

Executive Summary

Basinwide water quality planning is a watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the North Carolina Division of Water Quality (DWQ) for each of the 17 major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholders throughout the state.

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.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies. This includes providing agencies information related to financial and funding opportunities.
- Assure equitable distribution of waste assimilative capacity.
- Evaluate cumulative effects of pollution.
- Improve public awareness and involvement.
- Regulate point and nonpoint sources of pollution where other approaches are not successful.

This document is the third five-year update of the *Little Tennessee River Basinwide Water Quality Plan*. The first basinwide plan for the Little Tennessee River basin was completed in 1997 and the second in 2002. The format of this plan was revised in response to comments received during the first and second planning cycles. DWQ replaced much of the general information in the first two plans with more detailed information specific to the Little Tennessee River basin. For this plan, a greater emphasis was placed on identifying water quality concerns on the watershed level in order to facilitate protection and restoration efforts.

DWQ considered comments from the Western North Carolina Basinwide Planning Conference held in the region and subsequent discussions with local resource agency staff and citizens during draft plan development. This input will help guide continuing water quality management activities throughout the river basin over the next five years.

Basin Overview

The Little Tennessee River basin is located within the Blue Ridge Province of the Appalachian Mountains of western North Carolina (Figure *iii* & *iv*). It encompasses about 1,800 mi² in Swain, Macon, Clay, Graham, Cherokee, and Jackson counties. Much of the land within the basin is federally owned (49 percent) and in the U.S. Forest Service's Nantahala National Forest (including the Joyce Kilmer/Slick Rock Wilderness Area) or the Great Smoky Mountains National Park (GSMNP). The basin also includes the Cherokee Indian Reservation. Subbasins

within the Little Tennessee River basin are described by a six-digit code (040401, 040402, 040403, 040404).

The North Carolina section of the Little Tennessee River is typical of many other mountain rivers. The gradient is relatively steep in most reaches of the river and the substrate is dominated by riffle habitats. The headwater reaches of the Little Tennessee River are located in Georgia. Most tributaries are high gradient streams capable of supporting trout populations in the upper reaches. Most of the basin is forested. However, lower reaches of many tributary catchments are farmed or developed resulting in the increased potential for nonpoint source problems.

The Little Tennessee River is one of three major tributaries of Fontana Lake. The other two are the Nantahala River and the Tuckasegee River. The Cheoah River, the fourth major tributary of the Little Tennessee River in North Carolina, has its confluence with the river below Fontana Lake.

The Little Tennessee River basin has one of the most outstanding and diverse aquatic communities within the entire state. It is home to a variety of rare species, including crayfish, mussels, fish, aquatic insects, and amphibians. The stretch of Little Tennessee River between Franklin and Fontana Lake (25 miles) has a faunal diversity that rivals any in the state and perhaps in the nation. Forestland continues to comprise a large majority of this basin, owing to its relatively pristine condition. Although habitat fragmentation due to dam construction has occurred throughout this system in North Carolina and Tennessee, it continues to support an incredibly rich and diverse ecosystem.

Information presented in this basinwide water quality plan is based on data collected from September 1999 to August 2004. Maps of each subbasin are included in each of the subbasin chapters. Each subbasin has its own characteristics and water quality concerns. These are discussed in Chapters 1 - 4.

DWQ identifies the stressors of water quality impact as specifically as possible depending on the amount of information available in a watershed. Most often, the source of the stressor is based on the predominant land use in a watershed. In the Little Tennessee River basin, sediment, habitat degradation, and fecal coliform bacteria contamination were the most commonly identified possible stressors. Water quality decline can often be attributed to a combination of many stressors that lead to habitat and water quality degradation. In some way, every person, industry, landowner, and municipality in the basin impacts water quality. Therefore, every resident of the basin must play a role in management strategies designed to protect and restore the streams, lakes, and rivers of the basin.

Subbasin 04-04-01

The Little Tennessee River originates in Rabun County, Georgia and flows north into Macon County, North Carolina. Subbasin 04-04-01 contains approximately 35 miles of the Little Tennessee River from the state line to the Macon-Swain county line below Tellico Creek. The river upstream of Lake Emory (Porters Bend Dam) has a very gradual gradient as it flows through a broad valley. Below the lake, the gradient steepens and the flow quickens as it flows through the Needmore Tract towards Fontana Reservoir. Major tributaries to the Little Tennessee River in this subbasin include the Cullasaja River and Cartoogechaye Creek; smaller tributaries include Middle, Coweeta, Cowee, Tessentee, Tellico, and Burningtown Creeks.

Headwaters of many tributaries are protected within the Nantahala National Forest. Most tributaries are high gradient streams capable of supporting trout populations in their upper reaches. In the lower reaches, many of the watersheds are farmed or developed and the tributaries are affected by erosion, scour, and sediment deposition. The Town of Franklin and a portion of the Town of Highlands are the large population centers in this subbasin. Strip development is focused along US 23/441 south from Franklin towards Dillard, Rabun Gap, and Mountain City, GA. Low-density residential development is increasing throughout the watershed. Despite the development, almost 90 percent of the subbasin is forested

There are 12 NPDES permitted dischargers in this subbasin. The largest is the Town of Franklin WWTP, which discharges 1.65 MGD into the Little Tennessee River (Lake Emory). This facility is required to monitor whole effluent toxicity.

Most sites monitored for benthic macroinvertebrates or fish were rated Good or Excellent; no sites were rated Poor. Two sites rated Fair, including the Little Tennessee River near the NC-GA state line and the upper reaches of the Cullasaja River near the Town of Highlands. The Little Tennessee River has at times experienced elevated conductivity due to permitted dischargers in Georgia, and the instream and riparian habitats continue to suffer from poor land use and watershed practices. The upper Cullasaja River continues to be impaired by land use practices in the Town of Highlands area. Streams that have consistently been rated Excellent were Coweeta, Turtle Pond, Burningtown, and Tellico Creeks

The primary problem in this basin continues to be nonpoint source pollution, including inputs of sediment and (or) nutrients. Although much of this subbasin is forested, development is often located along the stream corridor. Farmland and new residential areas are typically found adjacent to streams. The riparian zones at many of the sites in the subbasin are narrow, sparsely vegetated with mature trees and mowed lawns, or in pasture. Many of the streams sampled were more turbid than expected for mountain streams. Habitat degradation is attributable to the combination of steep gradients, chronic erosion, and nonpoint source sedimentation. Many of the sites would benefit from bank stabilization and stream restoration techniques.

