

Chapter 2 - Broad River Basin Overview

2.1 General Overview

The headwaters and major tributaries of the Broad River basin begin in the Blue Ridge Mountains of western North Carolina and flow through the foothills and piedmont of North Carolina before entering South Carolina (Figure A-4). The Broad River continues to flow through South Carolina and drains to the Atlantic Ocean via the Congaree and Santee Rivers.

Broad River Basin Statistics (NC Portion)

Total Area: 1,513 sq. miles
Stream Miles: 1,495
Lake Acres: 1,954
No. of Counties: 8
No. of Municipalities: 27
No. of Subbasins: 6
Population (2000): 342,282*
Estimated Pop. (2020): 172,133*
% Increase (2000-2020): 23.3%
Pop. Density (1990): 112 persons/sq. mi.

* Based on % of county land area estimated to be within the basin (Table A-11).

The four major tributaries to the Broad River in North Carolina are the Green River, Second Broad River, First Broad River and North Pacolet. There are four man-made lakes in the basin sampled by DWQ: Lake Lure, Lake Summit, Lake Adger and Moss Lake (Kings Mountain Reservoir). Several areas in the basin are classified for water supply use, and approximately 30 percent of the streams are supplementally classified as trout waters.

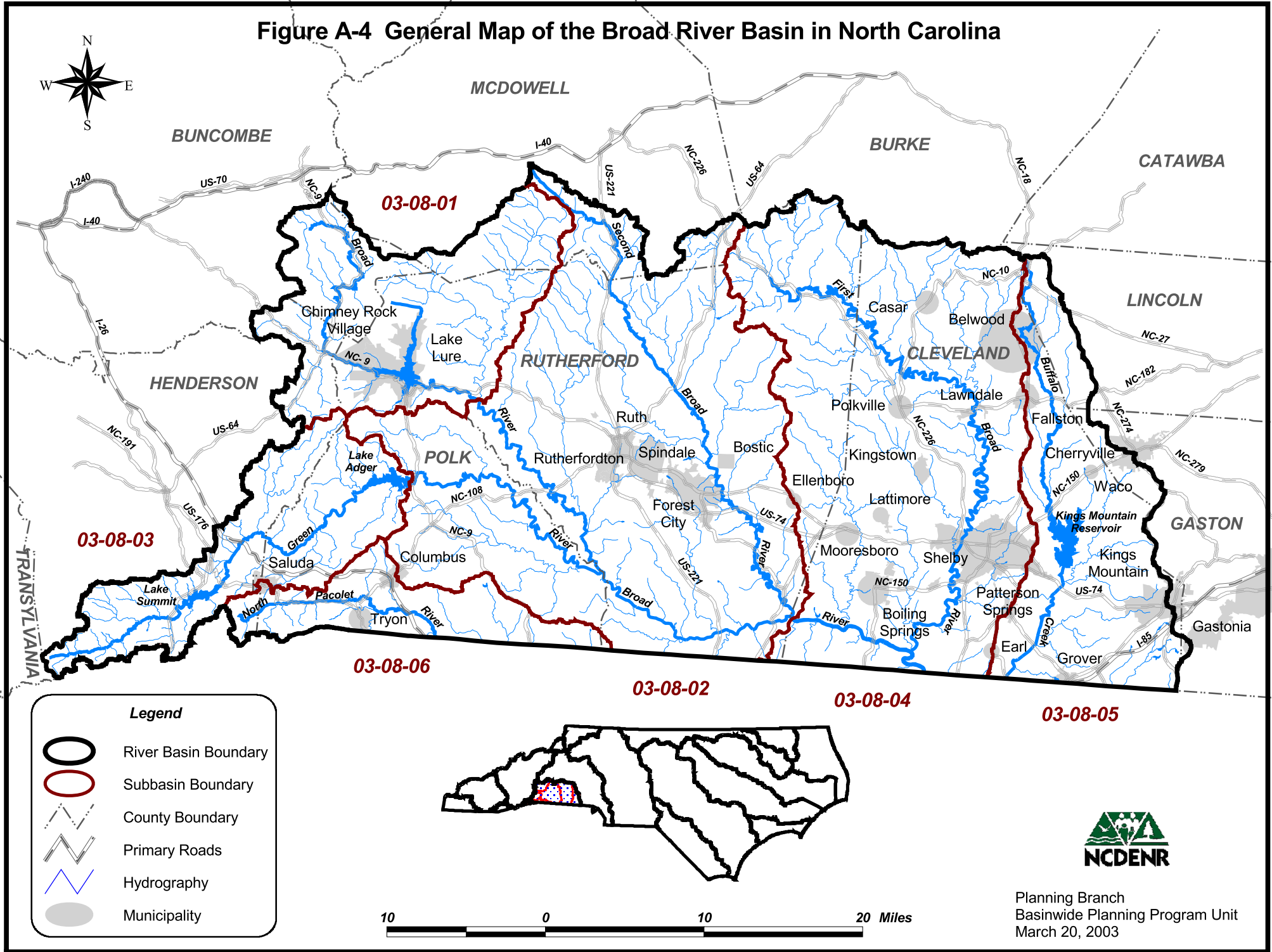
Seventy-four percent of the land in the basin is forested and about 22 percent is in managed pasture lands. Only 2 percent of the land falls into the urban/built-up category. Despite the large amount of forested lands and the relatively small amount of urban area, the basin has seen a significant decrease

