownership, and much of the land is used for agricultural activities. In addition, NC 143 parallels the stream for much of its length. The NC Department of Transportation is currently conducting a major widening project on NC 28 in Graham County (subbasin 04-04-02). As this highway is improved, traffic will likely increase on NC 143 between NC 28 and Robbinsville. DWQ plans to sample this stream during the next basinwide cycle.

Section C

Current and Future Water Quality Initiatives

Chapter 1 -
Current Water Quality Initiatives

1.1 Workshop Summaries

In March 2001, DWQ held three workshops in the Little Tennessee River basin at Sylva, Franklin and Robbinsville. There were approximately 70 people in attendance representing a variety of interests. Figure C-1 gives an estimation of groups/interests represented based on information recorded on attendance sheets.

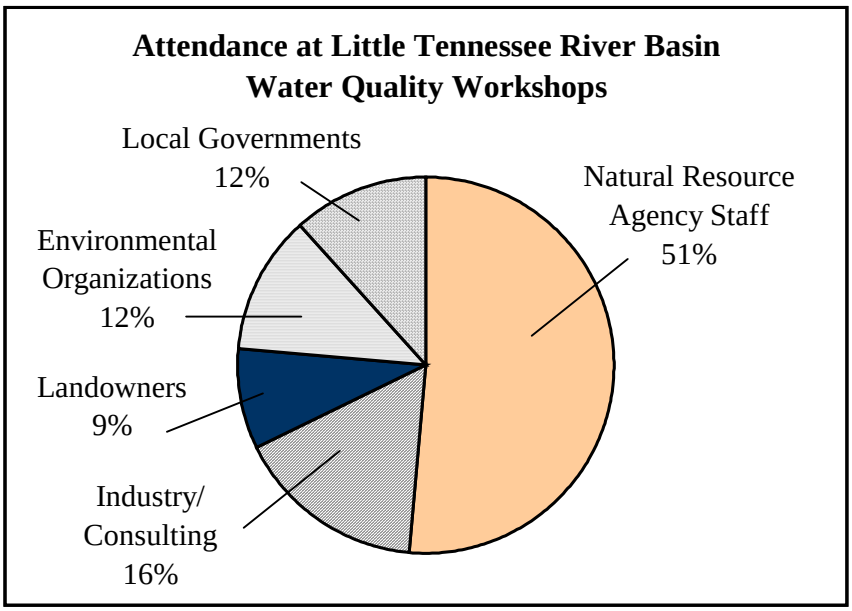


Figure C-1 Percent of Total Attendance by Various Interests at DWQ Water Quality Workshops in the Little Tennessee River Basin (2001)

DWQ staff gave presentations about general water quality in the Little Tennessee River basin, basinwide planning and the Wetlands Restoration Program. Participants at each workshop also gave brief presentations about local water quality initiatives. Workshop attendees were asked to discuss the following questions in small groups:

1. What are the main threats to water quality in the Little Tennessee River basin?
2. Where are the problem areas or waters?
3. What recommendations do you have for addressing these problems/waters?
4. What local agencies or organizations should be involved in addressing the problems?

The discussion on these questions was very productive. Comments and responses were recorded. A general summary providing common ideas and viewpoints expressed by more than one group is presented below. DWQ considered these comments while drafting the revised *Little Tennessee River Basinwide Water Quality Plan* and will continue to use these comments to guide water

quality activities in the Little Tennessee River basin. The most frequently cited threats to water quality identified by workshop participants were:

- Sedimentation (variety of sources)
- Runoff from developed areas (stormwater)
- Development/population growth
- Lack of public education regarding impacts to water quality and regulations
- Inadequate monitoring and lack of coordination between groups collecting data

Please refer to Section A, Chapter 4 (page 59) for discussion of some of these issues. All groups commented that nonpoint source pollution, primarily from excess sediment and/or nutrients and bacteriological contamination, was a major threat to water quality in the Little Tennessee River basin. Appendix V contains a summary of major public comments received throughout the process of plan development and public review. A more detailed summary of input from public workshops is available upon request.

1.2 Federal Initiatives

1.2.1 Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration projects. Approximately $1 million is 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, is available online at http://h2o.enr.state.nc.us/nps/bigpic.htm.

One project in the Little Tennessee River basin has been partially funded (federal Section 319 money must be matched with nonfederal dollars) through the Section 319 base program between 1990 and 2000. Funding for the project totaled $100,000. Refer to Part 2.4.3 for details.

1.2.2 USDA – NRCS Environmental Quality Incentives Program (EQIP)

Authorized in the 1996 farm bill, the Environmental Quality Incentives Program (EQIP) provides technical assistance, cost share payments, incentive payments and education to producers to address a broad range of soil, water, air, wildlife and related natural resource concerns. This voluntary program provides assistance to farmers in complying with federal and state environmental laws and encourages environmental enhancement. Local workgroups, convened by local Soil and Water Conservation Districts, identify the specific resource concerns to be addressed, set priority area goals, select cost share practices, establish ranking criteria for evaluating applications, and set their own schedule for approving applications.

In 2001, North Carolina has $3,689,400 available for cost sharing on installation of best management practices and educational assistance to producers. At least half of this funding is targeted to improving livestock operations. Almost the entire Little Tennessee River basin is

included within two 2001 EQIP Priority Areas: the Little Tennessee, which includes Jackson and Swain counties, and the upper Little Tennessee in Macon County.
NRCS district contacts for the Little Tennessee River basin are included on the Nonpoint Source contact sheet found in Appendix VI or visit the website: http://www.nc.nrcs.usda.gov/Programs/eqip.htm.

1.2.3 US Fish and Wildlife Service

The US Fish and Wildlife Service (FWS) has proposed designation of three segments of river (80.2 miles) in the Little Tennessee River basin as critical habitat for the Appalachian elktoe under the Endangered Species Act of 1973: 24.0 miles of the Little Tennessee River in Macon and Swain counties, 41.6 miles of the Tuckasegee River in Jackson and Swain counties, and 14.6 miles of the Cheoah River in Graham County. If the proposal is made final, federal agencies would be required to ensure that actions they fund, permit or implement are not likely to result in the destruction or adverse modification of critical habitat.

For further information, contact John Fridell by calling (828) 258-3939.

1.2.4 Tennessee Valley Authority

The quality of the water in the Tennessee River system affects not only the people who live in the valley, but also business, industry and the entire ecosystem's plant and animal life. In managing the watershed, the Tennessee Valley Authority (TVA) uses an integrated method that balances water quality with the other demands on the system.

Reservoir Ratings

TVA rates the condition of each reservoir based on five ecological indicators. Refer to page 50 for further information.

Fish Populations

TVA and state agencies issue sport fishing ratings of the region's reservoirs, indicating the availability of important sport species. TVA's annual Catch Depletion Survey monitors the size and health of bass populations in 19 reservoirs.

Clean Water

TVA works with other agencies, communities and industries to improve water quality. Through its Clean Water Initiative, which began in 1992, TVA builds partnerships with community residents, businesses and government agencies to promote watershed protection. TVA's Watershed Teams are responsible for carrying out the program. They focus on improving water and shoreline conditions so that people and aquatic life can benefit from having clean water.

Among other accomplishments, these community coalitions have:

- Instituted agricultural and urban management practices that reduce water pollution.
- Treated eroded land and stabilized streambanks.

- Planted vegetation and installed structures intended to improve aquatic habitat.
- Collected waste and litter from streambanks and shores.

TVA's Clean Water Initiative served as a model for the development of the national Clean Water Action Plan announced by the Clinton-Gore administration in 1998. TVA was actively involved in developing the plan, which is designed to protect public health and restore the nation's waterways by helping communities form partnerships to address water quality problems.

Clean Marinas and Clean Boating

TVA's Tennessee Valley Clean Marina Initiative certifies marinas that are in compliance with pollution control standards. TVA is also an active participant in the national Clean Boating Campaign, helping educate boating enthusiasts and marina operators in practices that reduce pollution and erosion on the waterways.

Aiding Aquatic Life During Hydropower Production

Two conditions arising from hydropower production are harmful to fish and other forms of aquatic life: low levels of dissolved oxygen in the area just below a dam (called tailwater), and dry streambeds that sometimes result when hydro-generation is off.

In 1991, TVA undertook a $50 million tailwater improvements program to tackle these problems. It committed to providing minimum flows through all its dams, and it devised various aeration methods to increase oxygen in the water. Studies show that the program has improved conditions for aquatic life in more than 300 miles of river and has resulted in a dramatic increase in tailwater fishing, which aids local economies.

For further information about TVA water quality programs in the Little Tennessee River basin, contact Watershed Team member Gary Williams by calling (865) 988-2428 or by email ggwilliams@tva.gov or visit the website at http://www.tva.gov/environment/water/.

1.3 State Initiatives

1.3.1 NC Agriculture Cost Share Program

The North Carolina Agriculture Cost Share Program was established in 1984 to help reduce the sources of agricultural nonpoint source pollution to the state's waters. The program helps owners and renters of established agricultural operations improve their on-farm management by using Best Management Practices (BMPs). These BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater pollution. The Agriculture Cost Share Program is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned control measures and technical specifications are completed. The annual statewide budget for BMP cost sharing is approximately $6.9 million.

For more information about the NC Agriculture Cost Share Program, contact David Williams with the Division of Soil and Water Conservation at (919) 733-2302. County contact information is listed in Appendix VI.

1.3.2 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 major goal of the NCWRP is to restore or improve the vital functions provided by wetlands, streams and riparian buffer zones within the context of local watershed management and overall aquatic ecosystem health. These vital functions include water quality protection, erosion control, flood prevention, fisheries and wildlife habitat, and recreational opportunities. The NCWRP is not a grant program. Instead, it funds wetland, stream and riparian zone projects directly through the Wetlands Restoration Fund.

Restoration sites are targeted through the development and use of Watershed Restoration Plans (formerly called "Basinwide Wetland and Riparian Restoration Plans"). These plans are developed, in part, using information compiled in DWQ's Basinwide Water Quality Plans and Basinwide Assessment Reports. The NCWRP Plans evaluate resource data and existing water quality initiatives within local watersheds in order to select "Targeted Local Watersheds". Targeted Local Watersheds are areas with the greatest need and opportunity for stream and wetlands restoration efforts, and where NCWRP resources can be most efficiently focused for maximum restoration benefit. The NCWRP Watershed Restoration Plans are updated every five years, generally on the same timeline as DWQ's Basinwide Water Quality 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 Nonpoint Source Program. Integrating wetlands and riparian restoration components with 319 funded and/or Clean Water Management Trust Fund projects will often optimize the overall water quality benefits within a given watershed.

Table C-1 lists the NCWRP's draft targeted Local Watersheds in the Little Tennessee River basin. Other agencies, individuals and private groups are encouraged to target their search for restoration projects within these local watersheds.

Table C-1 Wetlands Restoration Program Draft Targeted Local Watersheds (2001)

Subbasin	Targeted Local Watershed Name(s)	Targeted Local Watershed Number(s)
04-04-01	Little Tennessee River Middle Creek	06010202020010
04-04-01	Upper Cullasaja River	06010202030010
04-04-01	Little Tennessee River Crawford Branch Iotla Creek	06010202040020
04-04-02	Lower Scott Creek Tuckasegee River	06010203020010
04-04-02	Savannah Creek	06010203020030
04-04-04	Sweetwater Creek	06010204010020
04-04-04	Atoah Creek Long Creek	06010204010030

The NCWRP actively seeks landowners [both public and private] within the Little Tennessee River basin who have potentially restorable stream, wetland or riparian buffer 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.

1.3.3 Clean Water Management Trust Fund

The Clean Water Management Trust Fund offers approximately $40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters and establishing a network of riparian buffers and greenways. In the Little Tennessee River basin, seven projects have been funded for a total of $6,329,967 (Table C-2).

Table C-2 Projects in the Little Tennessee River Basin Funded by the Clean Water Management Trust Fund (as of 8/01)

Stream or Watershed	Project	Project Lead	Amount Funded
Tuckasegee River	Wastewater Improvements	Town of Bryson City	$80,000
	Riparian Easements	Conservation Fund/ Southern Appalachian Highlands Conservancy	$294,300
Tuckasegee River	Wastewater Improvements	Jackson County	$452,000
Little Tennessee River	Restoration	Macon County	$3,885,000
	Buffer Acquisition	Southern Appalachian Highlands Conservancy	$222,000
	Restoration	Swain County Economic Development	$195,900
Tuckasegee River	Wastewater Improvements	Tuckaseigee Water & Sewer Authority	$1,200,767

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

1.3.4 Eastern Band of Cherokee Indians

The Eastern Band of Cherokee Indians (ECBI) is a sovereign governmental authority with more than 56,000 acres of mountainous terrain within the Little Tennessee River basin, including numerous streams and rivers. ECBI conducts its own extensive surface water chemistry monitoring program and, in 2001, adopted and received approval for its own water quality standards. The water quality standards state: "High quality water is a critical resource of the Eastern Band of Cherokee, providing sustenance to our people, land, wildlife and livestock."

The ECBI environmental program has conducted stream restoration activities on approximately 5,000 feet of stream using natural channel design techniques. A sediment monitoring program is in place to monitor suspended solids levels during storm flows. ECBI is also involved with the Kids in the Creek and Stream Watch educational programs and is in the process of developing an educational video focused on water quality. ECBI has also gotten funding to cover about an acre of land with pervious pavement as a demonstration project through the Section 319 program.

In 2001, ECBI hired a wetland/stream coordinator whose main job responsibility it is to develop and manage a wetland/stream protection and restoration program for the Cherokee Indian Reservation. Tasks include inventory and mapping of wetlands and streams on Cherokee land, a riparian corridor assessment, focused stream monitoring and outreach activities.

ECBI hosted various citizens, organizations and agency staff at Little Tennessee Watershed 2001; a conference to discuss water quality and restoration efforts throughout the entire river basin. Staff currently participate in the Little Tennessee River Basin Nonpoint Source Team (page 122).

For further information about the Eastern Band of Cherokee water quality programs, call (828) 497-6824 or email Cherise Maples (chermapl@hotmail.com) or Carmen McIntyre (carmmcin@nc-cherokee.com).