Subbasin 04-04-02

This subbasin drains 1,021 square miles. The majority of the subbasin lies in Jackson and Swain counties, but small portions of Graham and Macon counties are also included.

Fontana Lake is the largest impoundment in this region and the body of water to which all streams in this subbasin flow. Fontana Lake/Reservoir, operated by the Tennessee Valley Authority, is the result of damming the Little Tennessee River in the 1940's near Fontana Village on the Graham/Swain County line. Flood control and hydroelectric power generation are the primary purposes for Fontana Lake, though recreational use is growing steadily.

The principle tributaries to the Little Tennessee River are the Oconaluftee River and the Tuckasegee River. This subbasin contains over 1,390 miles of streams and rivers and 12,456 acres of lakes and ponds.

Much of the catchment to the north of the Little Tennessee River is within either the Great Smoky Mountains National Park or the Cherokee Indian Qualla Boundary. Most streams on the north side of the lake are in a roadless area and can only be reached by hiking trails or boat

across Fontana Lake. Much of the remainder of this subbasin is included in the Nantahala National Forest, although this does not preclude other land uses.

The largest towns in the subbasin are Bryson City, Cherokee, Cullowhee, and Sylva. The area also contains some of the most pristine and some of the highest quality waters in the State. It also contains some of the most famous trout streams in North Carolina, including Hazel Creek, Forney Creek, Deep Creek and Noland Creek. Portions of Alarka Creek, the Tuckasegee River, Caney Fork, and most of the Oconaluftee River catchments are classified as High Quality Waters (HQW). Small streams, formally classified for water supply, have also been reclassified as HQW: Whiterock, Wolf, Clingman's, and Twentymile Creeks and Long, Jenkins, Dednan, and Moore Spring Branches. The Tuckasegee River upstream of Tanassee Creek is classified as Outstanding Resource Waters.

There are 25 NPDES permitted dischargers in this subbasin, but only three have permitted flows greater than 0.5 MGD: the Tuckasegee Water & Sewer Authority (0.5 MGD to Scott Creek); the Tuckasegee Water & Sewer Authority (1.5 MGD to the Tuckasegee River), and the Town of Bryson City's WWTP (0.6 MGD to the Tuckasegee River). Only the latter two facilities are required to monitor whole effluent toxicity. See Section 2.3.1 for more information. For the listing of NPDES permit holders, refer to Appendix V.

The primary problem in this basin continues to be nonpoint source pollution, including inputs of sediment and (or) nutrients. Although much of this subbasin is forested, development is often located along the stream corridor. Farmland and new residential areas are typically found adjacent to streams, often with inadequate riparian buffer zones. Many of the sampled sites have roads that run parallel to the stream leading to narrow riparian zones with frequent breaks. Water quality was not a problem throughout most of this area, but there was evidence of habitat problems. These included few pools, relatively uniform riffles and runs, and an embedded substrate. These changes have been shown to have less effect on the benthic macroinvertebrates than fish fauna.

Whereas actual water quality is the most important parameter for macroinvertebrates in mountain streams, fishes are affected to a higher degree by habitat alterations (in addition to water quality), especially; the lack of riparian shading of the stream, increased nutrient loads, lack of bank stability, and silt accumulation of plunge pools and riffles. The lack of stream shading raises water temperatures, excluding sensitive cold-water fishes such as trout. An increase in nutrient loads causes a shift in species composition towards dominance by the central stoneroller and the river chub. Silt accumulation, caused by unstable banks and overland runoff limits habitats in riffles, resulting in a low number or complete lack of darters and sculpin.

Subbasin 04-04-03

This subbasin contains most of the Nantahala River catchment. Headwaters of the Nantahala River are entirely within the Nantahala National Forest. The river, from its source to the confluence with Roaring Fork, is classified ORW. Much of the land adjacent to this reach is privately owned. The river and most tributaries are high gradient systems capable of supporting wild trout populations.

The Nantahala River was impounded in 1942, creating Nantahala Lake. Additional flow is diverted into the project from Whiteoak and Dicks Creek. Duke Energy acquired the development in 1988. 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. Development has increased along the gorge corridor as it relates to the recreational industry. Ninety six percent of the subbasin is forested.

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.

Subbasin 04-04-04

This subbasin contains the Cheoah River and all of its tributaries. Significant sections of most tributary catchments are within the Nantahala National Forest and are minimally impacted. These tributaries are typically high-gradient streams capable of supporting trout populations. However, lower reaches of some tributaries and corridors along Tulula Creek, Sweetwater Creek, Little Snowbird Creek, Yellow Creek, and the Cheoah River are not in the national forest. Thus, they are more likely to be impacted by land disturbing activities. Tulula Creek flows through the Town of Robbinsville, where the stream becomes the Cheoah River at its confluence with Sweetwater Creek. Ninety four percent of the subbasin is forested.

Robbinsville is the only urban area in this subbasin. There are only three NPDES permitted dischargers in this subbasin. The Robbinsville Wastewater Treatment Plant (WWTP), a minor municipal discharger releases 0.63 MGD into Long Creek, a tributary of the Cheoah River. The town's water treatment plant discharges 0.1 MGD to Rock Creek, a headwater tributary to Long Creek. Wide Creek Trout Sales has an unlimited discharge to Snowbird Creek, a tributary to Lake Santeetlah. None of these facilities is required to monitor whole effluent toxicity.

The Cheoah River is dammed below Robbinsville to form Santeetlah Lake. Tapoco, Inc. manages the flow in the river and in the impoundment to provide hydroelectric power for the Aluminum Company of America. The de-watered tailwater reach is approximately nine river miles in length prior to its confluence with the Little Tennessee River below Cheoah Dam.

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 HQW by definition. Several other streams would likely meet the criteria for reclassification to HQW or Outstanding Resource Waters. Refer to Chapter 5 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.

Use Support Summary

Use support assessments based on surface water classifications form the foundation of this basinwide plan. Surface waters are classified according to their best-intended use. Determining how well a waterbody supports its use (*use support* rating) is an important method of interpreting water quality data and assessing water quality.

Biological, chemical, and physical monitoring data collected between September 1999 and August 2004 were used to assign use support ratings in the Little Tennessee River basin. A total of 39.9 miles (5.4 percent) and 170.6 acres (1.4 percent) of stream are Impaired in the Little

Tennessee River basin. The impairments are associated with toxic impacts and impoundment. Table *i* and Table *ii* present a summary of the Impaired waters and the associated stressors. Figures *i* and *ii* present a summary of stressors and sources identified for all waters in the Little Tennessee River Basin. Current status and recommendations for restoration of water quality for each Impaired water are discussed in the subbasin chapters (Chapters 1 - 4). Maps showing the current use support rating are also presented in each subbasin chapter.

