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 northeast 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.

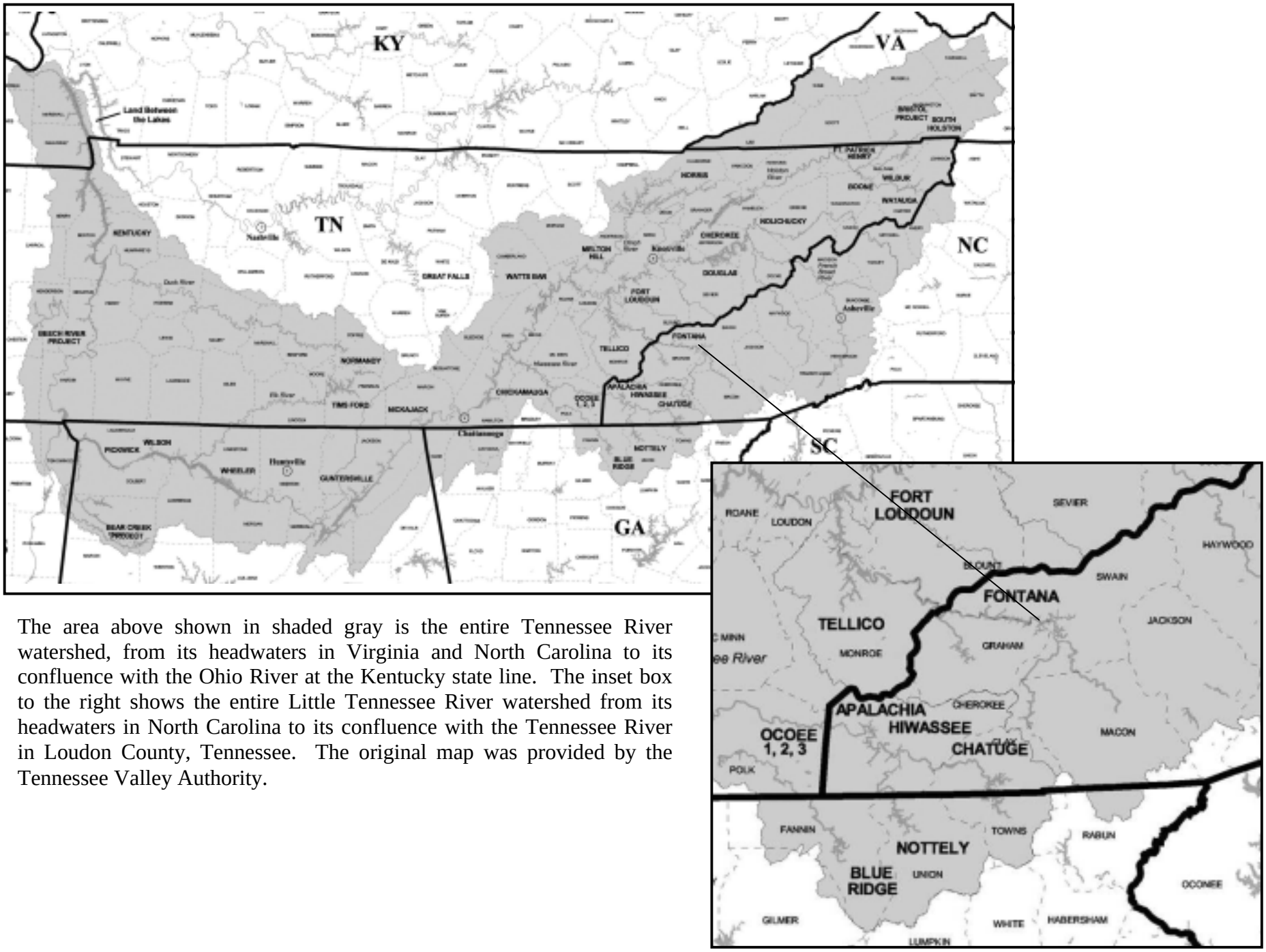
Although the Little Tennessee River basin is barely considered medium-sized when compared with other North Carolina river basins (approximately 1,800 square miles), it contains more than 2,500 miles of streams and rivers and 18,000 acres of lakes. Both the Roanoke and Tar-Pamlico River basins, which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