1.3.5 NC Department of Transportation

In 1994, the NC Department of Transportation (NCDOT) purchased a 225-acre site in the Little Tennessee River basin called Tulula Bog to develop a mitigation bank to allow for compensation of wetland impacts associated with highway projects. The site was degraded in the mid-1980s during construction of a golf course and is being restored to its original condition. The largest fen was still intact at the time of purchase, but degraded fens and streams were scattered throughout the property. Restoration strategies include recreating the original stream channel, removing spoil, filling ditches, constructing vernal pools, and revegetating portions of the site. Faculty and students from the University of North Carolina at Asheville have been involved with collecting information on baseline ecological conditions and evaluating restoration activities at the site. The Tulula Wetlands Mitigation Bank is located in Graham County in the floodplain of Tulula Creek (Moorhead et al., 2001).

1.3.6 Wildlife Resources Commission

The Wildlife Resources Commission (NCWRC) Division of Inland Fisheries manages the state's freshwater fisheries through fisheries research, fisheries management, hatchery operation and habitat conservation.

Habitat Conservation Program

Habitat conservation biologists review proposed development projects and evaluate the potential environmental threats associated with each project in the Little Tennessee River basin. WRC recommends project design modifications to minimize adverse environmental impacts and also recommends mitigation to compensate for unavoidable impacts.

In the mountain region, frequent and severe flooding has resulted in damage to many streams from debris blockages and erosion. WRC reviewed numerous proposals for work in streams sponsored by the Natural Resources Conservation Service (NRCS) as part of their Emergency Watershed Protection Program (EWP). EWP provides assistance to landowners to relieve imminent hazards to life and property from floods and other natural disasters. As a result, the NRCS has joined staff of the WRC and other state and federal agencies to examine more environmentally sound methods of stream restoration. Interagency flood response teams are being developed to respond rapidly to landowner needs while taking into account natural tendencies of streams and protection of aquatic habitat.

Biologists also review highway improvement projects and, in many cases, recommend design modifications or alignment shifts to minimize impacts to wildlife and fishery habitats. Linear roadway projects often have multiple stream crossings and can affect many different habitat types.

WRC works closely with the NC Department of Transportation (NCDOT) to develop mitigation strategies to offset loss of wildlife and fisheries habitat. WRC identifies areas that should be preserved and helps restore habitat on previously disturbed areas. In the mountain region, one large highway project can result in as much as 10,000 feet of high quality streams, either trout streams or tributaries to trout streams, to be placed in culverts. As mitigation for this loss of high quality fishery habitat, the NCDOT has agreed to set up a restoration fund to be administered by WRC for restoration of approximately 25,000 linear feet of degraded streams. Ultimately, the restoration will involve bank stabilization, fencing livestock out of the stream, revegetating streambanks, installing fish habitat enhancing devices, and purchasing conservation easements to protect the areas that have been restored.

Brook Trout Distribution and Genetics Study

In order to preserve and protect brook trout populations, WRC started a project in 1990 to locate all brook trout populations. Essentially all streams located on public lands (excluding the Great Smoky Mountains National Park) and many streams on private lands were sampled. Surveys were begun at the lower end of a watershed, moving upstream until all fish recorded were brook trout or no fish at all were found. The location of the brook trout populations and waterfalls that

keep brown and rainbow trout from invading were mapped. Those populations most likely to be classified as "southern" brook trout were selected for genetic analysis.

About 343 brook trout populations were found in 22 counties by the end of 1999. Most of these populations occur in headwater streams that border the Blue Ridge Parkway, the North Carolina-Tennessee state line, and headwater streams of the Little Tennessee, Nantahala and Tuckasegee Rivers. WRC genetically tested 134 of the 343 known brook trout populations and classified 48 of them as originating from the original "southern" populations.

A recent survey of other states in the southeast indicates that about 50 percent of the all brook trout populations and about 30 percent of all "southern" populations exist in North Carolina (excluding the Great Smoky Mountains National Park). Brook trout protection will continue to be a major goal in North Carolina's trout management program. Surveys to locate brook trout on private lands will be conducted whenever opportunities arise, and additional genetic testing will be completed as funding becomes available.

For more information, contact the Division of Inland Fisheries by calling (919) 733-3633 ext. 281 or visit the Wildlife Resources Commission website at http://www.state.nc.us/Wildlife/.

1.4 Regional Initiatives

1.4.1 Southwestern NC Resource Conservation and Development (RC&D)

The Southwestern NC Resource Conservation and Development Council, Inc. is a 501 c(3) nonprofit organization supported nationally by USDA, through the Natural Resources Conservation Service and locally by the Boards of County Commissioners and the County Soil and Water Conservation Districts in Macon, Jackson, Swain, Graham, Clay, Cherokee and Haywood counties and the Eastern Band of the Cherokee Indians. Organized in 1970, Southwestern NC RC&D has been serving western North Carolina for over 30 years.

The Mission of RC&D is to build public and private partnerships, create financial leverage, and increase the capacity of communities to meet their locally identified resource conservation and development needs. This is achieved by engaging the interests of the public and private sectors to balance the conservation and development of human and natural resources; and creating efficient community and natural resource management by bringing together cooperative action for a common benefit.

RC&D provides technical assistance with project planning, design and engineering. RC&D staff provides project planing assistance; however, RC&D coordinates assistance with NRCS, Soil and Water Conservation Districts, other agencies, private organizations and professionals to provide on the ground support. RC&D provides financial assistance for project implementation, grant writing and counseling assistance with public, private and corporate grant programs. The RC&D Council can sponsor project grants and administer project grant funds if needed.

For the past ten years, the Southwestern NC RC&D Council has assisted in fostering and currently supports several active local grassroots watershed associations, including the Little Tennessee Watershed Association, the Upper Cullasaja River Watershed Association and the

Watershed Association for the Tuckasegee River. Since 1998, RC&D has provided contracting assistance to Upper Little Tennessee River Stream Bank and Riparian Restoration, Section 319 and CWMTF programs. Southwestern NC RC&D provides technical and Section 319 administrative support to the Little Tennessee River Basin Nonpoint Source Team. The RC&D Council, in 2001, sponsored a request to the CWMTF to offer to buy out the currently permitted trout farm facilities on West Buffalo Creek in Graham County.

The Southwestern NC RC&D Council office is located in Waynesville, NC. For more information, call Tim Garrett at (828) 452-2519.

1.4.2 Western North Carolina Alliance

The Western North Carolina Alliance is a grassroots organization which aims to promote a sense of stewardship and caring for the natural environment. The Alliance's primary goal is to protect and to preserve our natural land, water and air resources through education and public participation in policy decisions at all levels of business and government. The Alliance encourages its members to recognize the interrelationships among environmental issues and to take personal responsibility for achieving protection of the environment in their communities.

Water quality is only one of many aspects of the environment that the Alliance works to improve and protect. The Alliance supports the development and enforcement or standards and regulations sufficient to protect surface waters and groundwater from sediments, organic pollution and toxins; and to preserve and restore waterways as healthy ecosystems, as well as recreational and esthetic resources. Since the state of our waters depends in large measure on how land is treated, the maintenance of water quality should be a goal of all land users, regulatory agencies and land-use planning efforts.

The Alliance encourages strong county sedimentation control laws and private actions, as provided for by the North Carolina Sedimentation Control Act. The Alliance supports public education on water quality and conservation issues. The Alliance also encourages voluntary efforts by citizens to investigate and protect local water quality. The Alliance supports the reclassification of streams to the highest and most protective classification achievable.

For further information, contact the western office of the Western North Carolina Alliance Western Office in Franklin by calling (828) 524-3899 or by email franklin@wnca.org. You may also visit the website at http://www.main.nc.us/wnca/.

1.4.3 Tuckaseigee Chapter – Trout Unlimited

The members of Tuckaseigee Chapter of Trout Unlimited (TC-TU) in Western North Carolina are from Haywood, Jackson, Macon and Swain counties. The organization's goal is the preservation and conservation of coldwater fisheries throughout Western North Carolina. One of the best ways to preserve fisheries for future generations is through education and leadership. One of the most significant problems we face in Western North Carolina is sedimentation, due to the growth being experienced by our counties. TC-TU is working to find solutions to problems that are associated with development.

Jerry Deweese is the current President and can be contacted by email deweej@BlueRidgePaper.com or by visiting the website at http://www.smokyonthefly.com/tucktu/.

1.4.4 Southern Appalachian Highlands Conservancy

A nonprofit, non-governmental organization, the Conservancy has a mission that encompasses the Southern Appalachian region. The Conservancy has committed itself to protecting important lands in the region. Through its Community Land Trust Conservation Project, the Conservancy's Board of Trustees has adopted a strategy of fostering the growth of affiliates to engage in land conservation work on a local level. Local volunteer groups, called "affiliates" (or "chapters") represent the Conservancy within their own communities and help the Conservancy fulfill its mission of conserving the region's important lands.

The Conservancy's regional initiative encourages the use of conservation easements and other nonregulatory land preservation techniques by landowners throughout the mountain region, where increasing development pressure threatens the loss of scenic, historic or environmentally important lands. To date, the Conservancy has preserved approximately 1,000 acres of land in the mountain region, including lands bordering the Great Smoky Mountains National Park and the Blue Ridge Parkway.

Established in 1994 as the Nikwasi Land Trust, the Land Trust for the Little Tennessee (page 123) was the first and most successful affiliate group of the Southern Appalachian Highlands Conservancy (SAHC). The organization has become established as an independent land trust, but will continue collaborative work with SAHC.

For more information, contact the Southern Appalachian Highlands Conservancy by calling (828) 253-0095 or by email southapps@ioa.com.

1.4.5 Save Our Rivers, Inc.

Save Our Rivers, Inc. (SOR), founded in 1990, has monitored water quality in the Cullasaja River since 1994. Working with the Volunteer Water Information Network program of the University of North Carolina in Asheville, the group samples for chemicals and fecal coliform. Serving as a clearinghouse, the group has also been instrumental in assisting citizens and agencies when incidents occur that need serious attention. With its generic name, SOR has assisted many other rivers across the state and nation in providing information and support. SOR promotes public involvement in the protection of water quality and quantity and has either coordinated or participated in multiple outreach efforts within western North Carolina.

For more information about SOR, contact Peg Jones at (828) 369-7877 or by email rivers@dnet.net.

1.5 Local Initiatives

1.5.1 Little Tennessee Watershed Association (LTWA)

The Little Tennessee Watershed Association (LTWA), Inc. is organized to work with public agencies, conservation interests, community groups, and public and private landowners to develop and implement a strategy for the conservation and improvement of the water quality and habitat of the Little Tennessee River and its tributaries above the Fontana Reservoir.

The LTWA presently operates four major projects: stream restoration, stream monitoring, education and stream stewardship. Long-term data collection allows LTWA to measure the effect of restoration efforts. Through the stewardship program, LTWA rewards landowners for their own efforts to protect the watershed. The educational program builds public support for conservation efforts.

In 1999, the LTWA, with the Macon Middle School, designed and developed a research station on the Cullasaja River for the middle school students. Students actually collect and analyze information on sediment, benthic macroinvertebrates and water quality, learn about the inter-relationships between abiotic and biotic factors which determine the overall condition of the watershed, and more importantly, develop a clearer understanding of the environment through a "hands on" approach to environmental education. The LTWA also has developed several lectures and talks on water quality, the Little Tennessee River watershed, and the various programs it monitors.

As part of its ongoing efforts in education, the LTWA has initiated a Stream Stewardship Program throughout the Little Tennessee watershed. This program has been developed to acknowledge those landowners who have demonstrated good management practices on their lands adjacent to a waterway. Each successful candidate receives recognition of his accomplishments at the first general meeting in February, and each receives a sign to post on his property advertising his efforts to use the best available land use practices in protecting his portion of a waterway.

For more information about the Little Tennessee Watershed Association, contact Executive Director, Carla Norwood by calling (828) 369-6402 or by email ltwa@dnet.net. The LTWA website address is http://www.littletennesseewatershed.org/.

1.5.2 Watershed Association for the Tuckasegee River (WATR)

The Watershed Association for the Tuckasegee River (WATR) is a fairly new group of grassroots-organized citizens who wish to see their community keep its peaceful character amidst booming growth. One of the primary objectives of WATR is to increase citizen involvement and activity on behalf of the river. An excerpt from WATR's mission statement states the goals of the organization: "We recognize the necessity of clean water and the value of the river to the whole community. We will encourage ways of using the river and ways of working and living that maintain and enhance the quality of the waters moving through this watershed. We will

strive to find an appropriate balance of use, protection, and active restoration that maintains the Tuckasegee River even as the river and its waters maintain us."

WATR has established a water quality monitoring program for the Tuckasegee River. Seven sites are sampled quarterly by Eastern Band of Cherokee water quality staff (under contract) and analyzed at a NC certified laboratory for fecal coliform, total suspended solids, dissolved oxygen and temperature. A volunteer monitoring program is also being organized to collect samples from sediment samplers, conduct benthic macroinvertebrate monitoring, and do habitat assessments that focus more heavily on the tributaries. WATR members have also organized several field days on the river and written articles to newspapers emphasizing local water quality issues.

WATR is currently governed by a volunteer Board and Executive Committee. For more information, call (828) 631-1500 or email watrinfo@watrnc.org. WATR's website address is http://www.watrnc.org/.

1.5.3 Little Tennessee River Basin Nonpoint Source Team

In 1995, the Little Tennessee Nonpoint Source (NPS) Team was organized by local stakeholders, with guidance from DWQ, to address water quality problems in the Little Tennessee River basin caused by nonpoint source pollution. The NPS Team was awarded a $100,000 grant through the Section 319 program to implement nonpoint source pollution BMP demonstration and education projects. The team allocated $23,000 of the grant toward the development of a watershed management plan to improve water quality in Crawford Branch. Eight potential sites for installation of nonpoint source pollution BMPs were identified as part of the management options outlined in the *Crawford Branch Watershed Management Plan* (Land-of-Sky, January 2001). The Little Tennessee NPS Team, with cooperation from Macon County, is currently working to construct a stormwater demonstration project on one of the eight sites. Additionally, the team is developing a comprehensive website for the Little Tennessee River basin in North Carolina that will provide information about nonpoint source pollution problems throughout the basin, display water quality data that is currently being collected by a variety of agencies and organizations, and provide links to water quality education, improvement and funding programs.