Table *i* Summary of Use Support Ratings by Category and Subbasin in the Little Tennessee River Basin

Use Support Rating	Subbasin 04-04-01		Subbasin 04-04-02		Subbasin 04-04-03		Subbasin 04-04-04	
	Aquatic Life	Recreation	Aquatic Life	Recreation	Aquatic Life	Recreation	Aquatic Life	Recreation
Monitored Waters								
Supporting	133.2 mi	35.9 mi	150.6 mi	26.5 mi	32.0 mi	3.5 mi	29.0 mi	1.4 mi
Impaired*	3.7 mi (2.7%)	0.0	0.0 0.0	30.7 mi (54%) 170.6 ac (100%)	0.0	0.0	3.4 mi (1%)	0.0
Not Rated	2.1 mi 42.1 ac	0.0 0.0	5.3 mi 10,947.9 ac	0.0 0.0	1,380.2 ac	0.0	281.9 mi	0.0
Total	139.0 mi 42.1 ac	35.9 mi	155.9 mi 10,947.9 ac	57.2 mi 170.6 ac	32.0 mi 1,380.2 ac	3.5 mi 0.0 ac	314.3 mi	1.4 mi
Unmonitored Waters								
Not Rated	0.0	0.0	9.5 mi	9.5 mi	0.0	0.0	0.0	0.0
No Data	368.9 mi 11.6 ac	472.0 mi 53.7 ac	1,225.0 mi 1,508.8 ac	1,323.7 mi 12,286.1 ac	214.8 mi 0.0 ac	243.3 mi 1,380.2 ac	306.9 mi	619.7 mi
Total	368.9 mi 11.6 ac	472.0 mi 53.7 ac	1,234.5 mi 1,508.8 ac	1,333.2 mi 12,286.1 ac	214.8 mi 0.0 ac	243.3 mi 1,380.2 ac	306.9 mi	619.7 mi
Totals								
All Waters**	507.9 mi 53.7 ac	507.9 mi 53.7 ac	1,390.4 mi 12,456.7 ac	1,390.4 mi 12,456.7 ac	246.8 mi 1,380.2 ac	246.8 mi 1,380.2 ac	621.2 mi	621.1 mi
* The noted percent Impaired is the percent of monitored miles/acres only.								
** Total Monitored + Total Unmonitored = Total All Waters.								

Use support methodology has changed significantly since the 2002 revision of the *Little Tennessee River Basinwide Water Quality Plan*. In the previous plan, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated use. Impaired waters were rated PS and NS, depending on the degree of degradation. NR was used to identify waters with no data or those that had inconclusive data.

The 2002 *Integrated Water Quality Monitoring and Assessment Report Guidance* issued by the Environmental Protection Agency (EPA) requests that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting (S), Impaired (I), Not Rated (NR), or No Data (ND). These ratings refer to whether the classified uses of the water (such as water supply, aquatic life, primary/secondary recreation) are being met. Detailed information on use support methodology is provided in Appendix VIII.

Table ii Summary of Impaired Waters in the Little Tennessee River Basin

Stream/ River Name*	Assessment Unit Number (AU#)	Subbasin	Class	Miles/ Acres	Category	Water Quality Stressor/Source
Cullasaja River (Ravenel Lake)	2-21-(0.5)a	04-04-01	WS-III Tr	3.7 mi	Aquatic Life	Toxic impacts and habitat degradation associated with impoundment
Savannah Creek	2-79-36	04-04-02	C Tr	13.4 mi	Recreation	Fecal coliform bacteria, Turbidity and habitat degradation associated with agriculture
Scott Creek	2-79-39	04-04-02	C Tr	15.3 mi	Recreation	Fecal coliform bacteria associated with failing septic systems, MS4 NPDES and WWTP NPDES, turbidity and habitat degradation associated with impervious surfaces and construction
Tuckasegee River	2-79-(35.5)a, 2-79-(38)	04-04-02	C Tr	2.1 mi	Recreation	Fecal coliform bacteria
Tuckasegee River Arm of Fontana Lake	2-(78)a	04-04-02	C	170.6 ac	Recreation	Fecal coliform bacteria and sediment
Cheoah River	2-190-(22)a	04-04-04	C Tr	3.4 mi	Aquatic Life	Habitat degradation associated with impoundment

Use Support Category	Units	Total Impaired Length/Acres	Percent of Impaired Monitored Waters
Aquatic Life	Freshwater miles	9.2 mi	1.4
Recreation	Freshwater miles/acres	30.7 mi/170.6 ac	31.3/100
Fish Consumption	Freshwater miles	0.0	0.0
Water Supply	Freshwater miles	0.0	0.0

Use support methods were developed to assess ecosystem health and human health risk through the development of use support ratings for five categories: aquatic life, fish consumption, recreation, shellfish harvesting, and water supply. These categories are tied to the uses associated with the primary classifications applied to North Carolina rivers, streams, and lakes. 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*. This document is available on-line at <http://h2o.enr.state.nc.us/csu/>.

Challenges Related to Achieving Water Quality Protection

Several streams in the Little Tennessee River basin appear on the 303(d) list of impaired waters and as urbanization continues the risk of impairment increases. Balancing economic growth and water quality protection will be a tremendous challenge. Point source impacts on surface waters can be measured and addressed through the basinwide planning process and do not represent the greatest threat to water quality in the basin.

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.

The cumulative effects of nonpoint source pollution are the primary threat to water quality and aquatic habitat in the Little Tennessee River basin. Nonpoint source pollution issues can be identified through the basinwide plan, but actions to address these impacts must be taken at the local government level. Such actions should include:

- Develop and enforce local erosion control ordinances
- Require stormwater best management practices for existing and new development
- Develop and enforce buffer ordinances
- Conduct comprehensive land use planning that assesses and reduces the impact of development 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. Individual homeowners can participate in resource protection by doing the following on their own properties.