(-62,300 acres) in cultivated cropland and increase (+60,500 acres) in developed areas over a 15-year period (1982 to 1997).







The geography of the Broad River basin contributes to its ecological significance. The basin drains a section of the Blue Ridge escarpment, yet the area is primarily within the Piedmont physiographic province providing a wide range of habitat types in the basin. The Broad River basin is home to 15 rare aquatic and wetland-dwelling animal and plant species. Two aquatic animals that are listed as threatened by the State of North Carolina are the bog turtle and the mussel, creeper. The Green Salamander is also listed by the state as endangered. The basin includes a considerable portion of the South Mountains--a biographically rich area that is considered of national importance for its ecological assemblage.

The estimated population of the basin in 2000 was 342,282, and the population is projected to increase 23 percent by 2020. Most of the basin's population is found in subbasin 03-08-02 in Spindale, Rutherfordton and Forest City and in subbasin 03-08-04 in and around Shelby, although there are large number of municipalities scattered throughout the basin.

Figure A-4 General Map of the Broad River Basin in North Carolina



Legend

-  River Basin Boundary
-  Subbasin Boundary
-  County Boundary
-  Primary Roads
-  Hydrography
-  Municipality



Planning Branch
 Basinwide Planning Program Unit
 March 20, 2003

2.2 Local Governments and Planning Jurisdictions in the Basin

The Broad River basin encompasses all or portions of eight counties and 27 municipalities. Table A-3 provides a listing of these municipalities, along with the appropriate regional planning jurisdiction (Council of Governments). Three municipalities are located in more than one major river basin.

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

County	Region	Municipalities
Buncombe	B	None
Cleveland	C	Belwood, Boiling Springs, Casar, Earl, Fallston, Grover, Kings Mountain * ♦, Kingstown, Lattimore, Lawndale, Mooresboro, Patterson Springs, Polkville, Shelby, Waco
Gaston	F	Cherryville ♦, Kings Mountain * ♦
Henderson	B	Saluda *
Lincoln	F	None
McDowell	C	None
Polk	C	Columbus, Saluda *, Tryon
Rutherford	C	Bostic, Chimney Rock Village, Ellensboro, Forest City, Lake Lure, Ruth, Rutherfordton, Spindale

* Located in more than one county.

♦ Located in more than one major 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.

Region	Name	Location
B	Land of Sky Regional Council	Asheville
C	Isothermal Planning and Economic Development Commission	Rutherfordton
F	Centralina Council of Governments	Charlotte

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey (USGS) 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 Broad River basin is made up of one hydrologic area, the Upper Broad. DWQ has a two-tiered system in which the state is subdivided into 17 major river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Broad River basin in North Carolina is subdivided by DWQ into six subbasins. Maps of each subbasin are included in Section B of this plan.