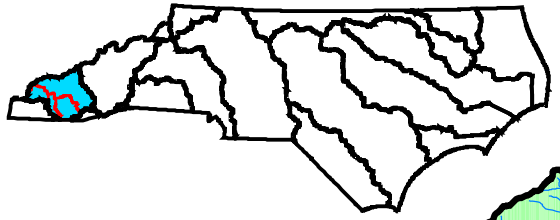
The estimated population of the basin in 2000 was 79,493, and the population is projected to increase 31 percent by 2020. Most of the basin's population is located in and around Franklin, Sylva and Cherokee, and the largest population increases will likely be around these urban areas. The basin also 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
Deep Creek
Hazel Creek
Little
Cheoah River
Fontana Lake
Santeetlah Lake
Snowbird Creek
Robbinsville
Bryson City
Tuckasegee River
Dillsboro
Scott Creek
Sylva
Caney Fork River
Tennessee
Nantahala
Nantahala Lake
Cartoogechaye Creek
Franklin
Cullasaja River
Thorpe Lake
Little Tennessee River
Highlands

Legend
- River Basin Boundary
- Subbasin Boundary
- County Boundary
- Hydrography
- Federal Lands
- Municipality

10 0 10 Miles

NCDENR
Planning Branch
Basinwide & Estuary Planning Unit
October 23, 2001

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).

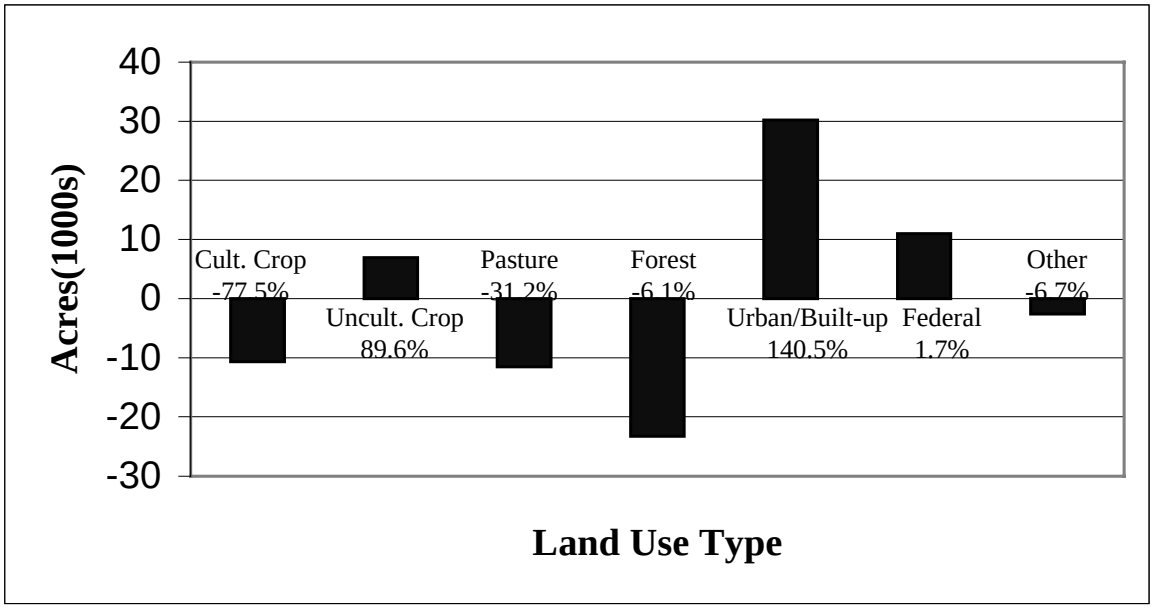


Figure A-6 Land Cover Changes from 1982 to 1997 for the Little Tennessee River Basin (Source: USDA-NRCS, NRI, updated June 2001)

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.