- To decrease polluted runoff from paved surfaces, households can develop alternatives to areas traditionally covered by impervious surfaces. Porous pavement materials are available for driveways and sidewalks, and native vegetation and mulch can replace high maintenance grass lawns.
- Homeowners can use fertilizers sparingly and sweep driveways, sidewalks, and roads instead of using a hose.
- Instead of disposing of yard waste, use the materials to start a compost pile.
- Learn to use Integrated Pest Management (IPM) in the garden and on the lawn to reduce dependence on harmful pesticides.
- Pick up after pets.
- Use, store, and dispose of chemicals properly.
- Drivers should check their cars for leaks and recycle their motor oil and antifreeze when these fluids are changed.
- Drivers can also avoid impacts from car wash runoff (e.g., detergents, grime, etc.) by using car wash facilities that do not generate runoff.
- Households served by septic systems should have them professionally inspected and pumped every 3 to 5 years. They should also practice water conservation measures to extend the life of their septic systems.
- Support local government watershed planning efforts and ordinance development.

Impacts from Steep Slope Disturbance

Dramatic elevation changes and steep slopes define mountain topography. Building sites perched along mountainsides provide access to unparalleled vistas and are a major incentive for development. However, construction on steep slopes presents a variety of risks to the environment and human safety.

Poorly controlled erosion and sediment from steep slope disturbance negatively impact water quality, hydrology, aquatic habitat, and can threaten human safety and welfare. Soil types, geology, weather patterns, natural slope, surrounding uses, historic uses, and other factors all contribute to unstable slopes. Improper grading practices disrupt natural stormwater runoff patterns and result in poor drainage, high runoff velocities, and increased peak flows during storm events. There is an inherent element of instability in all slopes and those who choose to undertake grading and/or construction activities should be responsible for adequate site assessment, planning, designing, and construction of reasonably safe and stable artificial slopes.

Local communities also have a role in reducing impacts from steep slope development. These impacts can also be addressed through the implementation of city and/or county land use and sediment and erosion control plans. Land use plans are a non-regulatory approach to protect water quality, natural resources and sensitive areas. In the planning process, a community gathers data and public input to guide future development by establishing long-range goals for the local community over a ten- to twenty-year period. They can also help control the rate of development, growth patterns and conserve open space throughout the community. Land use plans examine the relationship between land uses and other areas of interest including quality-of-life, transportation, recreation, infrastructure and natural resource protection (Jolley, 2003).

Population Growth and Changes in Land Use

Little Tennessee River Basin Statistics (North Carolina Portion)

Total Area: 1,797 sq. miles
Freshwater Stream Miles: 2,565 mi
No. of Counties: 6
No. of Municipalities: 9
No. of Subbasins: 4
Population (2000): 116,966*
Pop. Density (2000): 44 persons/sq. mile*

Water Quality Statistics

Aquatic Life

Percent Monitored Streams: 23.2% mi, 89.1% ac
Percent Supporting: 53.5% mi
Percent Impaired: 1.4% mi

Recreation

Percent Monitored Streams: 3.5% mi, 1.2% ac
Percent Supporting: 68.7% mi
Percent Impaired: 31.3% mi, 100% ac

* Estimated based on % of county land area that is partially or entirely within the basin, not the entire county population.

The Little Tennessee River basin encompasses all or portions of six counties and nine municipalities. In 2000, the overall population in the basin (based on the percent of the county land area in the basin) was 79,493. The most populated areas are located in and around Webster, Highlands, Sylva, Dillsboro and Santeetlah.

Between 1990 and 2000, county populations increased by over 20,000 people. The fastest growing county was Macon (21.2 percent increase), followed by Jackson (19.0 percent increase). County populations are expected to grow by another 34,000 people (22.5 percent) by 2020. This would result in a total population of over 150,000 people in the six counties partially or entirely contained within the Little Tennessee River basin. Population growth trends and the accompanying impacts to water quality are discussed in Chapters 6 and 7.

Expanding populations are typically characterized by a loss of natural areas and an increase in impervious surface. Based on the current land cover information provided by the National Resources Inventory (USDA-NRCS, 2001), there was a 77.5 percent decrease (10,700 acres) in cultivated cropland in the Little Tennessee River basin from 1982 to 1997. Uncultivated cropland increased by nearly 89.6 percent (6,900 acres). Pasture land decreased by 31.2 percent (11,500 acres). Urban and built-up areas also increased by nearly 141 percent (30,200 acres). Land use cover tables and statistics are included in Appendix III.

Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. The impacts on rivers, lakes, and streams can be significant and permanent if stormwater runoff is not controlled. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

Impacts from Stormwater Runoff

Stormwater runoff is rainfall or snowmelt that runs off the ground or impervious surfaces (e.g., buildings, roads, parking lots, etc.) instead of absorbing into the soil. In some cases, stormwater runoff drains directly into streams, rivers, lakes, and oceans. In other cases, particularly in urbanized areas, stormwater drains into streets and manmade drainage systems consisting of inlets and underground pipes, commonly referred to as a storm sewer system. Stormwater runoff is a primary carrier of nonpoint source pollution in both urbanized and rural areas. The impact of stormwater runoff is particularly severe in developing areas where recently graded lands are highly susceptible to erosion. Water quality impacts are also evident in urbanized areas where stormwater runoff is increased by impervious surfaces and is rapidly channeled through ditches or curb and gutter systems into nearby streams. For more information on stormwater as it relates to growth and development, refer to Chapter 7.

There are several different stormwater programs administered by DWQ. One or more of these programs may affect communities in the Little Tennessee River basin. The goal of DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs try to accomplish this goal by controlling the source(s) of pollution. For more information on statewide stormwater programs, refer to Chapter 8.

Septic Systems and Straight Pipes

In the Little Tennessee River basin, wastewater from many households is not treated at a wastewater treatment plant (WWTP). Instead, it is treated on-site through the use of permitted septic systems. However, wastewater from some homes illegally discharges directly into streams through what is known as a "straight pipe". In some cases, wastewater can also enter streams through failing septic systems. In highly susceptible areas, wastewater from failing septic systems or straight pipes can contaminate a drinking water supply or recreational waters with nutrients, disease pathogens (such as fecal coliform bacteria), and endocrine disturbing chemicals.

In order to protect human health and maintain water quality, straight pipes must be eliminated and failing septic systems should be repaired. The NC Wastewater Discharge Elimination (WaDE) Program is actively helping to identify and remove straight pipes (and failing septic systems) in the western portion of North Carolina. This program uses door-to-door surveys to locate straight pipes and failing septic systems, and offers deferred loans or grants to

homeowners who have to eliminate the straight pipes by installing a septic system. Refer to Chapter 8 for more information on septic systems and straight pipes.