The Little Tennessee NPS Team currently meets quarterly at Western Carolina University. For more information, contact Dr. Gary Smith by calling (828) 227-3506 or by email smithg@email.wcu.edu.

1.5.4 Upper Cullasaja Watershed Association (UCWA)

Formed in 1999 as a local, citizen-based watershed organization for the upper Cullasaja River watershed on the Highlands Plateau, the Upper Cullasaja Watershed Association (UCWA) has successfully initiated a wide range of water resource quantity and quality projects. UCWA worked with the NC Division of Water Resources and the US Geological Survey (USGS) to obtain joint funding and installation of a USGS flow gauging station on the Cullasaja River in July 2001, after a 30-year hiatus in long-term streamflow measurement on this river. Additional work with DWQ and USGS groundwater specialists resulted in the restoration of regular groundwater elevation measurements in two Town of Highlands' water supply wells. Plans are

also being developed for a major groundwater research project to be centered in the upper Cullasaja River watershed in the near future.

To expand its studies of the water balance on the Plateau, UCWA implemented an expanded rainfall measurement network in the second half of 2001 to more accurately define the total water input to the watershed. UCWA has active projects in progress to install sediment-trapping basins in key locations around Mirror Lake and to pursue sediment removal from the lake and other lakes in the watershed. Plans for 2002 include a water quality monitoring project in Lake Sequoyah, which is the public water supply for the Town of Highlands. Continuous, data-logging probes will be placed in the lake and each of its tributaries to monitor multiple water quality indicators.

The data collected by all UCWA projects are made available to the public as part of UCWA's programs to raise public awareness about water quality and quantity concerns in the watershed. For over 2 years, UCWA has published a public information column, "Know Your Watershed", in *The Highlander* twice a month as an integral part of UCWA's public education and awareness initiatives.

For more information about the Upper Cullasaja River Watershed Association, contact Executive Director, Bob Wright by email twodogs01@earthlink.net or call (828) 526-9938.

1.5.5 Land Trust for the Little Tennessee

The mission of the Land Trust for the Little Tennessee is to conserve the natural, scenic, rural and historic character of the upper Little Tennessee Valley for the benefit of present and future generations. To this end, the trust works with private landowners, local citizen groups and local government to help identify, preserve and manage important heritage lands in the area. Goals of the Land Trust are to:

- Achieve long-term protection of important natural, historical, agricultural and recreational properties in private ownership in the upper Little Tennessee Valley.
- Provide information to private landowners about options available for private land conservation and for the preservation of family lands, and to provide support to those landowners who seek to establish a long-term conservation plan for their properties.
- Promote sensible planning for private lands in the valley to insure that if development occurs, it is done without destroying the area's unique natural, scenic, rural and historic qualities.
- Help provide educational programs that enhance understanding of land use as well as of techniques and incentives available for private land conservation.
- Identify and secure sources of funding to support the mission of the Land Trust.

The Land Trust is currently working toward the preservation of lands in the Little Tennessee Watershed and, in November 1999, acquired 60 acres at the junction of Tessentee Creek and the Little Tennessee River near Otto in southern Macon County. The land includes nearly a mile of creek and river frontage, over 20 acres of floodplain, and one of the largest and most diverse wetlands in the upper river valley.

For more information, contact Paul Carlson, Executive Director of the Land Trust for the Little Tennessee by calling (828) 524-2711 or by email nikwasi@dnet.net.

1.5.6 Little Tennessee River Greenway and Restoration Project

The purpose of the Little Tennessee River Greenway and Restoration Project is to draw together public and private organizations, citizen groups and individuals to work on behalf the Little Tennessee River. Goals include:

- Protection of riparian areas of the river and its tributaries.
- Restoration of eroding streambanks.
- Use of conservation easements to preserve environmentally sensitive areas.
- Wetlands protection and enhancement.
- Restoration of Lake Emory, a small reservoir immediately below Franklin. The lake is choked with mud that threatens to spill into lower stretches of the river.
- Creation of a greenway through the most populated part of the valley, with recreational, educational and cultural amenities.
- Public education initiatives to increase awareness of clean water and other environmental issues.

The Steering Committee, representing local government, industry and citizen groups, oversees the Restoration and Greenway projects. Members of the Committee serve as liaisons to other agencies and citizen groups involved with different aspects of the project.

In May 1998, the Steering Committee unveiled a plan for a greenway along the Little Tennessee River, anchored by three attractions at major nodes. Proposed attractions are a cultural/conference center on the river near Dowdle Mountain, an aviary/gardens near the town bridges at the entrance to Franklin and a state-funded "Appalachian Aquarium". The aquarium/nature center would serve as both a tourist attraction and an environmental education center for the region. Various partners in the project have received funding to complete other goals established by the project (see Macon County, Little Tennessee Watershed Association and Land Trust for the Little Tennessee summaries). For further details, visit the website at http://www.littletennessee.org/project.html.

1.5.7 Macon County

In 1998, the CWMTF awarded Macon County at grant for $3.8 million. About $3 million of the grant was earmarked for restoration of the badly degraded urban portion of the Little Tennessee River. The balance was for expansion of on-going restoration efforts in the larger watershed. (See the Little Tennessee Watershed Association summary on page 121.)

Macon County also received a $250,000 grant in 1998 from the NC Parks and Recreation Trust Fund to develop Phase I of the Greenway, during a brief ceremony held on the banks of the Little Tennessee River. The grant, which requires a 50/50 match, will be used to construct two miles of hiking/bicycling paths, install two pedestrian bridges and build other amenities, including

restrooms, a fishing pier and canoe put-in. This phase of the trail will extend from the town bridges on Main Street to the US 64/23/441 bypass (http://www.littletennessee.org/trail.html).

In 1999, Macon County contracted with the Corps of Engineers to conduct a $650,000 feasibility study on restoration of Lake Emory. Costs will be split between the Corps and Macon County, with local match from in-kind services and the CWMTF (description below). After completing a two-year study, the Corps expects to undertake a $7 million restoration of the lake.

The Macon County Watershed Council was established by Macon County in 2001. The Council functions to advise Macon County about watershed and water quality issues and is made up of representatives from both the Upper Cullasaja Watershed Association and the Little Tennessee Watershed Association.

Macon County also adopted an erosion and sediment control ordinance in 2001, which builds on the current program administered by the state. An Erosion and Sediment Control Plan must be submitted if one half of an acre of land (or more) is disturbed, rather than the one acre minimum set by the state program. The Macon County ordinance also includes incentives for contractors that attend a Clear Water Contractor training course. The county has also proposed a general Land Use Ordinance.

For more information about watershed programs and ordinances within Macon County, contact County Manager Sam Greenwood by calling (828) 349-2025.

1.5.8 Town of Highlands

The Town of Highlands adopted an erosion and sediment control ordinance in 1992 and a watershed buffer plan and ordinance in 1994. The erosion and sediment control ordinance applies to any land-disturbing activities of one acre or greater and sets rules to reduce site erosion, limits the slope of land that can be disturbed, and stipulates revegetation of exposed slopes. Highlands is a locally delegated program, and therefore, has the ability to enforce the ordinance on behalf of the state. Sediment control within riparian buffers are required for any land-disturbing activity adjacent to streams and lakes and a buffer width of 25 feet is established for disturbance adjacent to classified trout waters (Tr). The ordinances also provide requirements for stormwater outlet protection, borrow and waste areas, access and haul roads, operations in lakes or natural watercourses, existing uncovered areas, and design and performance standards for activities adjacent to classified high quality waters (HQW).

The Town of Highlands Planning Department implements and enforces these ordinances and staff may be reached by calling (828) 526-5266.

1.5.9 Jackson County

In November 2000, Jackson County implemented a locally delegated erosion and sediment control program. Like the statewide program administered by the Division of Land Resources, the county requires an erosion and sediment control plan for development activities disturbing more than one acre of land. The county attempts to inspect all projects weekly. Land-disturbing activities that occur on sites less than one acre in size are inspected only when a complaint is

received. For more information about Jackson County's program, contact Erosion Control Officer, Jeff McCall, by calling (828) 586-7560.

Greenway plans…

1.5.10 Jackson Macon Conservation Alliance

The Chattooga Conservancy has been helping citizens in the Highlands and Cashiers communities establish the Jackson Macon Conservation Alliance (JMCA). The JMCA coalesced from a bitter water quality dispute that recently lead to a landmark ruling in NC, where an administrative judge gave priority to measurable units of turbidity instead of the implementation of voluntary best management practices in cases involving erosion control, mitigation and enforcement. The judge's decision has set the stage for rewriting state sedimentation laws, oversight of which is foremost on the JMCA's actions. The organization has also endorsed the designation of the Cullasaja River as a state Natural and Scenic River; such a designation could result in greater scrutiny of actions that would impact the river.

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 outlined 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-applying 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. The program will catalyze voluntary efforts by stakeholder groups in impaired watersheds to restore those waters by providing various incentives and other support. For locations where local groups choose not to take responsibility for restoring their impairments, the program will consider the option of developing a set of mandatory requirements for NPS pollution categories.

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. 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 Divisions of Environmental Health and Land Resources and 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

DWQ staff have identified some additional research needs that would be useful for assessing, protecting and restoring the water quality of the Little Tennessee River basin. The following list is not inclusive. Rather, it is meant to stimulate ideas for obtaining more information to better address water quality problems in the 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.
- *Increased urban planning is needed*. Increasing population in these areas will demand more water and generate more wastewater. In addition, conversion of land from forests and farms will increase impervious surfaces producing higher than natural streamflows and cause erosion. Streams in these areas will likely remain (or become) impaired unless this growth is planned for and managed properly.
- *More education is needed about water quality issues in general*. Education for developers, realtors, local public officials and other citizens about all types of habitat degradation and BMPs for controlling the quantity and quality of stormwater.
- *Study of existing and new septic system impacts*. Identification of failing septic systems is needed throughout the basin, along with identification of general areas that contain marginal or unsuitable soils for this type of waste treatment. More resources are needed to monitor watershed areas that contain a large number of septic systems.

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 an 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. If you would like to see the Scope of Work for the enforcement assessment, see DENR's web page at http://www.enr.state.nc.us/novs/scope.htm/.

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Appendix I

NPDES Dischargers
and
Individual Stormwater Permits
in the
Little Tennessee River Basin

NPDES Dischargers in the Little Tennessee River Basin

Permit	Facility	County	Region	Type	D1	D2	D3	D4	MGD	Subbasin	Receiving Stream
NC0075612	Wildcat Cliffs Country Club	Macon	Asheville	Minor Non-Municipal	5				0.05	04-04-01	UT Cullasaja River
NC0059552	Highlands Falls Community Association	Macon	Asheville	Minor Non-Municipal	13	5			0.003	04-04-01	UT Cullasaja River
NC0051381	Highlands Falls WWTP	Macon	Asheville	Minor Non-Municipal	5	6	10		0.135	04-04-01	Saltrock Branch
NC0037991	Highlands Mountain Club	Macon	Asheville	Minor Non-Municipal	6				0.022	04-04-01	UT Monger Creek
NC0032778	Highlands, Town - WTP (4th St)	Macon	Asheville	Minor Non-Municipal	21				not limited	04-04-01	Big Creek
NC0021407	Highlands, Town - WWTP	Macon	Asheville	Minor Municipal	1				0.5	04-04-01	Cullasaja River
NC0067326	Macon Co Schools - Cullasaja	Macon	Asheville	Minor Non-Municipal	3				0.002	04-04-01	Cullasaja River
NC0067300	Macon Co Schools - Macon Middle	Macon	Asheville	Minor Non-Municipal	3				0.01	04-04-01	Cullasaja River
NC0058262	S.B. Association, Inc.	Macon	Asheville	Minor Non-Municipal	5	10			0.05	04-04-01	Monger Creek
NC0036692	Skyline Lodge	Macon	Asheville	Minor Non-Municipal	13				0.01	04-04-01	Big Creek
NC0086461	Western Sand Corporation (2***)	Macon	Asheville	Minor Non-Municipal	43				0.06	04-04-01	Little Tennessee River
NC0021547	Franklin, Town - WWTP	Macon	Asheville	Major Municipal	1				1.65	04-04-01	Little Tennessee River
NC0060844	Laurel Hills Homeowners Association	Macon	Asheville	Minor Non-Municipal	6				0.009	04-04-01	UT Little Tennessee River
NC0070394	Willowbrook Park	Macon	Asheville	Minor Non-Municipal	5				0.0246	04-04-01	Coweeta Creek
NC0074250	Gateway Chevron, Inc.	Jackson	Asheville	Minor Non-Municipal	13	10	8	2	0.005	04-04-02	Camp Creek
NC0066958	Jackson Co BOE - Blue Ridge School	Jackson	Asheville	Minor Non-Municipal	3				0.01	04-04-02	Hurricane Creek
NC0066940	Jackson Co BOE - Scotts Creek School	Jackson	Asheville	Minor Non-Municipal	3				0.0063	04-04-02	Scott Creek
NC0020214	Tuckaseigee W&SA / Plant 2 - Sylva	Jackson	Asheville	Minor Municipal	1				0.5	04-04-02	Scott Creek
NC0032808	Ensley Adult Care Home, Inc.	Jackson	Asheville	Minor Non-Municipal	11				0.0085	04-04-02	Blanton Branch
NC0000264	Jackson Development Corp.	Jackson	Asheville	Minor Non-Municipal	2				0.005	04-04-02	Tuckaseegee River
NC0038687	Singing Waters Camping Resort	Jackson	Asheville	Minor Non-Municipal	13				0.0075	04-04-02	Trout Creek
NC0074624	Western Carolina University - WTP	Jackson	Asheville	Minor Non-Municipal	21				0.0005	04-04-02	Tuckasegee River