Table A-4 Hydrologic Subdivisions in the Broad River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ Subbasin 6-digit Codes
<i>Upper Broad</i>	03050105	03-08-01
Lake Lure		03-08-01
Second Broad River and tributaries		03-08-02
Middle portion of Broad River		03-08-02
Upper Green River		03-08-03
First Broad River and tributaries		03-08-04
Lower portion of Broad River in NC		03-08-04
Buffalo Creek and tributaries		03-08-05
North Pacolet River and tributaries		03-08-06

The entire Broad River basin is approximately 5,419 square miles in size. In the North Carolina portion (roughly 28 percent of the entire watershed), 1,495 miles of freshwater streams drain 1,513 square miles of terrain. The average drainage area is 0.97 square miles per stream mile. In comparison, the neighboring French Broad and Catawba River basins have an average drainage of 0.68 and 1.09 square miles per stream mile; while the largest river basin in the state, the Cape Fear River basin, drains 1.5 square miles per stream mile. In the Broad River basin, especially in the western portion of the basin, there are many streams draining small areas of land (high drainage density due to mountainous terrain). But in the Cape Fear River basin, there are few streams draining much larger portions of land. Areas with high drainage density are associated with high flood peaks, high sediment production, relatively low suitability for traditional agriculture, and high development costs for the construction of buildings and the installation of roads and bridges.

Hydrologic Features

There are four major reservoirs in the North Carolina portion of the Broad River basin sampled by DWQ. Lake Summit, managed by Northbrook Carolina Hydro LLC, and Lake Adger, managed by Duke Power, are impoundments of the Green River. Both lakes are used for electrical energy production and have no minimum flow requirements. Lake Lure, managed by the Town of Lake Lure, is an impoundment of the mainstem of the Broad River. Although Lake Lure has no minimum flow requirement, a flow of 6.6 cfs is required at the town’s wastewater treatment plant located downstream of the dam. Flows from this reservoir have been shown to negatively influence the quality of water in the Broad River immediately downstream of the dam.

Kings Mountain Reservoir (Moss Lake) is the water source for the Town of Kings Mountain. The dam has a minimum flow requirement of 12.0 cfs. In addition to general protection of aquatic life and secondary recreation, three lakes are classified for primary recreation and one is designated drinking water supply (Table A-5).

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

Subbasin/ Lake	County	Classification*	Surface Area (ac)	Mean Depth (ft)	Volume (x 10 ⁶ m ³)	Watershed (mi ²)
<i>03-08-01</i>						
Lake Lure	Rutherford	B Tr	732	66	12	95
<i>03-08-03</i>						
Lake Adger	Polk	C	460	26	14.4	138
Lake Summit	Henderson	B Tr, C Tr	232	22	11.5	43
<i>03-08-05</i>						
Kings Mountain Reservoir	Cleveland	WS-III CA	530	46	7.4	68

* An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-20 on page 35).

2.4 Land Cover

Land cover information in this section is from the most current National Resources Inventory (NRI), as developed by the United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS, NRI, updated June 2001). The NRI is a statistically based longitudinal survey that has been designed and implemented to inventory land cover types and acreages. 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 includes reviewing previously recorded data when 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 previously published for the 1982, 1987 or 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 and for the major watersheds within the basin, as defined by the USGS 8-digit hydrologic units. Data from 1982 are also provided for a comparison of change over 15 years. During this period, the amount of cultivated cropland in the basin decreased significantly (-62,300 acres), while the amount of uncultivated cropland almost doubled (+14,100 acres). Land in the urban/built-up category increased 146.1 percent or 60,500 acres. Figure A-5 presents these land cover changes. Descriptions of land cover types identified by the NRI are found in Table A-7.