Water Quality Stressors

Water quality stressors are identified when impacts have been noted to biological (fish and benthic) communities or water quality standards have been violated. Certain stressors are associated with specific use support categories. Whenever possible, water quality stressors are identified for Impaired waters as well as waters with notable impacts. For example, in the recreation category, violations of the fecal coliform bacteria standard are the reason for impairment; therefore, fecal coliform bacteria is the stressor for Impaired waters in this category. A discussion of the two most significant stressors in the Little Tennessee is presented below and a summary of all stressors and their sources is presented in Figures *i* & *ii*.

Figure *i* Stressors Identified for Streams in the Little Tennessee River Basin

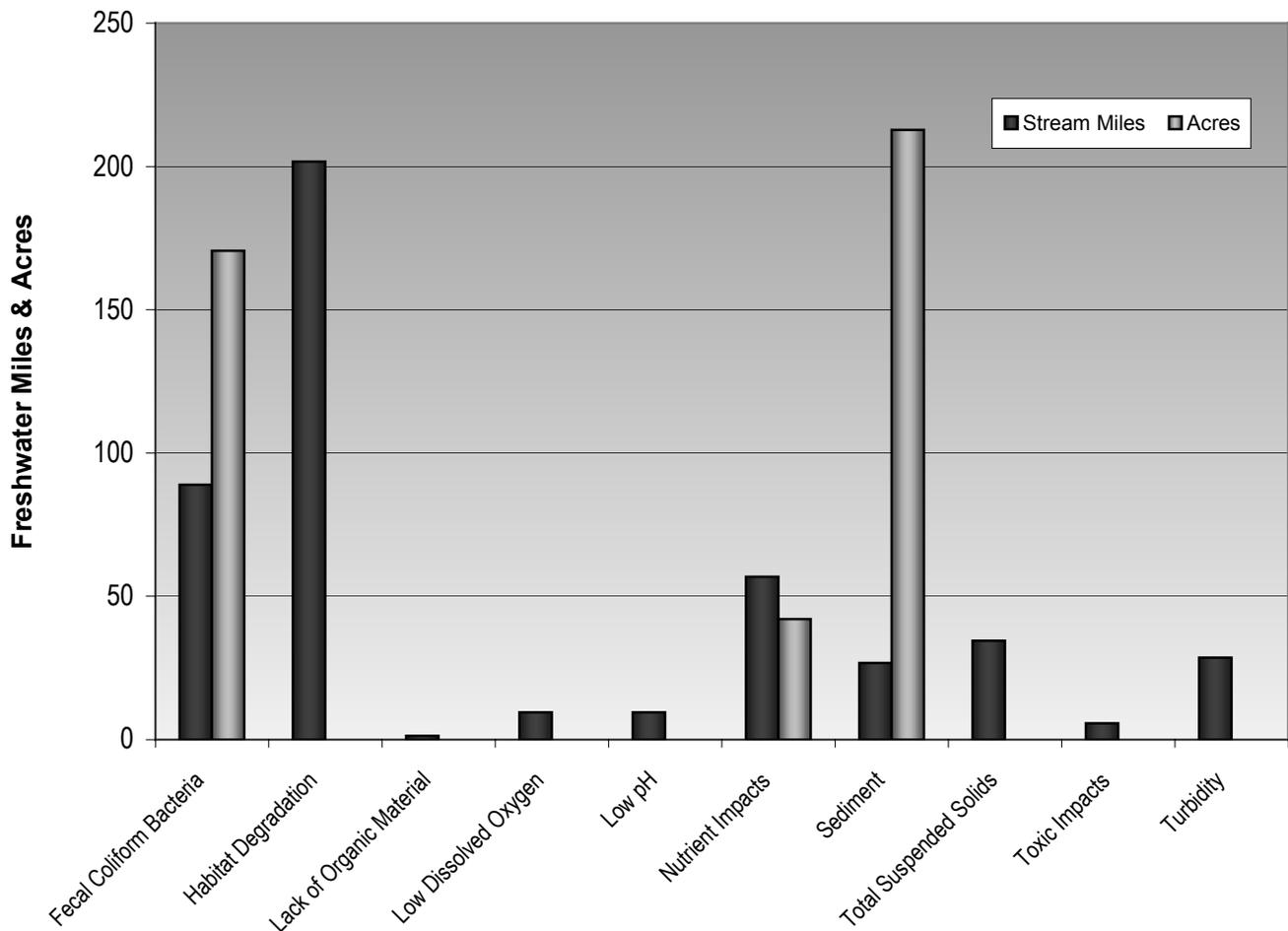
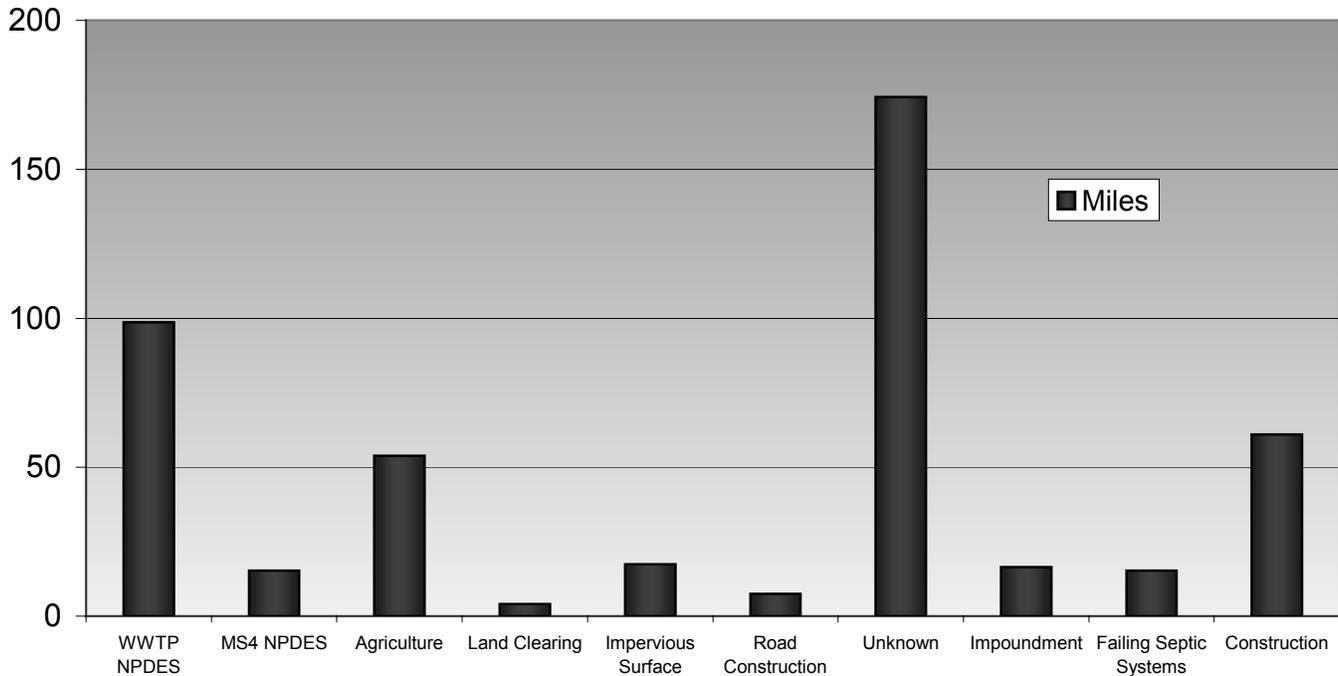