NPDES Dischargers in the Little Tennessee River Basin

Permit	Facility	County	Region	Type	D1	D2	D3	D4	MGD	Subbasin	Receiving Stream
NC0059200	Trillium Links & Village LLC	Jackson	Asheville	Minor Non-Municipal	5	6			0.02	04-04-02	UT Thorpe Lake
NC0039578	Tuckaseigee W&S Authority / Plant 1	Jackson	Asheville	Major Municipal	1	2			1.5	04-04-02	Tuckasegee River
NC0075736	Whiteside Estates, Inc.	Jackson	Asheville	Minor Non-Municipal	5	13			0.1	04-04-02	Grassy Camp Creek
NC0026557	Bryson City, Town - WWTP	Swain	Asheville	Minor Municipal	1				0.6	04-04-02	Tuckasegee River
NC0061620	Hide-Away Campground, Inc.	Swain	Asheville	Minor Non-Municipal	8	13			0.01	04-04-02	Tuckasegee River
NC0025101	US Department of Interior - Smokemont	Swain	Asheville	Minor Non-Municipal	13				0.03	04-04-02	Oconaluftee River
NC0084441	Smoky Mountain Country Club	Swain	Asheville	Minor Non-Municipal	5	13			0.12	04-04-02	Conleys Creek
NC0020524	USDA - LBJ Civilian Conservation	Macon	Asheville	Minor Non-Municipal	11				0.034	04-04-02	Wayah Creek
NC0023086	Peppertree - Fontana Village	Graham	Asheville	Minor Non-Municipal	10	13	45		0.304	04-04-02	Little Tennessee River
NC0023281	Tapoco Lodge & Village WWTP	Graham	Asheville	Minor Non-Municipal	13	10			0.02	04-04-02	Little Tennessee River
NC0027341	TVA - Fontana Hydro Plant	Graham	Asheville	Minor Non-Municipal	48	14			not limited	04-04-02	Little Tennessee River
NC0037737	Nantahala Village	Swain	Asheville	Minor Non-Municipal	13	81			0.0078	04-04-02	UT Nantahala River
NC0057193	Nantahala Outdoor Center	Swain	Asheville	Minor Non-Municipal	10	13	2	40	0.02	04-04-03	Nantahala River
NC0067318	Macon Co Schools - Nantahala	Macon	Asheville	Minor Non-Municipal	3				0.002	04-04-03	Partridge Creek
NC0025879	Robbinsville, Town - WWTP	Graham	Asheville	Minor Municipal	1	3		5	0.63	04-04-04	Long Creek
NC0083071	Robbinsville, Town - WTP	Graham	Asheville	Minor Non-Municipal	21				0.01	04-04-04	Rock Creek
NC0078719	Riverbend Trout Farm	Graham	Asheville	Minor Non-Municipal	29				not limited	04-04-04	West Buffalo Creek
NC0084981	Darren Stewart Trout Farm	Graham	Asheville	Minor Non-Municipal	29				not limited	04-04-04	West Buffalo Creek
NC0081035	Hemlock Trout Farm	Graham	Asheville	Minor Non-Municipal	29				not limited	04-04-04	West Buffalo Creek
NC0078638	Holders Trout Farm	Graham	Asheville	Minor Non-Municipal	29				not limited	04-04-04	West Buffalo Creek
NC0079090	Wide Creek Trout Sales ***	Graham	Asheville	Minor Non-Municipal	29				not limited	04-04-04	Snowbird Creek

Discharge Codes Indicating Types of Wastewater Discharged (D1-D4)

1	Domestic	Municipal
2	Domestic	Industrial/Commercial
3	Domestic	Schools
5	Domestic	Subdivisions
6	Domestic	Condominiums
8	Domestic	Mobile Home Parks
9	Domestic	Hospitals
10	Domestic	Restaurants
11	Domestic	Institutions (colleges, prisons)
13	Domestic	Lodging (hotels, campgrounds, rest areas)
14	Non-Contact cooling water/condensate	
21	Water plants (Surface water)	
29	Fish or Seafood farms	
40	Laundry waste	
43	Sand dredging	
45	Swimming pool backwash	
48	Hydroelectric turbines	
81	Food Preparation (Not classified elsewhere)	

NPDES Individual Stormwater Dischargers in the Little Tennessee River Basin

Permit #	Facility Name	Receiving Stream	Subbasin	County
NCS000295	Packaging Corp of America	Scott's Creek	04-04-02	Jackson

Appendix II

Biological Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**
- **Lakes Assessment**

Benthic Macroinvertebrate Sampling Methodology and Bioclassification Criteria

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 unimpaired 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 are also 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 in other seasons, EPT taxa richness can be adjusted. The biotic index values can also be seasonally adjusted for samples collected 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.

Flow Measurement

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. However, some between-year changes in the macroinvertebrate community may be due largely to changes in flow. High flow years magnify the potential effects of nonpoint source runoff, leading to scour, substrate instability and reduced periphyton. Low flow years may accentuate the effects of point source dischargers by providing less dilution of wastes.

For these reasons, all between-year changes in the biological communities are considered in light of flow conditions (high, low or normal) for one month prior to the sampling date. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term mean flows. High flow is defined as a mean flow >140% of the long-term mean for that time period, usually July or August. Low flow is defined as a mean flow <60% of the long-term mean, while normal flow is 60-140% of the mean. While broad scale regional patterns are often observed, there may be large geographical variation within the state and large variation within a single summer period.

Habitat Evaluation

DWQ has developed a habitat assessment form to better evaluate the physical habitat of a stream. The habitat score has a potential range of 1-100, based on evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed for assigning ratings indicating Excellent, Good, Fair or Poor habitat.

Table A-II-1 Benthic Macroinvertebrate Data Collected in the Little Tennessee River Basin, 1983 - 1999 (Current basinwide monitoring sites are bolded.)

Subbasin/Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
04-04-01								
L Tennessee R	SR 1629	Macon	B-1	2-(1)	08/99	60/14	6.23/4.74	F
					08/94	69/27	5.27/4.41	G-F
L Tennessee R	SR 1651	Macon	B-2	2-(1)	10/99	62/29	4.41/3.48	G-F
					08/87	64/20	5.63/4.74	G-F
					08/85	52/18	5.53/4.77	F
					08/83	66/21	5.94/4.64	F
L Tennessee R	NC 28	Macon	**B-3**	2-(1)	08/99	86/32	5.33/3.75	G-F
					07/94	57/27	5.02/4.27	G
					08/87	75/28	5.49/4.44	G-F
					06/86	72/26	5.70/4.51	G-F
					08/85	64/26	5.18/4.26	G-F
					08/84	64/28	4.92/4.17	G-F
					08/83	73/30	5.28/4.12	G-F
Middle Cr	SR 1635	Macon	B-4	2-(8)	08/99	-/25	-/4.15	G-F
Coweeta Cr	SR 1114	Macon	B-5	2-10	08/99	-/39	-/3.01	E
					07/94	-/39	-/2.89	E
Cartoogechaye Cr	SR 1307	Macon	B-6	2-19-(1)	06/96	84/45	3.21/2.70	E
Cartoogechaye Cr (downstream)	SR 1307	Macon	B-7	2-19-(1)	06/96	77/36	3.93/2.83	G
Cartoogechaye Cr	SR 1146	Macon	**B-8**	2-19-(1)	08/99	-/41	-/3.18	E
					07/94	-/30	-/3.29	G
Cartoogechaye Cr	SR 1152	Macon	B-9	2-19-(10.5)	08/88	62/16	5.31/4.44	G-F
Cullasaja R (above Mirror Lake)	US 64	Macon	B-10	2-21-(0.5)	06/99	47/14	5.70/4.97	F
					10/96	-/18	-/4.82	F
					10/91	-/9	-/5.59	P
					12/90	-/14	-/4.87	F
Mill Cr (above old WWTP)		Macon	-11	2-21-3	10/91	36/12	5.32/4.41	F
					12/90	-/15	-/4.25	F
Mill Cr (below old WWTP)		Macon	B-12	2-21-3	06/99	44/15	4.53/3.69	F
					10/91	50/12	5.49/3.90	F
					12/90	-/17	-/3.14	F
Cullasaja R (below Lake Sequoyah)	off US 64	Macon	B-13	2-21-(5.5)	10/96	-/20	-/4.12	G-F
					07/94	70/27	5.10/3.76	G-F
					10/91	-/20	-/4.02	G-F
					12/90	-/30	-/3.38	G-F
Cullasaja R (at Jackson Hole)	off US 64	Macon	B-14	2-21-(5.5)	06/99	-/49	-/2.70	E
Cullasaja R	SR 1678	Macon	B-15	2-21-(5.5)	06/99	90/50	3.71/2.86	E
					10/96	86/45	3.57/2.60	E
					07/94	85/42	4.01/3.23	E
					10/91	95/48	3.74/3.08	E
					12/90	-/37	-/2.71	G
Cullasaja R	US 64/SR 1524	Macon	B-16	2-21-(5.5)	10/96	-/37	-/2.47	G
					10/91	-/35	-/3.33	G
					12/90	-/28	-/3.17	G-F
Cullasaja R	US 64/SR 1668	Macon	**B-17**	2-21-(5.5)	08/99	99/51	3.95/3.34	E
Big Cr (above Highlands WTP)		Macon	B-18	2-21-51-1-(4)	06/99	-/41	-/2.04	E
Turtle Pond Cr	SR 1620	Macon	B-19	2-21-8	06/99	-/42	-/1.90	E
Brush Cr (near mouth)	near US 64	Macon	B-20	2-21-13	06/99	-/47	-/2.09	E
Buck Cr	NC 28	Macon	B-21	2-21-15	06/99	-/38	-/2.11	E
Walnut Cr	SR 1533	Macon	B-22	2-21-17	06/99	-/34	-/2.03	G
Ellijay Cr	SR 1524	Macon	B-23	2-23-23	06/99	-/40	-/3.20	E
N Pr Ellijay Cr	SR 1001	Macon	B-24	2-21-23-2	06/99	-/39	-/2.01	E
Crawford Br (at Franklin Memorial Pk)		Macon	B-25	2-22	06/99	-/24	-/3.66	NR
Crawford Br (at E Main St, Franklin)		Macon	B-26	2-22	06/99	33/7	7.50/4.70	NR
Iotla Cr	SR 1372	Macon	**B-27**	2-27	08/99	-/35	-/3.80	G
					07/94	-/21	-/4.25	G-F
Cowee Cr	NC 28	Macon	**B-28**	2-29	08/99	-/35	-/3.06	G
					07/94	-/24	-/3.32	G-F
Burningtown Cr	SR 1371	Macon	**B-29**	2-38	08/99	-/39	-/3.19	E
					07/94	-/30	-/2.72	G
Tellico CR	SR 1367	Macon	**B-30**	2-40	08/99	108/54	3.57/2.61	E
					07/94	84/43	3.46/2.69	E

Subbasin/Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
04-04-02								
Little Tennessee R	off SR 1113	Swain	**B-1**	2-(1)	08/99	75/31	4.73/3.67	G
					07/94	82/39	4.71/4.15	G
					06/94	79/32	4.61/3.98	G
Alarka Cr	SR 1140	Swain	B-2	2-69-(2.5)	11/88	59/37	2.33/1.63	E
Alarka Cr	SR 1185	Swain	**B-3**	2-69-(2.5)	08/99	86/51	3.66/3.11	E
					07/94	91/48	3.69/3.08	E
Bearmeat Br	Near SR 1140	Swain	B-4	2-69-3	11/88	-/24	-/1.71	G
Tuckasegee R (below Greenland Cr)		Jackson	B-5	2-79-(0.5)	06/88	99/51	3.85/2.80	E
Tuckasegee R	SR 1140	Jackson	**B-6**	2-79-(0.5)	07/99	-/46	-/1.95	E
					09/94	-/39	-/2.42	E
					09/89	101/47	3.59/1.97	E
UT Panthertown Creek		Jackson	B-7	2-79-1	06/99	-/26	-/1.25	E
Panthertown Creek		Jackson	B-8	2-79-1	06/99	-/28	-/1.72	G
Hurricane Cr	SR 1145	Jackson	B-9	2-79-23-2	12/91	-/45	-/1.66	E
					09/89	-/39	-/2.06	E
Cedar Cr	SR 1120	Jackson	B-10	2-79-23-3	09/89	89/40	4.36/2.92	G
Grassy Camp Cr (headwaters)		Jackson	B-11	2-79-23-4-1	08/84	52/21	4.27/2.04	G-F
Grassy Camp Cr	SR 1145	Jackson	B-12	2-79-23-4-1	09/89	-/27	-/2.03	G-F
UT Shortoff Cr	SR 1150	Jackson	B-13	2-79-23-4-1-1	08/84	54/27	2.50/1.18	E
Mill Cr	SR 1145	Jackson	B-14	2-79-23-5	09/89	-/28	-/2.08	G
Pine Cr	SR 1145	Jackson	B-15	2-79-23-6	09/89	87/36	4.34/2.96	G
W Fk Tuckasegee R	SR 1133	Jackson	B-16	2-79-23-(7)	07/99	-/35	-/2.98	G
Caney Fk	SR 1740	Jackson	**B-17**	2-79-28-(2.5)	07/99	97/53	3.68/3.03	E
					07/94	93/56	3.25/2.68	E
Mull Cr	SR 1737	Jackson	B-18	2-79-28-3	07/94	-/29	-/1.45	G
Moses Cr	SR 1739	Jackson	**B-19**	2-79-28-8	07/99	-/37	-/1.91	E
Moses Cr	SR 1740	Jackson	B-20	2-79-28-8	07/94	-/33	-/2.47	G
Cullowhee Cr	SR 1001	Jackson	**B-21**	2-79-31	07/99	-/43	-/2.95	E
					08/94	-/32	-/2.59	G
Whiterock Cr (near school)		Jackson	-22	2-79-31-1-(2)	12/91	-/31	-/1.64	E
Savannah Cr	SR 1367	Jackson	**B-23**	2-79-36	07/99	53/32	3.80/3.48	G
					07/94	77/40	3.88/3.22	E
Tuckasegee R	SR 1378 (at end)	Jackson	**B-24**	2-79-(38)	07/99	75/40	4.31/3.81	G
Tuckasegee R	off SR 1377	Jackson	B-25		07/94	101/48	4.43/3.41	E
					08/90	86/43	4.17/3.32	G
					08/88	83/39	4.45/3.15	G
					07/86	67/32	4.73/3.53	G
					08/84	65/25	4.68/3.77	G-F
Scott Cr	SR 1556	Jackson	**B-26**	2-79-39	07/99	70/36	4.14/3.22	G
					07/94	69/28	5.27/3.91	G-F
Fisher Cr (above WTP)	SR 1447	Jackson	B-27	2-79-39-11-(1)	04/87	-/24	-/2.50	G*
Fisher Cr (below WTP)	SR 1447	Jackson	B-28	2-79-39-11-(2)	04/87	-/24	-/2.49	G*
Conley Cr	SR 1177	Swain	**B-29**	2-79-52	07/99	-/44	-/3.17	E
					07/94	94/42	3.62/3.10	E
Beech Flats Pr (headwaters, above)	US 441	Swain	B-30	2-79-55-2	10/95	39/26	1.46/0.85	E*
Beech Flats Pr (below)	US 441	Swain	B-31	2-79-55-2	10/95	16/7	3.08/0.37	F*
Beech Flats Pr	US 441	Swain	B-32	2-79-55-2	09/94	-/22	-/1.35	G-F
Beech Flats Pr (above Kephart Pr)		Swain	B-33	2-79-55-2	10/95	69/41	1.90/1.17	E
Kephart Pr (near mouth)		Swain	B-34	2-79-55-3	10/95	63/42	1.92/1.26	E
Oconaluftee R (below Bradley Fk)	US 441	Swain	B-35	2-79-55-(11)	03/89	86/48	2.39/1.65	E
Bradley Fk (at Smokemont)	off US 441	Swain	**B-36**	2-79-55-12-(11)	07/99	67/39	2.67/1.87	E
					10/95	69/42	1.94/1.24	E
					09/94	-/31	-/1.24	G
					03/89	-/45	-/1.68	E
Mingus Cr	US 441	Swain	B-37	2-79-55-16-(2)	03/89	-/41	-/2.06	E
Oconaluftee R (below Raven Fk)	US 441	Swain	B-38	2-79-55-(16.5)	03/89	-/42	-/2.29	E
Oconaluftee R (at Birdtown)	SR 1359	Swain	**B-39**	2-79-55-(16.5)	07/99	104/53	3.98/3.28	E
					07/94	86/46	4.12/3.12	G
					07/89	88/47	4.21/3.33	E
					03/89	93/50	3.74/2.83	E
					08/87	102/44	4.28/3.04	E
					08/85	93/41	4.13/2.95	G