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

LAND COVER	MAJOR WATERSHED AREAS *				
	1997 TOTALS		1982 TOTALS		% change since 1982
	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	
Cult. Crop	48.6	5.1	110.9	11.4	-56.2
Uncult. Crop	31.6	3.3	17.5	1.8	80.6
Pasture	125.6	13.1	120.2	12.4	4.5
Forest	605.2	63.3	640.8	65.9	-5.6
Urban & Built-Up	101.9	10.7	41.4	4.3	146.1
Federal	0.0	0.0	0.0	0.0	0.0
Other	43.5	4.5	41.7	4.3	4.3
Totals	956.4	100.0	972.5	100.0	
SUBBASINS	03-08-01, 03-08-02, 03-08-03 03-08-04, 03-08-05, 03-08-06				
8-Digit Hydraulic Units	03050105				

* = Watershed areas defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.
 Source: USDA, Soil Conservation Service - 1982 and 1997 NRI

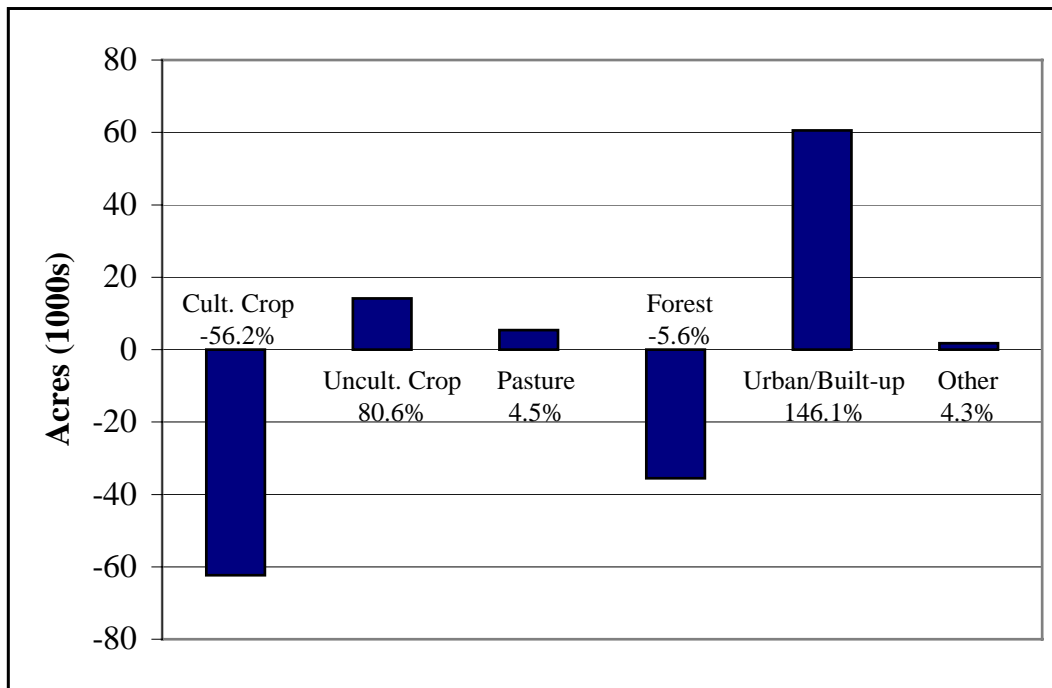


Figure A-5 Land Cover Changes from 1982 to 1997 for the Broad River Basin
 (Source: USDA-NRCS, NRI, updated June 2001)

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

Land Use Type	Land Use 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	<p><i>Rural Transportation:</i> 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).</p> <p><i>Small Water Areas:</i> Waterbodies less than 40 acres in size and streams less than one-half mile wide.</p> <p><i>Census Water:</i> Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width.</p> <p><i>Minor Land:</i> Lands not in one of the other categories.</p>

The North Carolina Corporate Geographic Database contains land cover information for the Broad River basin based on satellite imagery from 1993-1995. The state's Center for Geographic Information and Analysis (CGIA) developed 24 categories of statewide land cover information. 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.

Figure A-6 provides an illustration of the relative amount of land area that falls into each major cover type for the Broad River basin. Section B of this plan provides land cover data specific to each subbasin.