Figure ii Sources of Stressors Identified in the Little Tennessee River Basin



Fecal Coliform Bacteria

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a direct danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health. Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of fecal coliform bacteria can indicate high levels of sewage or animal wastes that could make water unsafe for human contact (swimming). Fecal coliform bacteria and other potential pathogens associated with waste from warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of fecal coliform bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters. Most new stream impairments that were identified in the Little Tennessee during this assessment period were due to fecal coliform bacteria contamination. Over 30 miles of stream are now impaired for recreation in this basin. These streams are discussed in Chapter 2.

Habitat Degradation

In the Little Tennessee River basin, nearly 200 stream miles are suffering from at least one form of habitat degradation. Quantifying the amount of habitat degradation is very difficult in most cases. The most common stressors associated with physical habitat degradation are sediment, lack of organic material and stream channelization.

Sediment fills in pools and embeds or covers riffle habitat areas. Sediment may come from disturbed land in the watershed via runoff through storm sewers, ditches and roads or may be from stream banks that are eroded during high flow events. In many disturbed and developed

watersheds, increased surface runoff becomes more common as impervious surfaces prevent infiltration of rain into the ground. In addition to the loss of instream habitat as noted above, sediment also can alter fish feeding and damage gills. During high flow events, suspended sediment can scour habitats as well as fish and insects.

Organic materials (wood and leaf) in streams are important as habitat and as a food source. A lack of organic habitat can reduce the diversity of benthic and fish species. A lack of organic habitat may also result from reduced riparian area quality associated with unstable stream banks and a lack of stream shading. Organic material in streams can form temporary dams that slow waters during high flows, reducing stream bank erosion and providing increased habitat.

Channelized streams are characterized by having little habitat diversity. Straightened stream channels increase water velocity during rain events and prevent the formation of pools and riffles seen in naturally sinuous streams. Streams can become channelized due to watershed development, where streams are moved and straightened to allow for roads and structures to be built. This type of channelization is most common in highly urbanized areas where the streams are usually a stormwater conveyance. Ditching to drain land for forestry, agriculture and development also channelizes streams. These streams are often maintained as ditches and are not allowed to recover to a more natural state. Channelization can also occur by the force of large amounts of water running off the land. These high flows overrun natural bends and the sediment from eroded stream banks is deposited in the stream, resulting in low diversity aquatic habitats. These streams are most closely associated with urbanized and urbanizing areas.

To assess instream habitat degradation requires extensive technical and monetary resources. 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 impacted by activities that caused habitat degradation. As point-source discharges 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.

DWQ recommends the use of careful planning to maintain riparian buffers and the use of good land use management practices during all land disturbing activities to prevent habitat degradation. In addition, watersheds that are being developed need to maintain management practices for long periods to prevent excessive runoff that is the ultimate source of the habitat degradation noted above. Streams with noted habitat degradation are discussed in the subbasin chapters (Chapters 1-4).

Other chemical and biological factors can also impact water quality. These include excess algal growth, low dissolved oxygen, nitrogen and phosphorus levels, pH, and fecal coliform bacteria. Chapter 6 provides definitions and recommendations for reducing impacts associated with physical, chemical, and biological factors.

Local Involvement

Local organizations and agencies are able to combine professional expertise and local knowledge not present at the state and federal level. This allows groups to holistically understand the challenges and opportunities of local water quality concerns. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests and encourages others to become involved and invested in these projects. Working in cooperation across jurisdictional boundaries and agency lines opens the door to additional funding opportunities and

eases the difficulty of generating matching or leveraged funds. This could potentially allow local entities to do more work and be involved in more activities because funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of local efforts is key to water quality improvements, and DWQ applauds the foresight and proactive response by locally based organizations and agencies to protect water quality. There are many excellent examples of local agencies and groups using these cooperative strategies throughout the state. Several local watershed projects are highlighted throughout the subbasin chapters (Chapters 1-4). Chapter 13 also examines the local and federal initiatives underway in the Little Tennessee River basin.

Water Quality Standards and Classifications

Throughout the Little Tennessee River basin, water quality is generally good and even excellent. Chapter 5 discusses water quality standards and classifications and includes maps showing the designated Water Supply (WS) watersheds, High Quality Waters (HQW), and Outstanding Resource Waters (ORW).

In the Little Tennessee River basin, several municipalities and smaller outlying communities are being pressured to expand. This often involves construction and/or development in areas of pristine waters along several tributaries of the Little Tennessee, Tuckasegee, and the Cullasaja Rivers. HQW and ORW are supplemental classifications to the primary freshwater classification placed on a waterbody. Special management strategies are often associated with the supplemental HQW and ORW classification and are intended to prevent degradation of water quality below present levels from point and nonpoint sources of pollution.

Agriculture and Water Quality

Excess nutrient loading, pesticide and/or herbicide contamination, bacterial contamination, and sedimentation are often associated with agricultural activities, and all can impact water quality. Chapter 9 provides information related to agricultural activities in the Little Tennessee River basin and also identifies funding opportunities for best management practices (BMP). During this assessment period, the North Carolina Agricultural Cost Share Program (NCACSP) funded BMP projects totaling \$199,407 (Table *iii*). BMPs included planned systems for reducing soil erosion and nutrient runoff, planned systems for protecting streams and streambanks, and the installation of planned systems to manage liquid and solid waste to prevent or minimize degradation of soil and water resources.

In several streams throughout the basin, DWQ noted evidence and observed several areas where livestock had direct, easy access to the streams. Fencing, or livestock exclusion, prevents livestock from entering a stream and provides an area of vegetative cover, which can secure streambanks, lower stream velocities, trap suspended sediments, and decrease downgradient erosion. Livestock exclusion is also effective in reducing nutrient, bacteria, and sediment loads in a stream (Line and Jennings, 2002). For more information on either of these agricultural funding opportunities, see Chapter 9.