Subbasin/Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
04-04-02 (con't)								
Raven Fk (above trout farm)	USFS Road	Swain	B-40	2-79-55-17-(13.5)	03/89	-/43	-/1.48	E
Raven Fk (below Cherokee trout farm)		Swain	B-41	2-79-55-17-(15)	03/89	-/43	-/2.28	E
Raven Fk (below Straight Fk)		Swain	B-42	2-79-55-17-(15)	03/89	-/43	-/2.49	E
Raven Fk (below Sequoyah Church)		Swain	B-43	2-79-55-17-(15)	03/89	-/41	-/2.40	G
Straight Fk (below hatchery)		Swain	B-44	2-79-55-17-16-(20.5)	03/89	-/47	-/1.92	E
Soco Cr (near mouth)	old US 441	Swain	B-45	2-79-55-21	03/89	83/41	3.39/2.71	E
Deep Cr (above campground)		Swain	**B-46**	2-79-63-(16)	08/99	-/47	-/2.66	E
					07/94	-/41	-/2.27	E
Deep Cr	SR 1340	Swain	**B-47**	2-79-63-(21)	08/99	-/45	-/3.07	E
					07/94	88/50	3.17/2.42	E
Noland Cr (near mouth)		Swain	**B-48**	2-90	08/99	-/40	-/1.97	E
Forney Cr (near mouth)		Swain	**B-49**	2-97	08/99	81/46	2.66/1.68	E
					07/94	79/46	2.49/1.60	E
Bear Cr (near mouth)		Swain	B-50	2-97-17	07/94	71/44	2.19/1.43	E
Panther Cr	SR 1233	Swain	**B-51**	2-115	08/99	-/39	-/2.24	E
					07/94	-/37	-/1.86	E
Stecoah Cr	SR 1237	Swain	**B-52**	2-130	08/99	-/39	-/3.02	E
					07/94	-/29	-/3.69	G
Hazel Cr (near mouth)		Swain	**B-53**	2-146-(19)	08/99	106/56	2.95/1.96	E
					07/94	96/47	2.86/1.94	E
04-04-03								
Nantahala R (near Rainbow Springs)	USFSR 437	Macon	**B-1**	2-57-(0.5)	08/99	100/49	3.43/2.45	E
					07/94	77/48	2.68/2.22	E
					11/93	80/46	3.12/2.31	E
					07/91	94/54	2.45/1.65	E
					08/90	98/53	3.04/2.36	E
					08/88	98/49	3.46/2.67	E
					07/86	106/48	3.67/2.53	E
					08/84	106/45	3.78/2.16	E
Nantahala R	off SR 1401	Macon	B-2	2-57-(22.5)	11/93	-/33	-/3.07	G
Nantahala R	USFSR 308	Macon	**B-3**	2-57-(22.5)	08/99	-/41	-/2.41	E
					11/93	72/37	3.70/3.17	G
Nantahala R	SR 1310	Macon	B-4	2-57-(22.5)	11/93	66/39	4.19/3.12	G
Nantahala R	US 19/74	Swain	**B-5**	2-57-(22.5)	08/99	-/35	-/2.29	G
					07/94	71/36	3.67/2.19	G
					11/93	65/32	4.06/1.92	G
					07/86	68/27	4.68/2.77	G
					08/84	60/22	5.39/3.06	G-F
Bryson Br	USFSR 437	Macon	B-6	2-57-18	10/98	47/27	2.56/1.76	G
					09/95	59/33	2.44/1.70	E
Roaring Fk	USFSR 437	Macon	B-7	2-57-22	10/98	41/27	2.16/1.75	G
					09/95	57/31	2.48/1.68	E
Nantahala R, US 19/74, Swain	US 19/74	Swain	B-8	2-57-(22.5)	11/93	54/24	3.85/2.12	G-F
Jarrett Cr	USFSR 437	Macon	B-9	2-57-27	09/95	-/35	-/1.51	G
Big Choga Cr	USFSR 440	Macon	B-10	2-57-32	09/95	-/30	-/1.40	E
Wine Spring Cr	SR 1310	Macon	B-11	2-57-39	09/95	-/21	-/1.31	G-F
Dick's Cr	off SR 1401	Macon	B-12	2-57-42	08/99	-/34	-/1.93	G
					11/93	-/26	-/2.70	G-F
Whiteoak Cr (above trout farm)	off USFS Road 711	Macon	B-13	2-57-45	08/90	84/47	2.50/1.79	E
					05/90	83/48	2.50/1.52	E
					01/90	78/46	2.10/1.41	E
					11/88	59/34	2.32/1.63	E
Whiteoak Cr (below trout farm)	SR 1397	Macon	B-14	2-57-45	08/90	60/20	5.90/2.58	F
					05/90	79/35	4.06/1.92	G-F
					01/90	83/39	3.92/2.26	G-F
					11/88	41/10	6.16/1.63	F
Whiteoak Cr	SR 1423	Macon	B-15	2-57-45	08/90	94/31	4.32/2.14	G
					05/90	1044/46	3.31/1.86	G
					01/90	77/37	3.61/2.35	G-F

Subbasin/Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
04-04-03 (con't)								
Whiteoak Cr (above dam)	off SR 1310	Macon	B-16	2-57-45	08/99	-/31	-/2.14	G
					11/93	-/33	-/2.40	G
					08/90	78/26	4.07/1.91	G
					05/90	96/44	3.32/1.85	G
					11/88	-/33	-/2.50	G
Cold Spring Cr	USFS R 711	Macon	B-17	2-57-45-8	01/90	-/41	-/1.80	G
Queens Cr	SR 1412	Macon	B-18	2-57-51	08/99	-/29	-/1.38	E
					11/93	-/27	-/1.56	E
Silvermine Cr	SR 1103	Swain	B-19	2-57-55	11/93	-/22	-/2.77	G-F
04-04-04								
Tulula Cr	SR 1275	Graham	**B-1**	2-190-2-(0.5)	08/99	85/40	4.08/3.24	G
					07/94	78/34	3.76/2.97	G
Bear Cr	SR 1201	Graham	B-2	2-190-2-1	07/94	64/34	3.53/2.60	E
Cheoah R	SR 1138	Graham	B-3	2-190-2-(3.5)	07/89	80/39	3.88/3.07	E
					07/89	-/38	-/2.91	E
					08/87	97/40	4.77/3.45	G
					08/85	74/34	4.74/3.49	G
					08/83	81/32	4.56/3.31	G
Cheoah R	off US 129	Graham	B-4	2/190-(3.5)	07/94	73/32	4.01/3.42	G
Cheoah R	off SR 1138	Graham	**B-5**	2-190-(3.5)	08/99	88/48	3.48/2.84	E
Snowbird Cr	SR 1120	Graham	**B-6**	2-190-9-(0.5)	08/99	-/52	-/2.60	E
					06/90	-/49	-/1.66	E
Snowbird Cr	SR 1119	Graham	B-7	2-190-9-(15.5)	07/94	-/33	-/1.97	G
					06/90	-/47	-/2.08	E
L Snowbird Cr	SR 1115	Graham	B-8	2-190-9-17	08/99	-/39	-/1.41	E
W Buffalo Cr	Off SR 1123	Graham	B-9		06/90	83/40	2.95/1.79	E
W Buffalo Cr	SR 1123	Graham	B-10	2-190-12	08/99	-/39	-/2.54	E
					06/90	-/43	-/2.05	E
Hooper Mill Cr	Near SR 1123	Graham	B-11	2-190-12-3	06/90	85/49	2.24/1.69	E

[1] E = Excellent, G = Good, G-F = Good-Fair, F = Fair, P = Poor, and NR = Not Rated.

* Small stream criteria

Lakes Assessment

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 equations:

TON_{Score} = ((Log (TON) + 0.45)/0.24)*0.90

TP_{Score} = ((Log (TP) + 1.55)/0.35)*0.92

SD_{Score} = ((Log (SD) – 1.73)/0.35)*-0.82

CHL_{Score} = ((Log (CHL) – 1.00)/0.48)*0.83

NCTSI = $TON_{Score} + TP_{Score} + SD_{Score} + CHL_{Score}$

In general, NCTSI scores relate to trophic classifications (Table L1). 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 because of the potential variability of data collections which usually involve sampling a limited number of times during the growing season.

Table A-II-2 Lakes Classification Criteria

NCTSI Score	Trophic Classification
< -2.0	Oligotrophic
-2.0 – 0.0	Mesotrophic
0.0 – 5.0	Eutrophic
> 5.0	Hypereutrophic

Lakes are classified for their "best usage" and are subject to the state's water quality standards. Primary classifications are C (suited for aquatic life propagation /protection and secondary recreation such as wading), B (primary recreation, such as swimming, and all Class C uses), and WS-I through WS-V (water supply source ranging from highest watershed protection level I to lowest watershed protection V, and all Class C uses).

Lakes with a CA designation represent water supplies with watersheds that are considered Critical Areas (i.e., an area within 0.5 mile and draining to water supplies from the normal pool elevation of reservoirs, or within 0.5 mile and draining to a river intake).

Supplemental classifications may include HQW (High Quality Waters which are rated excellent based on biological and physical/chemical characteristics) and ORW (Outstanding Resource Waters which are unique and special waters of exceptional state or national recreational or ecological value). A complete listing of these water classifications and standards can be found in Title 15 North Carolina Administrative Code, Chapter 2B, Section .0100 and .0200.

Appendix III

Use Support Methodology
and
Use Support Ratings

Multiple-Category Use Support Methods

DRAFT December 11, 2001

A. Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met. For example, waters classified for fishing, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR). More specific methods are presented in Part C of this appendix.

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

B. Interpretation of Data and Information

Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classification from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with annual water supply reports from regional water treatment plant consultants.

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations. Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Refer to Part E for more information on the basis of assessments.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

C. Assessment Methodology

Use Support Categories and Uses

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories, as shown in the table below. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*.

	Use Support Categories					
Primary Classification	**Ecosystem Approach**	**Human Health Approach**				
	Aquatic Life/Secondary Recreation	**Fish Consumption**	**Primary Recreation**	**Water Supply**	**Shellfish Harvesting**	**Other**
C	X	X	N/A	N/A	N/A	X
SC	X	X	N/A	N/A	N/A	X
B	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	N/A	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. All existing data pertaining to a stream segment for each applicable use support category are entered into its record and can include, but is not limited to, use support ratings, basis of assessment, biological data, ambient monitoring data, problem parameters and potential sources. The following describes the data and methodologies used to make use support assessments for the surface water classifications (described in Section A, Chapter 3 of each basin plan) using the six use support categories. These methods will continue to be refined, as additional information becomes available.

Basis of Assessment

FS ratings are extrapolated up tributaries from monitored streams when no problematic dischargers or change in land use/cover are identified. The FS rating may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS ratings are not extrapolated to unmonitored tributaries. Refer to Part E for more information.

Problem Parameters

Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database and use support summary table. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Potential Sources

General nonpoint sources (NPS) and point sources (PS) of pollution are identified where there is sufficient information.

Aquatic Life and Secondary Recreation Use Support

The aquatic life and secondary recreation use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. The following is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life protection and secondary recreation.

Biological Data

There are two main types of biological data: benthic marcoinvertebrate and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient monitoring data and biological data are available, biological data are given greater weight.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be not rated.

Benthic Macroinvertebrate Bioclassifications

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera* and *Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

Bioclassification	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings

Pre-1999 Bioclassification	1st sample Bioclassification	Draft Use Support Rating	2nd sample Bioclassification	Final Use Support Rating
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable NR = Not Rated

The use of benthic macroinvertebrate data can be limited in some waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is not

appropriate for all swamp streams. Benthic macroinvertebrate data will not be used in waters characterized or classified by DWQ as swamp waters until the bioclassification criteria for these waters can be used with confidence. Benthic macroinvertebrate data are also not used to develop use support ratings for estuarine waters. Until bioclassification criteria for swamp and estuarine waters are developed, a designation of Not Rated (NR) will be used, and these waters will be listed as NR for aquatic life and secondary recreation use support assessments.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. The benthic macroinvertebrate data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities. For these reasons, the benthic macroinvertebrate bioclassifications provide a valuable assessment of the integrity of trout waters.