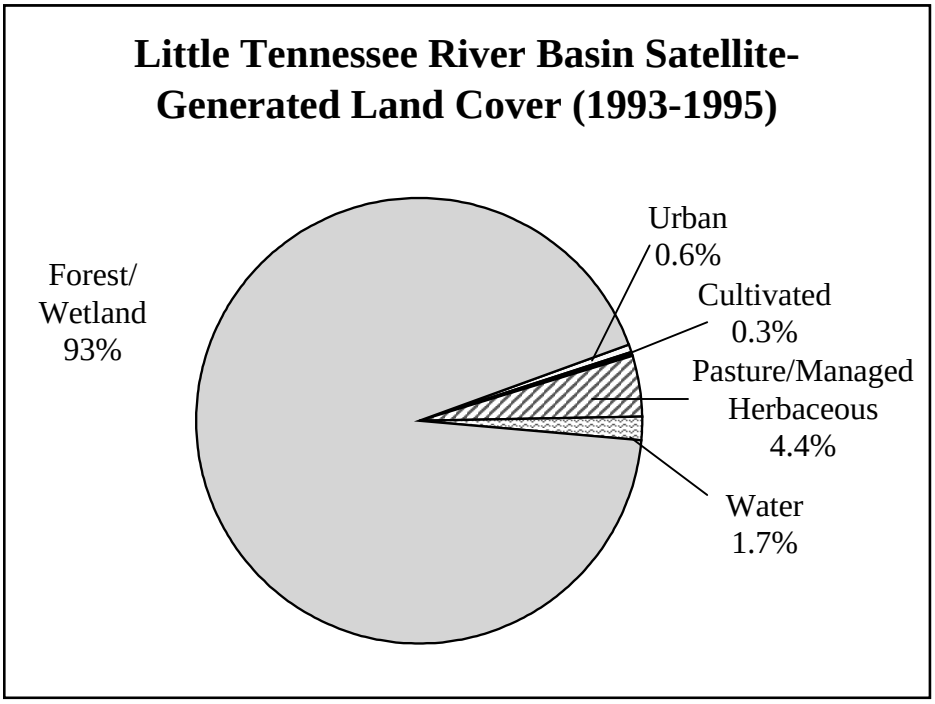


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Little Tennessee River Basin

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	Estimated 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.

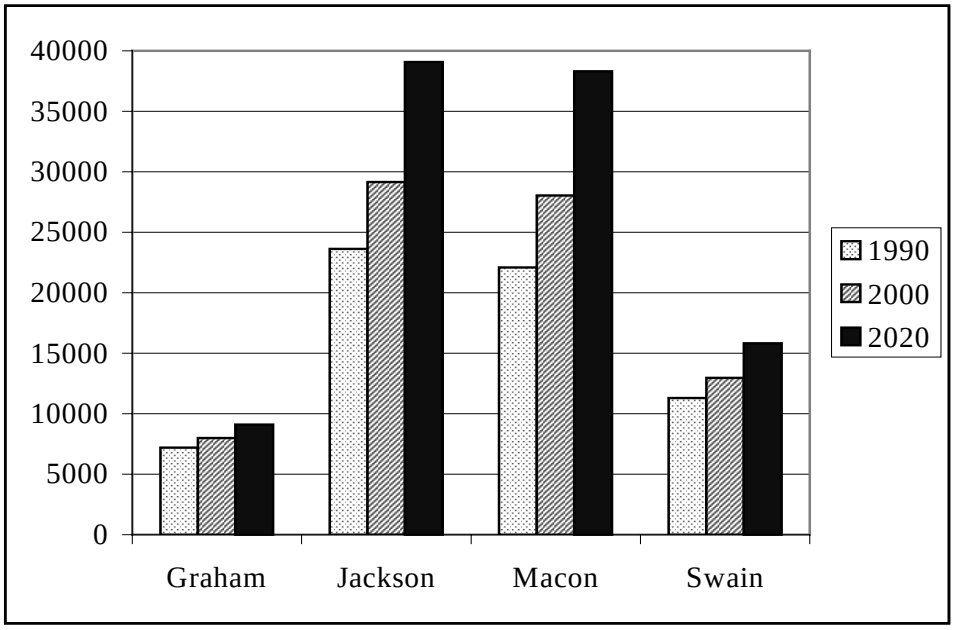


Figure A-8 Population Data for Selected Counties in the North Carolina Portion of the Little Tennessee River Basin

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).