Table *iii* Summary of NCACSP projects in the Little Tennessee River Basin

Purpose of BMP									
	Erosion Reduction ¹		Sediment Reduction ²		Stream Protection ³		Animal Waste ⁴		Total Cost (\$)
	Total	Cost (\$)	Total	Cost (\$)	Total	Cost (\$)	Total	Cost (\$)	
Subbasin 04-04-01	32.2 acres	4,203	5.51 acres	11,805	20 units 5,485 ft.	21,068 5,580	3 units	35,133	65,984
Subbasin 04-04-02	14.1 acres 230 ft.	1,878 392	1 unit	1,089	630 units 5,321 ft.	61,950 6,417	6 units	37,446	109,172
Subbasin 04-04-03	10 acres	2,250							2,250
Subbasin 04-04-04					15 units 814 ft.	20,806 1,195			22,001

¹ Erosion Reduction/Nutrient Loss Reduction in Field

² Sediment/Nutrient Delivery Reduction from Field

³ Stream Protection from Animals

⁴ Proper Animal Waste Management

Total Benefits					
Subbasin	Soil Saved (tons)	(N)itrogen Saved (lb.)	(P)hosphorous Saved (lb.)	Waste-N Saved (lb.)	Waste-P Saved (lb.)
03-02-01	3,158	2,606	142	1,683	332
03-02-02	4,174.34	2,681.32	326.30	5,307.70	3,226.60
03-02-03	70	38	5		
03-02-04	20.60	90	8		

* The North Carolina Agricultural Nutrient Assessment Tool (NCANAT) contains two field-scale assessment tools: the Nitrogen Loss Estimation Worksheet (NLEW) and the Phosphorus Loss Assessment Tool (PLAT). NCANAT is a product of the cooperative effort between the NC State University, NC Department of Agriculture & Consumer Services, USDA-NRCS and the NCDENR. The tool consists of a function that allows comparisons to be made before and after BMPs are installed. Gains and losses of nitrogen, phosphorus, and sediment due to BMP implementation can be computed. The DSWC has adopted this program to calculate these losses for the NCACSP reporting requirements.

Forestry and Water Quality

Based on land cover information provided by the North Carolina Corporate Geographic Database (CGIA) and the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), 93 percent (358,300 acres) of land in the Little Tennessee River basin consists of forestland. There was about 4 stream miles (AU# 2-23) that were noted or identified by stressors associated with land clearing or forestry activities. Where forest harvesting is identified as a source of water quality impact, DWQ will notify the Division of Forest Resources to investigate for potential violations and the enforcement of management strategies. Chapter 10 presents more information related to the impacts of forestry on water quality.

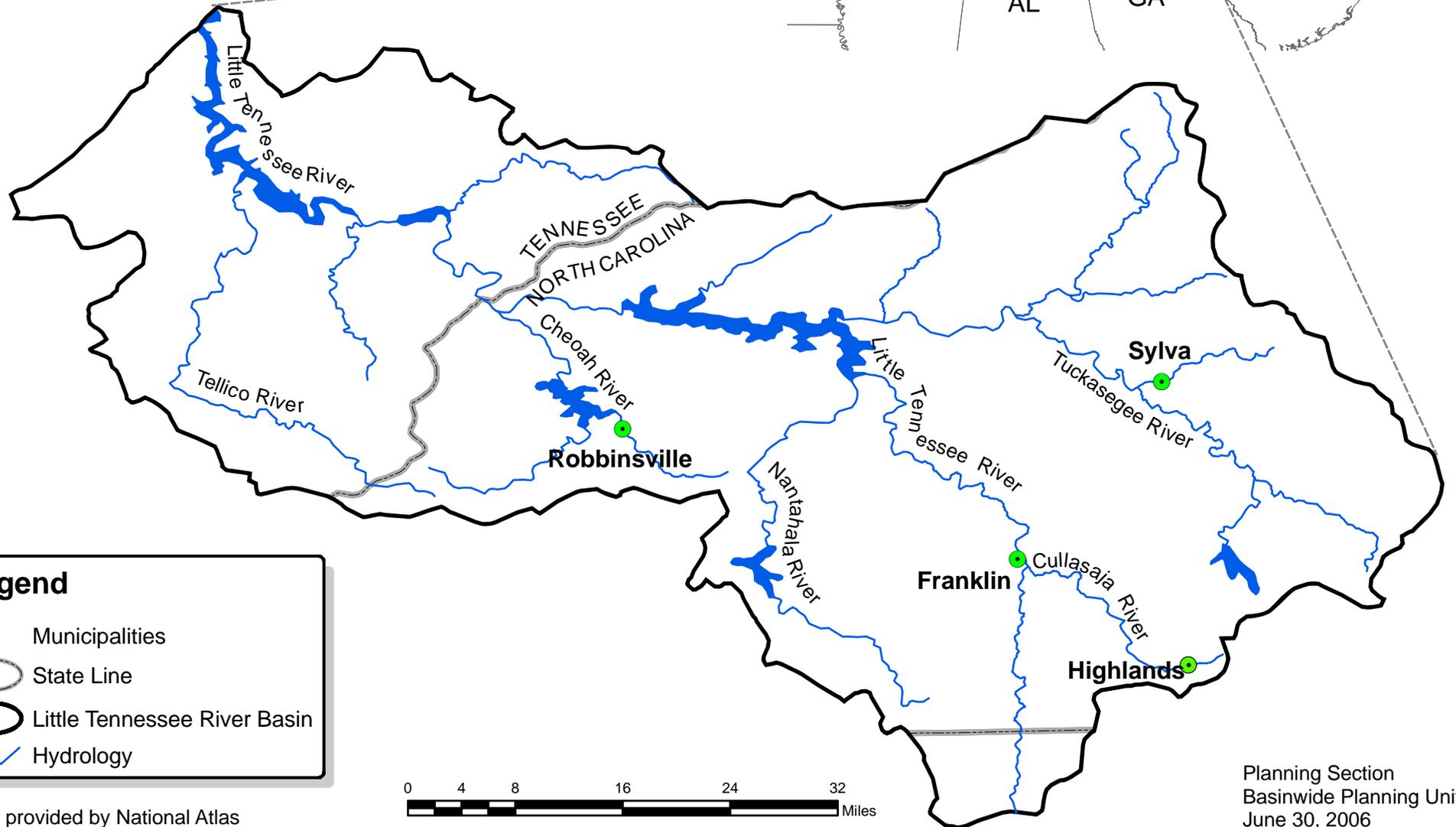
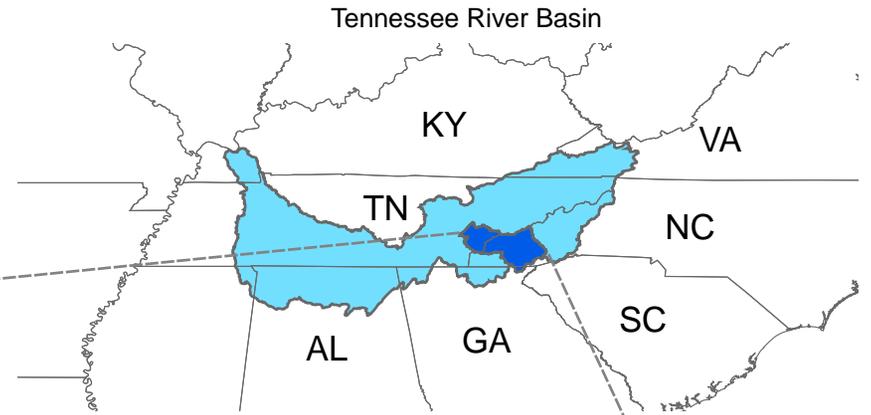
Water Resources