A designation of Not Impaired (NI) may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of FS.

Fish Community Bioclassification

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 NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The NCIBI is translated into use support ratings according to the following scheme:

NCIBI	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

The NCIBI was recently revised by DWQ (NCDENR, 2001b). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamilco, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin – all waters except for those draining the Sandhills in Moore, Lee and Harnett counties and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, NC, except for the south and southwest portions of Johnston County and the eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, NC, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All non-wadeable and large streams and rivers throughout the state.

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	**1st sample Bioclassification**	**Draft Use Support Rating**	**2nd sample Bioclassification**	**Final Use Support Rating**
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable NR = Not Rated

Ambient Monitoring Data

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, for analysis. Total number of samples and percent of samples exceeding the NC water quality standards are evaluated for the development of use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the ambient data would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life/secondary recreation use support. These parameters include ammonia, dissolved oxygen, pH, chloride, arsenic, cadmium, chromium, nickel and lead. These parameters are measured against standards for a minimum of ten samples as follows:

Standards Violation	Rating
Criterion exceeded ≤10%	Fully Supporting (FS)
Criterion exceeded 11-25%	Partially Supporting (PS)
Criterion exceeded >25%	Not Supporting (NS)

Data for copper, iron and zinc are not used according to the scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. 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.

Metals data for copper and iron are screened at the 85th percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85th percentile of ≥20 µg/l of copper and/or ≥2000 µg/l of iron are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being developed for zinc. If a stream does not have biological data that would deem a FS rating, then the stream can be rated PS or NS for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Three fails result in a NS rating, and two fails result in a PS rating.

It is important to note that some waters may exhibit characteristics outside the numerical standards due to natural conditions (e.g., many swamp waters are characterized by low pH and dissolved oxygen). These natural conditions do not constitute a violation of water quality standards.

NPDES Discharger Data

Aquatic Toxicity Data

For facilities that perform Whole Effluent Toxicity (WET) tests according to state NPDES discharge permit requirements, a review of the results of a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for aquatic toxicity data would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data, or has no ambient data, and that facility has failed three or more WET tests in the most recent two years, the stream is not rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

Discharge Effluent Data

NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period of data ending on August 31 of the year of biological sampling. Prior to May 31, 2000, facilities were screened for criterion 40 percent in excess of state water quality standards for conventional pollutant limitations or 20 percent in excess of state water quality standards for toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters.

After May 31, 2000, facilities are screened for criterion 20 percent in excess of state water quality standards for both conventional and toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters. Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available.

Therefore, streams will not be rated PS or NS based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

Fish Consumption Use Support

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a water. This use support category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories issued by the NC Department of Health and Human Services.

If a limited fish consumption advisory is posted at the time of use support assessment, the water is rated PS. If a no consumption advisory is posted at the time of use support assessment, the water is rated NS.

The current statewide limited fish consumption advisory for bowfin due to elevated levels of mercury in fish tissue is an exception. It is recognized that bowfin only live and reproduce in waters of the piedmont and coastal plain. Therefore, the use support ratings will be based on the combination of the current statewide fish consumption advisory for bowfin and the documented presence of bowfin in each river basin as found in *Freshwater Fisheries of North Carolina* (Menhinick, 1991). In river basins where there are documented populations of bowfin (Roanoke, Chowan, Pasquotank, White Oak, Lumber, Neuse, Tar-Pamlico, Cape Fear, Yadkin and Catawba), all waters will be rated PS for the fish consumption category. In river basins where there are no documented populations of bowfin (Little Tennesee, Hiwassee, Savannah, Watauga, New, French Broad and Broad), the waters will be rated FS for the fish consumption category unless there is a site-specific advisory.

In order to separate this from other fish consumption advisories and to identify actual bowfin populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables of the basin plans. A review of the present methods for assessing the fish consumption use support category is being conducted, and methods may be modified in the future.

Primary Recreation Use Support

In addition to the use support categories applicable to Class C and SC waters, the primary recreation use support category will be assessed for all Class B, Class SA and Class SB waters where data are available. This use support category is a human health approach to assess whether waters support primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact in an organized or frequent basis. The use support rating is based on swimming advisories issued by local health departments and by the NC Division of Environmental Health (DEH) beach monitoring program.

Freshwaters

Each January, the geometric mean for ambient stations in Class B waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request

is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

When reviewing fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. Monitored Class B waters are rated FS if the geometric mean over the five-year window is less than or equal to 200 colonies per 100 ml. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. Class B waters without fecal coliform data or swimming advisories are not rated.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments. County or local health departments are asked to list those waters with swimming advisories posted for at least two months in the previous five years (ending on August 31 of the year of biological sampling).

Estuarine waters

Each January, the geometric mean for ambient stations in Class SB and SA waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

DEH fecal coliform data are used to assess estuarine (SA and SB) waters. Each January, DEH submits a letter to DWQ stating which coastal waters were posted with an advisory reporting an increased risk from swimming during the prior year. When reviewing DEH fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the DEH fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. If DEH has no data on a water, that water will not be rated.

Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters.

Department of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

DEH Classification	DEH Criteria
Approved (APP)	**Fecal Coliform Standard for Systematic Random Sampling:** The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test. **Fecal Coliform Standard for Adverse Pollution Conditions Sampling:** The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data does not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. Thus, the DWQ Class SA waters must be separated out and rated for shellfish harvesting use support. The acreage of FS, PS and NS waters are calculated using GIS showing DWQ and DEH classifications as attribute information. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from

the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as NS.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ Class SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as PS or NS. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are assessed and rated PS.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this procedure will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures-based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the frequency of closure-based methods for the 2005 Cape Fear River use support assessment and basin plan.

Interim Frequency of Closure-Based Assessment Methodology

The interim method will be used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

Interim Frequency of Closure-Based Use Support Ratings

Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	FS
Closed ≤10% of data window	Portion of CAO closed ≤10%	FS
Closed >10% to ≤25% of data window	Portion of CAO closed >10% to ≤25% of data window	PS
Closed >25% of data window	Portion of CAO closed >25% of data window	NS
N/A	CAC and P/R**	NS

* Approved waters are closed only during extreme meteorological events (hurricanes).

** CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ will work with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if biological data are collected in a basin in 2000, then the five-year window for closure data would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH and DWQ staff will define subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed will be determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to pre-emptive closures because of named storms is not counted. For example, all waters in growing area E-9 were pre-emptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for 10 days after the APP waters were reopened.

Proposed Permanent Frequency of Closure-Based Assessment Methodology

Over the next few years DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closure-based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH as CAO. PRO, RES and CAC areas will be rated NS and CAO areas will be rated FS, PS or NS based on the methodology outlined above in the interim methods. Growing areas that have been reclassified by DEH during the data window from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

Water Supply Use Support

This use support category is used to assess all Class WS waters and is a human health approach to assess whether a water can be used for water supply purposes. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated FS. Specific criteria for rating waters PS and NS are yet to be determined.

Other Uses: All Waters in the State

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

D. Use of Outside Data

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 60 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the draft 2000 303(d) report and shown in the table below. Level 1 data can be use with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments

Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

E. Monitored vs. Evaluated

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Because a monitored rating is based on the most recent five-year window and site-specific data, it is treated with more confidence than an evaluated rating.

FS ratings are extrapolated up tributaries to monitored streams where there are no dischargers with permit violations or changes in land use/cover. Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS are not applied to unmonitored tributaries. Refer to the following summary for the basis 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[a] with data[b] ≤5[c] years old.
	Monitored/Evaluated (ME)	Stream segment[a] is unmonitored, but is assigned a use support rating based on another segment of same stream for which data[b] ≤5[c] years old are available.
Evaluated	Evaluated (E)	Unmonitored streams that are direct or indirect tributaries to monitored stream segments rated FS. Must share similar land use to the monitored stream segment.
Not Rated	Not Rated (NR)	Insufficient or no data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.

a) 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).
b) Major data sources include benthic macroinvertebrate and fish community bioclassifications and chemical/physical monitoring data.
c) From the year that basin monitoring was done.

F. Nutrient Enrichment Issues

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables 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.

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*).

Likewise, DWQ does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is used to determine use support 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 or aesthetic complaints, and taste and odor observations
- algal bloom reports
- macrophyte observations
- fish kill reports
- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission, lake associations and water treatment plant operators

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_____. BAU. 2001a. *Standard Operating Procedure*. *Biological Monitoring*. *Stream Fish Community Assessment and Fish Tissue*. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. North Carolina Department of Environment and Natural Resources. Raleigh, NC.

_____. BAU. 2001b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Western and Northern Mountains (French Broad, Hiwassee, Little Tennessee, New and Watauga River Basins)*. January 05, 2001. *Ibid*.

Aquatic Life/Secondary Recreation Use Support Summary – Little Tennessee River Basin

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter(s)	Potential Source(s)
Little Tennessee River	**From NC-GA State line to the confluence of Mulberry Creek**	**04-04-01**	**2.2**	**PS**	**M**	**Unknown Toxicity Habitat degradation**	**Sources Outside State Jurisdiction or Borders**
Little Tennessee River	From the confluence of Mulberry Creek to the confluence of Cartoogechaye Creek	04-04-01	15.6	FS	M	Habitat degradation	Agriculture
Little Tennessee River	From the confluence of Cartoogechaye Cr. To the confluence of Cowee Creek	04-04-01	11.7	FS	M	Habitat degradation	Urban Runoff/Storm Sewers Agriculture
Little Tennessee River	From the confluence of Cowee Creek to Nantahala River Arm of Fontana Lake	04-04-01	17.0	FS	M	Flow Alteration	Upstream Impoundment
Middle Creek	From source to Little Tennessee River	04-04-01	8.7	FS	M	Habitat degradation	Agriculture
Coweeta Creek	From source to Little Tennessee River	04-04-01	4.6	FS	M		
Cartoogechaye Creek	From source to a point 0.5 mile downstream of Lenior Branch	04-04-01	7.6	FS	M		
Cartoogechaye Creek	From a point 0.5 mi downstream of Lenior Branch to Town of Franklin water supply intake	04-04-01	0.6	FS	ME		
Cartoogechaye Creek	From Town of Franklin water supply intake to Little Tennessee River	04-04-01	5.6	FS	M		
Cullasaja River	**From source to Macon County SR 1545**	**04-04-01**	**3.2**	**PS**	**M**	**Habitat degradation Flow Alteration**	**Golf Courses Upstream Impoundment**
Mill Creek	**From source to Mirror Lake, Cullasaja River**	**04-04-01**	**1.3**	**PS**	**M**	**Unknown**	**Urban Runoff/Storm Sewers, Golf Courses**
Big Creek	From source to U.S. Hwy. 64 Bridge	04-04-01	4.9	FS	M		
Big Creek Arm of Lake Sequoyah	From a point 0.7 mile upstream of mouth to Lake Sequoyah, Cullasaja River	04-04-01	0.6	FS	M		
Cullasaja River	From dam at Lake Sequoyah to Little Tennessee River	04-04-01	18.5	FS	M		
Turtle Pond Creek	From source to Cullasaja River	04-04-01	3.9	FS	M		
Brush Creek	From source to Cullasaja River	04-04-01	4.2	FS	M		
Buck Creek	From source to Cullasaja River	04-04-01	7.8	FS	M		

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.

Aquatic Life/Secondary Recreation Use Support Summary – Little Tennessee River Basin

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter(s)	Potential Source(s)
Walnut Creek	From source to Cullasaja River	04-04-01	4.3	FS	M		
Ellijay Creek	From source to Cullasaja River	04-04-01	7.1	FS	M		
Crawford Branch	From source to Little Tennessee River	04-04-01	3.1	NR	M	Habitat degradation	Urban Runoff/Storm Sewers
Iotla Creek	From source to Little Tennessee River	04-04-01	5.4	FS	M		
Cowee Creek	From source to Little Tennessee River	04-04-01	4.0	FS	M		
Burningtown Creek	From source to Little Tennessee River	04-04-01	11.7	FS	M		
Tellico Creek	From source to Little Tennessee River	04-04-01	5.8	FS	M		
Alarka Creek	From source to Upper Long Creek	04-04-02	2.7	FS	ME		
Alarka Creek	From Upper Long Creek to Fontana Lake, Little Tennessee R.	04-04-02	13.2	FS	M		
Tuckasegee River	From source to Tennessee Creek	04-04-02	4.4	FS	M		
Panthertown Creek	From source to Tuckasegee River	04-04-02	2.9	FS	M		
Tuckaseegee River	From Tennessee Creek to West Fork Tuckaseegee River	04-04-02	4.3	FS	M		
West Fork Tuckasegee River	From Thorpe Dam to Tuckasegee River	04-04-02	9.8	FS	M		
Tuckasegee River	From West Fork Tuckasegee River to a point 0.6 mile upstream of WCU Power Dam	04-04-02	8.3	FS	ME		
Caney Fork	From source to Mull Creek	04-04-02	1.0	FS	ME		
Caney Fork	From Mull Creek to Tuckaseegee River	04-04-02	12.0	FS	M		
Moses Creek	From source to Caney Fork	04-04-02	4.0	FS	M		
Tuckasegee River	From a point 0.6 mile upstream of WCU Power Dam to WCU Power Dam (WCU water supply intake)	04-04-02	0.8	FS	ME	Habitat degradation	Highway/Road/Bridge Runoff
Tuckasegee River	From WCU Power Dam to Savannah Creek	04-04-02	7.7	FS	ME	Habitat degradation	Highway/Road/Bridge Runoff
Cullowhee Creek	From source to the first crossing of NC 107 near Cullowhee	04-04-02	8.7	FS	M		
Tuckasegee River	From Savannah Creek to Dillsboro Dam	04-04-02	1.9	FS	ME		

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.