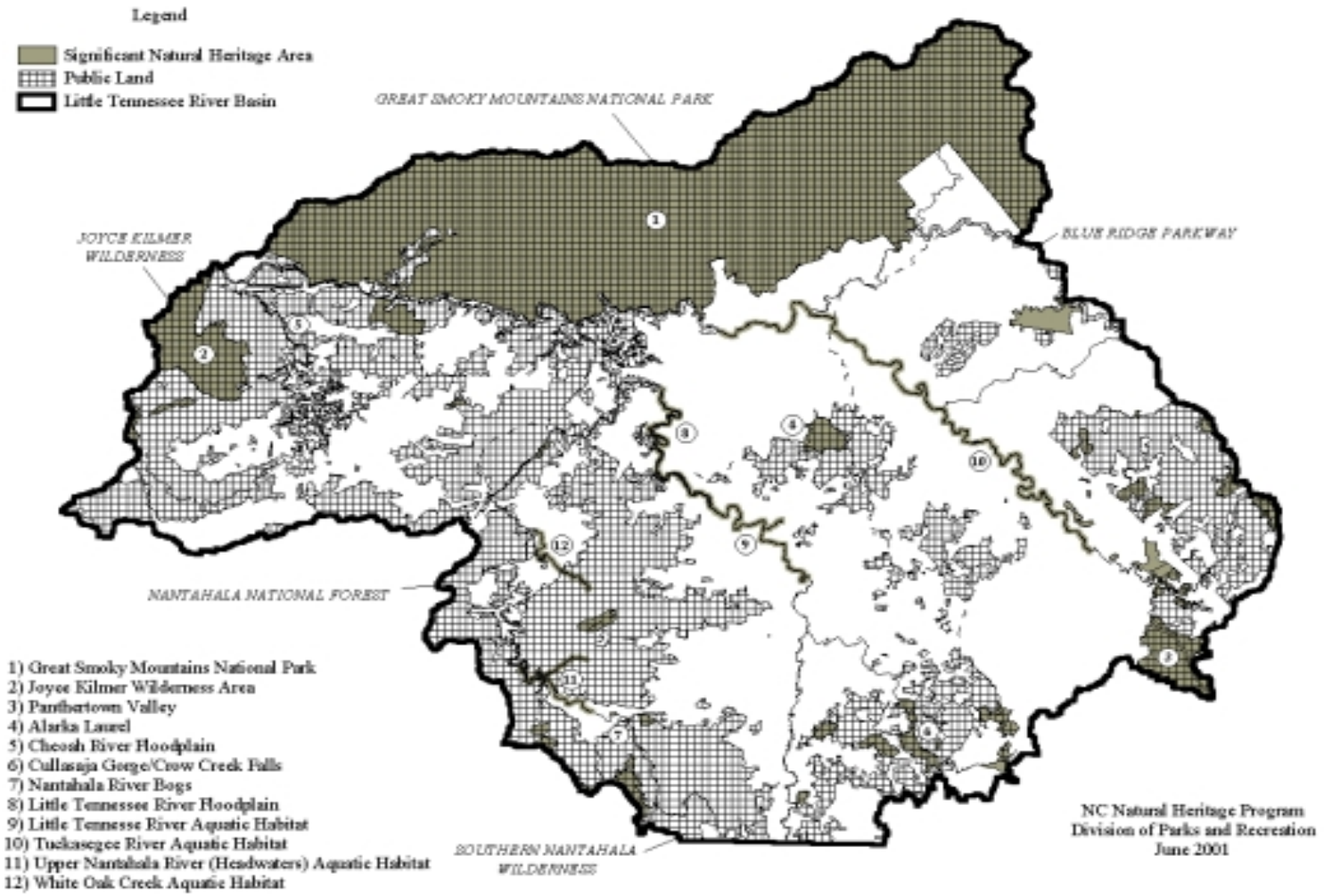


Figure A-9 Public Lands and Significant Natural Heritage Areas in the Little Tennessee River Basin

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.