Chapter 11 presents information related to minimum streamflow requirements, interbasin transfers, and the impact to water quality during drought conditions. The chapter also includes the federal cataloging units, or hydrologic units, as they relate to the state subbasin boundaries.

Natural Resources

The Little Tennessee River basin has one of the most outstanding and diverse aquatic communities within the entire state. It is home to a variety of rare species, including crayfish, mussels, fish, aquatic insects, and amphibians. The stretch of Little Tennessee River between Franklin and Fontana Lake (25 miles) has a faunal diversity that rivals any in the state and perhaps in the nation. Forestland continues to comprise a large majority of this basin, owing to its relatively pristine condition. Although habitat fragmentation due to dam construction has occurred throughout this system in North Carolina and Tennessee, it continues to support an incredibly rich and diverse ecosystem. Chapter 12 presents information related to the ecological significance of the basin and identifies endangered and threatened species, significant natural areas and aquatic habitats, and public lands that are locally significant.

Figure iii General Map of the Entire Little Tennessee River Basin

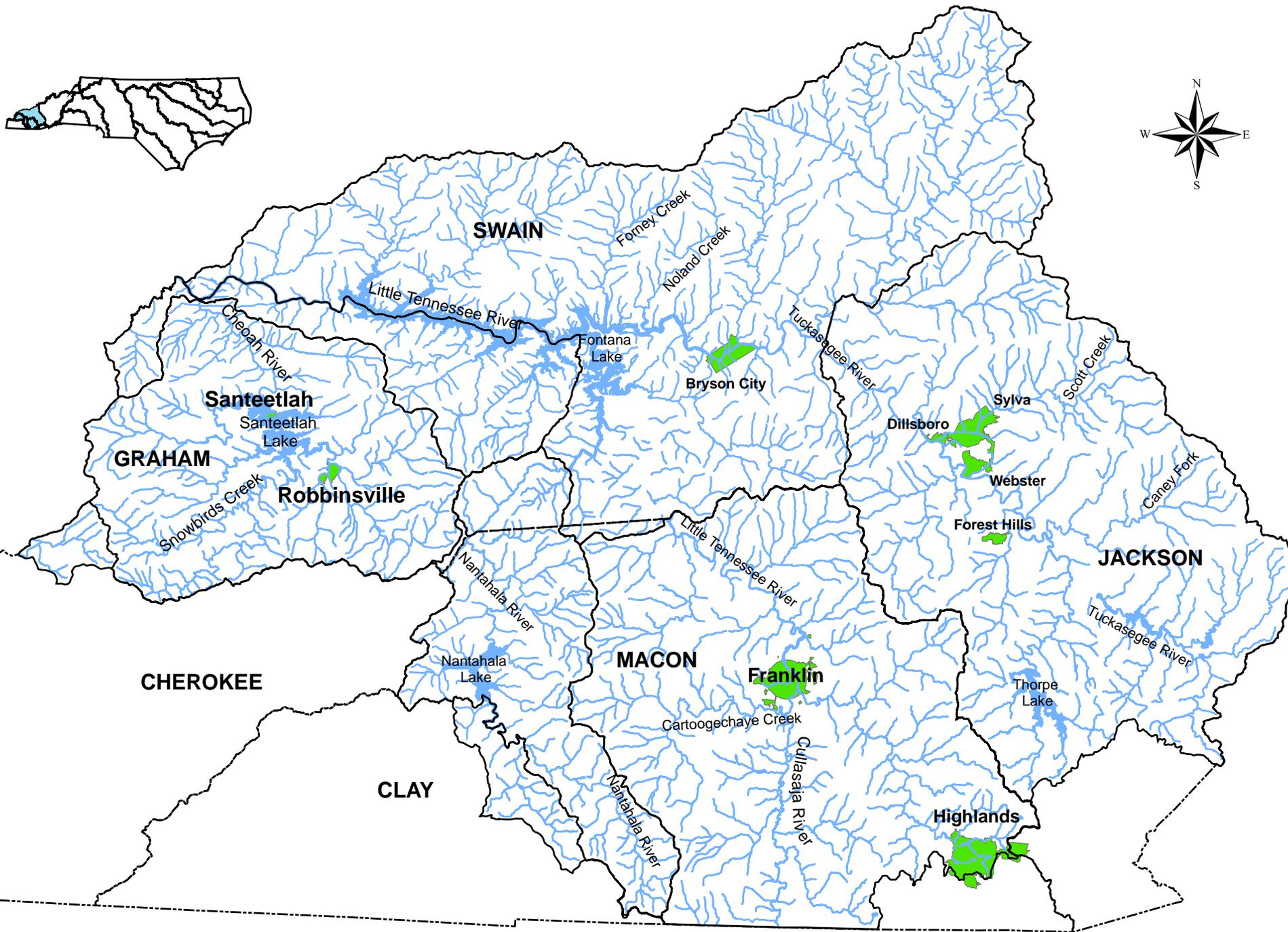


Legend

- Municipalities
- State Line
- Little Tennessee River Basin
- Hydrology

*Data provided by National Atlas

Figure iv General Map of the Little Tennessee River Basin in North Carolina



Planning Section
Basinwide Planning Unit
May 15, 2006

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Miles