Aquatic Life/Secondary Recreation Use Support Summary – Little Tennessee River Basin

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter(s)	Potential Source(s)
Savannah Creek	From source to Tuckasegee River	04-04-02	13.1	FS	M	Habitat degradation	Land Development Highway/Road/Bridge Runoff, Agriculture
Tuckasegee River	From Dillsboro Dam to Mack Town Branch	04-04-02	0.7	FS	M		
Scott Creek	From source to Tuckasegee River	04-04-02	14.7	FS	M	Habitat degradation, Fecal coliform	Urban Runoff/Storm Sewers Failing Septic Systems/Straight Pipes
Tuckasegee River	From Mack Town Br to Cochran Br	04-04-02	19.5	FS	M		
Conley Creek (Connelly Creek)	From source to Tuckasegee River	04-04-02	7.4	FS	M		
Oconaluftee River	From source to Collins Creek	04-04-02	2.4	FS	ME		
Beech Flats Prong	**From source to Aden Branch**	**04-04-02**	**2.3**	**PS**	**M**	**Acid Drainage**	**Other - Exposure to Anakeesta Rock Formations**
Beech Flats Prong	From Aden Branch to Oconaluftee River	04-04-02	2.5	FS	M		
Kephart Prong	From source to Oconaluftee River	04-04-02	2.2	FS	M		
Oconaluftee River	From Collins Creek to Bradley Fork	04-04-02	1.6	FS	ME		
Oconaluftee River	From Bradley Fork to Raven Fork	04-04-02	3.9	FS	M		
Bradley Fork	From source to Chasteen Creek	04-04-02	5.4	FS	ME		
Bradley Fork	From Chasteen Creek to Oconaluftee River	04-04-02	1.7	FS	M		
Oconaluftee River	From Raven Fork to Cherokee Indian Reservation boundary	04-04-02	9.0	FS	M		
Oconaluftee River	From Cherokee Indian Reservation boundary to Tuckaseegee River	04-04-02	1.4	FS	ME		
Deep Creek	From source to Indian Creek	04-04-02	13.0	FS	ME		
Deep Creek	From Indian Creek to Juney Whank Branch	04-04-02	0.7	FS	M		
Deep Creek	From Juney Whank Branch to Town of Bryson City water supply intake (just below GSMNP Boundary)	04-04-02	0.6	FS	ME		

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.

Aquatic Life/Secondary Recreation Use Support Summary – Little Tennessee River Basin

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter(s)	Potential Source(s)
Deep Creek	From Town of Bryson City water supply intake (just below GSMNP Boundary) to Tuckasegee River	04-04-02	1.8	FS	M		
Tuckasegee River	From Cochran Branch to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	04-04-02	0.3	FS	ME		
Noland Creek	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	04-04-02	11.7	FS	M		
Forney Creek	From source to Tuckasegee River Arm of Fontana Lake	04-04-02	9.2	FS	M		
Panther Creek	From source to Fontana Lake, Little Tennessee River	04-04-02	2.6	FS	M		
Stecoah Creek	From source to Fontana Lake, Little Tennessee River	04-04-02	6.9	FS	M		
LITTLE TENNESSEE RIVER	From the upstream side of Shoal Branch to Fontana Dam	04-04-02	5.5	FS	M		
Hazel Creek Arm of Fontana Lake, Little Tennessee River	Entire Arm	04-04-02	0.0	FS	M		
Hazel Creek	From source to a point 0.7 mile upstream of mouth	04-04-02	13.8	FS	M		
Hazel Creek	From a point 0.7 mile upstream of mouth to Hazel Creek Arm of Fontana Lake, Little Tennessee River	04-04-02	0.7	FS	ME		
Nantahala River	From source to Roaring Fork	04-04-03	14.0	FS	M		
Bryson Branch	From source to Nantahala River	04-04-03	2.6	FS	M		
Roaring Fork	From source to Nantahala River	04-04-03	2.7	FS	M		
Nantahala River	From Roaring Fork to Nantahala River Arm of Fontana Lake	04-04-03	22.0	FS	M		
Jarrett Creek	From source to Nantahala Lake, Nantahala River	04-04-03	3.7	FS	M		
Big Choga Creek	From source to Nantahala Lake, Nantahala River	04-04-03	3.0	FS	M		

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.

Aquatic Life/Secondary Recreation Use Support Summary – Little Tennessee River Basin

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter(s)	Potential Source(s)
Wine Spring Creek	From source to Nantahala Lake, Nantahala River	04-04-03	4.3	FS	M	Habitat degradation	Unknown
Dicks Creek	From source to Nantahala River	04-04-03	3.3	FS	M		
Whiteoak Creek	From source to Nantahala River	04-04-03	7.4	FS	M		
Queens Creek	From source to Nantahala River	04-04-03	4.9	FS	M		
Silvermine Creek	From source to Nantahala River	04-04-03	4.8	FS	M	Habitat degradation	Unknown
Cheoah River	From source to Town of Robbinsville's proposed Water Supply Intake, 850 feet downstream of the confluence of Sweetwater Creek	04-04-04	0.3	FS	M		
Tulula Creek	From source to a point 0.5 mile upstream of mouth	04-04-04	11.9	FS	M		
Tulula Creek	From a point 0.5 mile upstream of mouth to Cheoah River	04-04-04	0.4	FS	ME		
Cheoah River	From the Town of Robbinsville's proposed water supply intake, to Mountain Creek	04-04-04	1.1	FS	M		
Cheoah River, Santeetlah Lake	From Mountain Creek to Santeetlah Dam	04-04-04	7.0	FS	ME		
Snowbird Creek	From source to Polecat Branch	04-04-04	12.6	FS	ME		
Snowbird Creek	From Polecat Branch to Santeetlah Lake, Cheoah River	04-04-04	7.6	FS	M		
Little Snowbird Creek	From source to Snowbird Creek	04-04-04	15.5	FS	M		
West Buffalo Creek	From source to SR 1148 (Arm of Santeetlah Lake)	04-04-04	5.0	FS	M		
West Buffalo Creek Arm of Santeetlah Lake	**From SR 1148 to Santeetlah Lake, Cheoah River**	**04-04-04**	**2.9**	**PS**	**M**	**Nutrients**	**Aquaculture (Trout Farming Operations)**

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.

Primary Recreation Use Support Summary – Little Tennessee River Basin

Name	Description	Subbasin	Miles/ Acres	Rating	Basis
Cartoogechaye Creek	From Town of Franklin water supply intake to Little Tennessee River	04-04-01	5.6 mi	FS	M
Cullasaja River	From dam at Lake Sequoyah to Little Tennessee River	04-04-01	18.5 mi	FS	M
Nantahala River Arm of Fontana Lake	Entire Arm	04-04-02	Incl below	FS	M
Little Tennessee River (Fontana Lake)	From Nantahala River Arm of Fontana Lake to the upstream side of mouth of Shoal Branch	04-04-02	10,148 ac	FS	M
Tuckasegee River	From Mack Town Branch to Cochran Branch	04-04-02	19.5	FS	M
Oconaluftee River	From Collins Creek to Bradley Fork	04-04-02	1.6	FS	ME
Tuckasegee River Arm of Fontana Lake	That portion of Tuckasegee River Arm of Fontana Lake below the upstream side of the mouth of Noland Creek	04-04-02	Incl above	FS	ME
Nantahala River	From source to Roaring Fork	04-04-03	14.0	FS	M
Nantahala River (Nantahala Lake or Aquone Lake)	From Roaring Fork to Nantahala River Arm of Fontana Lake, Little Tennessee R.	04-04-03	1,606 ac	FS	M
Cheoah River (Santeetlah Lake)	From Mountain Creek to Santeetlah Dam	04-04-04	2,569 ac	FS	M
West Buffalo Creek Arm of Santeetlah Lake	**From SR 1148 to Santeetlah Lake, Cheoah River**	**04-04-04**	**280 ac**	**PS**	**M**

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 comprehensive public accounting of all impaired waters. North Carolina's list of impaired waters must be submitted to EPA by April 1 of every even year (40 CFR 130.7). The list includes waters impaired by pollutants, such as nitrogen, phosphorus and fecal coliform bacteria, and by pollution, such as hydromodification and habitat degradation. The source of impairment might be from point sources, nonpoint sources or atmospheric deposition. Some sources of impairment exist across state lines. North Carolina lists impaired waters regardless of whether the pollutant or source of pollution is known and whether the pollutant/pollution source(s) can be legally controlled or acted upon by the State of North Carolina. More complete information can be obtained from *North Carolina's Draft 2000 303(d) List* (http://h2o.enr.state.nc.us/mtu/), which can be obtained by calling the Planning Branch of DWQ at (919) 733-5083.

303(d) List Development

Generally, there are three 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; and 3) prioritizing listed waters for TMDL development. The following subsections describe each of these steps in more detail.

Sources of Information

North Carolina considers all practical existing and readily available data and information in preparing the 303(d) list. Sources solicited for "existing and readily available data and information" include, but are not limited to the following:

- The previous 303(d) list.
- Basinwide Water Quality Plans and Assessment Reports.
- 305(b) reports.
- 319 nonpoint source pollution assessments.
- Waters where specific fish or shellfish consumption bans and/or advisories are currently in effect.
- Waters for which effluent toxicity test results indicate possible or actual excursions of state water quality standards.
- Waters identified by the state as impaired in its most recent Clean Lakes Assessment.
- Drinking water source water assessments under the Safe Drinking Water Act.
- Trend analyses and predictive models used for determining numeric and narrative water quality standard compliance.
- Data, information and water quality problems reported from local, state or federal agencies, Tribal governments, members of the public and academic institutions.

Listing Criteria

Waters whose use support ratings were not supporting (NS) or partially supporting (PS) based on monitored information in the 305(b) report are considered as initial candidates for the 303(d) list. Waters that were listed on the previously approved 303(d) list are evaluated and automatically included if the use support rating was NS, PS or not rated (NR).

Guidance from EPA on developing the 1998 303(d) lists indicates 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 water should not receive attention. Instead, DWQ should resample or initiate more intensive studies to determine why the water is impaired. Thus, biologically impaired waters without an identified cause of impairment are on the draft 2000 303(d) list.

Assigning Priority

North Carolina has developed a TMDL priority ranking scheme that reflects the relative value and benefits that a water provides to the state. The priority ranking system is designed to take into account the severity of the impairment, especially when threats to human health, endangered species or the designated uses of the water are present.

A priority of High, Medium or Low has been assigned to all waters on Parts 1, 4, 5 and 6 of the list (the following section describes these parts in more detail). A high priority is assigned to all waters that are classified as water supplies. A high priority is also automatically assigned to all waters harboring species listed as endangered or threatened under the federal Endangered Species Act (ESA). A medium priority has minimally been assigned to waters harboring state listed endangered and threatened species. As a way of addressing anti-degradation concerns, classified Outstanding Resource Waters and High Quality Waters start at the medium priority. The remaining waters on the list are prioritized according to severity of the impairment.

New Format of the List

North Carolina has begun to make the structural changes prescribed in EPA's July 13, 2000 final TMDL rule. The *Draft 2000 §303(d) List* reflects many of these changes. EPA's final rule will likely eventually require 303(d) lists to be divided into four sections. North Carolina's 2000 list has been divided into six parts and reflects comments made on the proposed rules by North Carolina and other states. This six-part format meets the requirements of existing rules, and future lists will meet requirements of revised federal rules (when implemented). A summary of each part of the list is provided below. A more detailed discussion is found in the preface to the actual list document.

Part 1 - Waters impaired by a *pollutant* as defined by EPA.

"The term pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water." TMDLs will be submitted for all water/pollutant combinations listed in Part 1.

Part 2 - Waters impaired by *pollution*, not by a *pollutant*.

EPA defines *pollution* as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water" in the CWA section 502(19). EPA believes that in situations where the impairment is not caused by a *pollutant*, a TMDL is generally not the appropriate solution to the problem. In keeping with the principle that the 303(d) list is an

accounting of all impaired waters; however, these types of waters will remain on Part 2 of the list until water quality uses and standards are attained by some other means.

Part 3 - Waters for which EPA has approved or established a TMDL and water quality standards have not yet been attained.
Monitoring data will be considered when evaluating Part 3 waters for potential delisting. Waters will be moved to Part 1 of the list if updated information and data demonstrate that the approved TMDL is inadequate.

Part 4 - Waters for which TMDLs are not required.
Other required regulatory controls (e.g., NPDES permit limits, Phase I Federal Stormwater Permits, etc.) are expected to attain water quality standards by the next regularly scheduled listing cycle.

Part 5 - Biologically impaired waters with no identified cause of impairment.
Roughly half of the waters on North Carolina's 303(d) list appear on Part 5. Identification of the cause(s) of impairment will precede movement of these waters to Parts 1 and 2 of the list. EPA recognized that in specific situations the data are not available to establish a TMDL, and that these specific waters might be better placed on a separate part of the 2000 303(d) list (64 FR, 46025). Data collection and analysis will be performed in an attempt to determine a cause of impairment. North Carolina's proposed plan for managing biologically impaired waters can be found in the preface to Part 5 of the list.

Part 6 – The *proper technical conditions* do not yet exist to develop a TMDL.
"*Proper technical conditions* refers to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662). These are waters that would otherwise be on Part 1 of the list. In the proposed TMDL regulations, EPA again recognized that in some specific situations the data, analyses or models are not available to establish a TMDL, and that these specific waters might be better off on a separate part of the 2000 303(d) list (64 FR, 46025). North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. DWQ has included fecal impaired shellfish waters on this part of the list. North Carolina's approach to managing shellfish waters impaired because of fecal coliform violations is outlined in the preface to Part 6 of the list.

Scheduling TMDLs

North Carolina will submit TMDLs for each water within 13 years of its first listing, starting with the EPA-approved 1998 303(d) list. TMDLs for waters first listed in 1998 or earlier will be developed by 2011. As a general rule, TMDLs will be addressed according to highest priority in accordance with the rotating basinwide planning approach. Due to the wide range of complexities encountered in TMDL development, TMDLs will not necessarily be submitted to EPA in order of priority.

TMDLs on Part 1 of the 303(d) list are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement and "buy-in". Others

need to have a technical strategy budgeted and scheduled. Some are almost ready for submittal to EPA for approval. As the current regulations require, North Carolina has listed waters targeted for TMDL development within the next two years.