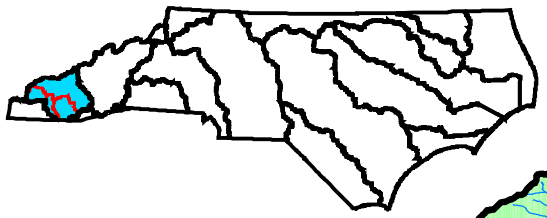
There are 43 permitted discharges in the Little Tennessee River basin. Table A-14 provides summary information (numbers of facilities and permitted flows) regarding the discharges by types and subbasin. Detailed information regarding the dischargers characterized in the table is provided in Appendix 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	26	1	2	43
Total Permitted Flow (MGD)	2.5	3.3	0.002	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	25	1	2	41
Total Permitted Flow (MGD)	0.9	1.8	0.002	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	23	1	1	37
Total Permitted Flow (MGD)	0.4	0.7	0.002	0.0	1.1

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



SWAIN

HAYWOOD

JACKSON

TRANSYLVANIA

GRAHAM

CHEROKEE

MACON

CLAY

04-04-01

04-04-02

04-04-03

04-04-04

Bryson City

Dillsboro

Sylva

Franklin

Robbinsville

Highlands

Fontana Lake

Santeetlah Lake

Nantahala Lake

Thorpe Lake

Cartoogechaye Creek

Scott Creek

Caney Fork River

Tuckasegee River

Little Tennessee River

Nantahala River

Cullasaja River

Deep Creek

Ocona Luftee River

Raven Fork

Hazel Creek

Cheoah River

Snowbird Creek

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).

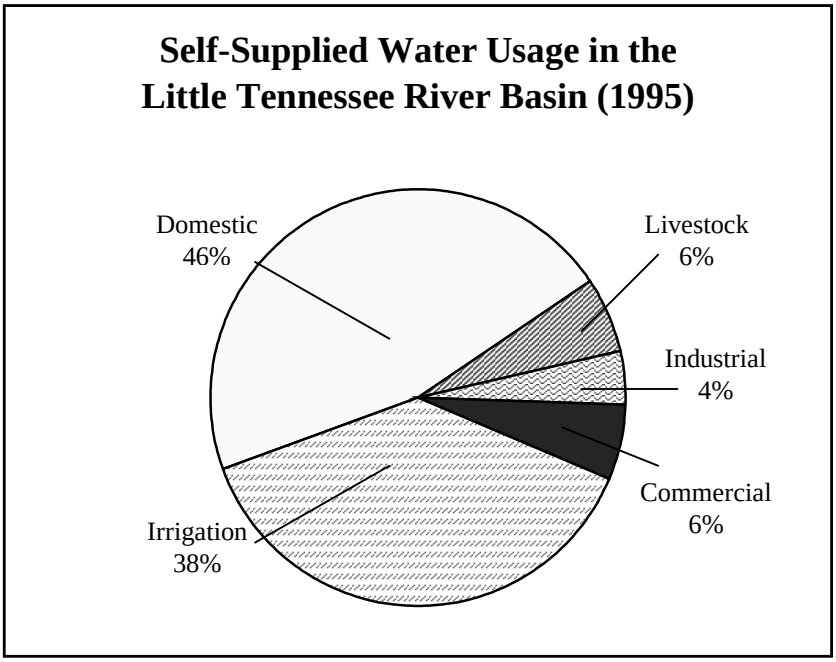


Figure A-11 Estimated Self-Supplied Water Use in the Little Tennessee River Basin (NCDENR-DWR, January 2001)

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 115 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/.