North Carolina has used "biological impairment" to place the majority of waters on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Part 5 is to be expected. It is important to understand that the identification of waters on Part 5 of the list does not mean that they are low priority waters. The problem parameter identification (PPI) approach is a high priority for the State of North Carolina. However, it should be noted that it may take significant resources and time to determine the cause of impairment. The PPI approach is also a declaration of need for more data and more time to adequately define the problems and whether they are affected by *pollution, pollutants* or a combination.

North Carolina believes it to be both practical and honest to schedule TMDL development for only those waters where we have some information about the cause of impairment. Scheduling TMDLs for waters that may not be impaired by a *pollutant* is misleading and counterproductive.

Delisting Waters

North Carolina relies heavily on the existing 305(b) reporting methodology to complete the 303(d) process. In general, waters will be removed from the 303(d) list when data show that a water is fully supporting its uses. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved 303(d) list will be removed from the 303(d) lists under the following circumstances:

- An updated 305(b) use support rating of fully supporting.
- Applicable water quality standards are being met (i.e., no longer impaired for a given *pollutant*).
- The basis for putting the water on the list is determined to be in invalid (i.e., was mistakenly identified as impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or *National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing Decisions*. Robert Wayland III, Director. Office of Wetlands, Oceans, and Watersheds. Aug 27, 1997.)
- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories.
- Typographic listing mistakes (i.e., the wrong water was identified).

Appendix V

Little Tennessee River Basin
Summary of Public Comment

Public Comment Summary	DWQ Comments	Location in Plan
New rule requiring development of management strategies for waters containing federally threatened and endangered species is not addressed.	Text related to the new rule has been added to the plan. DWQ does not currently have the resources or expertise needed in order to adequately implement the rule alone. DWQ recognizes the need to provide protection for these species and will continue working with other agencies toward this end.	Section A, Part 2.6.2
Water quality impacts in light of increasing population growth.	Projected population growth is a concern, especially for Macon and Jackson Counties. Planning for new development is an important component of water quality protection.	Section B, Part 1.6.1 Section B, Part 2.6.1 Section A, Part 4.3
Development, especially in terms of quantity of stormwater and the physical impacts on stream channels.	No local governments are currently required to obtain a permit for stormwater in the basin (none are US Census-designated Urban Areas), however Macon County and the Town of Highlands could potentially be required to obtain Phase II permits under state-designation criteria. The plan provides general recommendations for reducing water quality impacts of stormwater and local planning for development is encouraged.	Section A, Part 2.7.2 Section A, Part 4.3 Section A, Part 4.2
Lack of general education about water quality issues.	DWQ workshops are intended to provide some level of general education about water quality issues. In addition, a document called *A Citizen's Guide to Water Quality Management in North Carolina* is available from DWQ. The Planning Branch is also developing a guide targeted towards homeowners aimed at reducing quantity and improving the quality of stormwater. Unfortunately, DWQ does not currently have resources to do more face-to-face education that what is currently being done through the Basinwide Planning Program.	Section A, Chapter 2
Excess sediment in streams from streambank erosion and runoff from construction sites.	The plan provides details about erosion/sedimentation laws, research and enforcement. The plan also includes management strategies and recommendations, as well as contact information for agencies and local programs.	Section A, Part 4.2 Appendix VI
Impacts of dams	Text has been added discussing the impacts of dams on both water quality and aquatic life in streams. DWQ is heavily involved with re-licensing of hydroelectric projects in the basin.	Section A, Part 4.5 Section A, Part 2.9.4

Public Comment Summary	DWQ Comments	Location in Plan
Thermal modifications (heating) of coldwater fisheries due to a lack of riparian vegetation.	Loss of riparian vegetation can have a significant impact on temperature and fish in mountain streams are sensitive to this parameter. Small ponds and lakes in streams also contribute to heating of waters. DWQ encourages protection and restoration of woody vegetation along streams and lakes.	Section A, Part 4.2
Concerns about NCDOT practices, especially regarding sedimentation and stormwater control.	NCDOT was required to obtain a Phase I NPDES stormwater permit in 1999. All new road projects that encompass more than one acre are subject to more stringent sediment and erosion control BMPs and post-construction stormwater control. DWQ also made recommendations to NCDOT as part of this plan.	Section A, Part 2.7.2 Section A, Part 4.3 Section A, Part 4.2
Lack of equal or appropriate enforcement of current regulations as they relate to sediment control (i.e. level of enforcement is often based on the number of complaints)	Comments with regard to state or local sediment/erosion control programs have been passed on to the appropriate governing program. DWQ is working to provide these programs with better information about how turbidity standards can be met.	Section A, Part 4.2
Gravel roads and eroding road grades are a threat to water quality.	Recommendations are made for the NCDOT as well as developers, local governments and timber harvesting operations regarding construction and maintenance of mountain roads. Gravel roads, in particular, need BMPs to ensure minimal impact to nearby streams.	Section A, Part 4.2
Water withdrawals and interbasin transfers.	Information about current water withdrawal and interbasin transfer requirements, as well as lists of those registered, is included within the plan.	Section A, Part 2.9
Inadequate monitoring and lack of availability of water quality data.	DWQ uses limited monitoring resources to sample in targeted areas within each basin. As part of this process DWQ solicits data and information about water quality from all available sources and uses them to determine monitoring locations during each 5-year cycle. DWQ realizes there is generally not “easy access” to DWQ data, particularly water chemistry data, and will continue to work to provide better access in the future.	Section A, Part 3.4 Appendix III

REGULATORY ISSUES WORKGROUP

Recommendations

- Recommend that cross-training occur between state agencies to increase familiarity with domains in an effort to be of greater assistance to public.
- Recommend to the Divisions of Water Quality and Land Resources that regulations be modified where a permit is required from both Divisions in order to drain a lake or pond.
- Recommend to the US Army Corps of Engineers that it assess penalties for violations.
- Recommend to Macon County that it develop a strong Sediment and Erosion Control Ordinance (i.e., require a permit for disturbance of half an acre or greater).
- Recommend to the State Legislature that funding be allocated to the Divisions of Water Quality and Land Resources to increase their respective staffs in order to better enforce existing regulations.

Issues for Consideration

- Advise the Environmental Management Commission of gaps in regulations that address removal of private dams and sedimentation impacts.
- Consider statement regarding use of BMPs not absolving landowner of requirement to comply with water quality standards established by regulations.

TECHNICAL ISSUES WORKGROUP

Recommendations

- Recommend to Macon County that it promote the preservation of large tracts of forested and rural lands.
- Recommend to Macon County that future golf courses install retention ponds to collect runoff for onsite irrigation.
- Recommend to Macon County and municipalities that minimum lot sizes be established for development so that wastewater may be handled onsite. Such an action would promote quality of life as well by discouraging overcrowding of homes.
- Recommend to Macon County that it support a comprehensive study of water resources in order to determine the carrying capacity of population.

PLANNING ISSUES WORKGROUP

Recommendations

- Ask the DWQ Water Supply Watershed Protection Program to audit local implementation and enforcement of water supply watershed rules in the Cullasaja.
- Recommend to Macon County that it seek delegation from the NC Division of Land Resources to implement the Sediment and Erosion Control Act and hire staff to do so.
- Recommend to Macon County and municipalities that they adopt road construction standards that reflect the minimization of environmental impacts and that allow for safety concerns for residents (i.e., not to exceed 10% grade).
- Recommend to Macon County that it adopt a subdivision ordinance which requires submission and approval of a site plan in lieu of a building permit application. The county would then review the entire site, including road grade, percent impervious area, square footage of home, lot size, etc. Road grade may not exceed 10% and total impervious cover may not exceed 15%.
- Recommend to Macon County that it require the use of cisterns and other water capturing devices for large (i.e., total square footage exceeding 5000 feet) homes and businesses in an effort to minimize runoff and to provide water services.

Issues for Consideration

- Recommend to Macon County and municipalities that they determine the amount of imperviousness within their jurisdictions and compare that with past years, as determined from aerial photography in order to look at growth and water quality impacts.
- Ask the state to support Macon County, municipalities and water quality citizen groups in seeking funding to conduct an Integrated Pollution Source Identification study of the Cullasaja River as offered by TVA.

WATER SUPPLY ISSUES WORKGROUP

Recommendations

- Recommend to Macon County and municipalities that they provide water conservation kits and public education information regarding water saving devices, such as low flow toilets, cisterns, low flow shower heads, etc…in an effort to help address drought conditions. It was noted that the Division of Water Resources Water Conservation Program will provide assistance and supplies to the public in such an education effort.
- Recommend to local newspapers that daily information be published on the flow of the river, rainfall, rainfall average and deficit, etc.
- Recommend that North Carolina adopt legislation to form water management districts to enable options for local governments to address water supply issues.
- Recommend to Macon County municipalities that they establish stormwater utilities to collect fees in order to control and address stormwater impacts.
- Support the Planning Issues Workgroup's recommendations regarding limiting density within the water supply watershed to allow for more infiltration of runoff.
- Recommend to Macon County that it require onsite management of wastewater. Such a requirement would lead to larger lot sizes and will address growth beyond the ability to provide water and sewer.

Appendix VI

Little Tennessee 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 at 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. Most employees of the Department of Environment & Natural Resources, including Division of Water Quality, Division of Land Resources, and the Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

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 Conservationists	Alan Walker Perry Wilkerson	828-456-6341 Ext. 5	589 Raccoon Road, Suite 246, Waynesville, NC 28786 awalker.nc.usda.gov or pwilkerson@nc.usda.gov

County	District Conservationist	Phone	Address
Jackson/Swain	Kayla Hudson	828-586-6344	538 Scotts Creek Rd., Sylva, NC 28779 khudson@nc.usda.gov
Macon	Levourn Wiggins	828-524-3311	203 Sloan Rd., Franklin, NC 28734 james.wiggins@nc.usda.gov
Graham	K.D.Cook	828-837-6417	225 Valley River Rd., Ste. J, Murphy, NC
Southwestern RC&D	Timothy Garrett	828-452-2519	P. O. Box 1230, Waynesville, NC 28786 swrcd@dnet.net

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. For detail information, please visit the web site of the Division of Soil and Water Conservation at http://www.enr.state.nc.us/DSWC/files/do.htm.

County	Board Chairman	Phone	Address
Jackson Graham	William R. Shelton	828-497-6089	400 Thomas Cove Rd., Whittier, NC 28789
Macon Swain	James B. Roper	828-524-3421	780 Olive Hill Rd., Franklin, NC 28734

*** 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 and 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	David B. Williams	919-715-6103	Archdale Building, 512 North Salisbury Street, Raleigh, NC 27626
Area 1, Asheville	Davis Ferguson	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	Dr. Donald Eaddy	919-733-7125	2 West Edenton Street, Raleigh, NC 27601

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
Jackson	Jeff Seiler	828-586-4009	538 Scotts Creek Rd., Sylva, NC 28779 Jeff_Seiler@ncsu.edu
Swain	Jeff Seiler	828-488-3848	60 Almond School Road, Bryson City, NC 28713 Jeff_Seiler@ncsu.edu
Macon	Kenneth McCaskill	828-349-2052	5 West Main St., Franklin, NC 28734 Kenneth_McCaskill@ncsu.edu
Graham	Teresa Garland	828-479-7979	PO Box 486, Robbinsville, NC 28771 Teresa_Garland@ncsu.edu
Area Specialized Agent Aquaculture	Skip Thompson	828-456-3575	589 Raccoon Rd., Ste. 118, Waynesville, NC 28786 Skip_Thompson@ncsu.edu
Area Specialized Agent Community Resource Development	Rob Hawk	828-586-4009	538 Scotts Creek Rd., Sylva, NC 28779 Rob_Hawk@ncsu.edu

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.

District 9 Ranger	Gerald McCall	828-586-4007	443 Hwy. 116, Sylva, NC 28779
Central Office	Moreland Gueth	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	1612 Mail Service Center, Raleigh, NC 27699-1621
Asheville Region	Richard Phillips	828-251-6208	59 Woodfin Place, Asheville, NC 28801-2482

Local Erosion and Sedimentation Control Ordinances:

Three local governments in the basin have qualified to administer their own erosion and sedimentation control ordinances for construction.

Jackson County	Jeff McCall	828-586-7560	401 Grindstaff Rd., Ste. 110, Sylva, NC 28779
Swain County	Don Simonds	828-488-9134	PO Box 2321, Bryson City, NC 28713
Town of Highlands	Vacant as of printing	828-526-5266	P.O. Box 460, Highlands, NC 28741

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
Modeling	Michelle Woolfolk	919-733-5083 x505	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	Tom Reeder	919-733-5083 x557	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
Local Office	Owen Anderson	828-452-2546	20830 Great Smoky Mtns. Expressway, Waynesville, NC 28786

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.

Ask for the project manager covering your county.

Asheville Region	Robert Johnson	828-271-7980, ext. 3	151 Patton Ave., Room 208, 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	1636 Mail Service Center, Raleigh, NC 27699-1636
Asheville Region	Landon Davidson	828-251-6208	59 Woodfin Place, Asheville, North Carolina 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

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	919-570-6746	2728 Capital Boulevard, Raleigh, NC 27604
Asheville Region		828-251-6788	

County	Primary Contact	Phone	Address
Jackson	Randall Turpin	828-586-8994	538 Scotts Creek Road, Suite 100, Sylva, NC 28779 randallturpin@jacksonnc.org
Graham	Donna Sawyer	828-479-7900	PO Box 546, Moose Branch Rd, Robbinsville, NC 28771 gchd.graham.co@ncmail.net
Macon	Ken Ring	828-349-2081	189 Thomas Heights Road, Franklin, NC 28734 kring@maconnc.org
Swain	Charlotte Wilson	828-488-3198	100 Teptal Terrace, Bryson City, NC 28713 swainhd@dnet.net

* Most employees of the Department of Environment and Natural Resources, including Division of Water Quality, Division of Land Resources and Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

Appendix VII

Glossary
of
Terms and Acronyms

Glossary

§	Section.
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.
channelization	The physical alteration of streams and rivers by widening, deepening or straightening of the channel, large-scale removal of natural obstructions, and/or lining the bed or banks with rock or other resistant materials.
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).
conductivity	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.
habitat degradation	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 streambed scour.
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.

impervious	Incapable of being penetrated by water; non-porous.
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 the community health of a population of 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.
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOCs are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance).
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 and water quality standards.
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 toxicity. 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.