Unfortunately, due to differences in the system of categorizing various land cover classes, it is not currently 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 1993-1995 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.

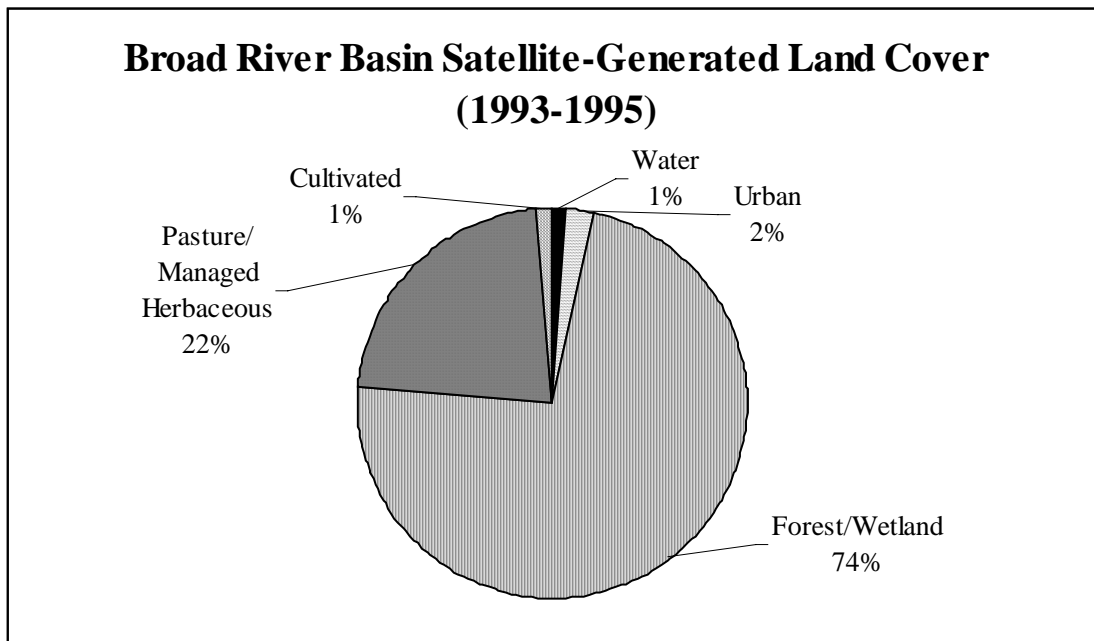


Figure A-6 Percentages within Major CGIA Land Cover Categories in the Broad River Basin

2.5 Population and Growth Trends

Population

The Broad River basin in North Carolina had an estimated population of 169,001 based on 1990 census data. Table A-9 presents census data for 1970, 1980 and 1990. It also includes population densities (persons/square mile) based on the *land area* (excludes open water) for the basin. Most of the basin’s population (67%) is located in subbasins 03-08-02 (Rutherford, Polk and McDowell counties) and 03-08-04 (Rutherford and Cleveland counties). These two subbasins contain approximately 113,503 people.

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

SUBBASIN	POPULATION ¹			POPULATION DENSITY ²			LAND AND WATER AREAS ³			
	(Number of Persons)			(Persons/Square Mile)			Total Land and Water Area		Land Area	Water Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
03-08-01	4,640	7,449	5,659	25	41	31	117,552	183.7	182.5	1.2
03-08-02	47,197	54,704	57,440	92	107	112	328,415	513.2	512.1	1.1
03-08-03	4,793	6,476	8,186	35	48	60	87,495	136.7	136.1	0.6
03-08-04	50,495	55,847	56,063	119	131	132	272,892	426.5	425.1	1.3
03-08-05	26,861	34,317	34,047	151	193	191	115,613	180.6	177.9	2.7
03-08-06	6,454	6,755	7,606	89	93	105	46,608	72.9	72.7	0.2
TOTALS	140,440	165,548	169,001	93	110	112	968,575	1,513.5	1,506.4	7.1

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.

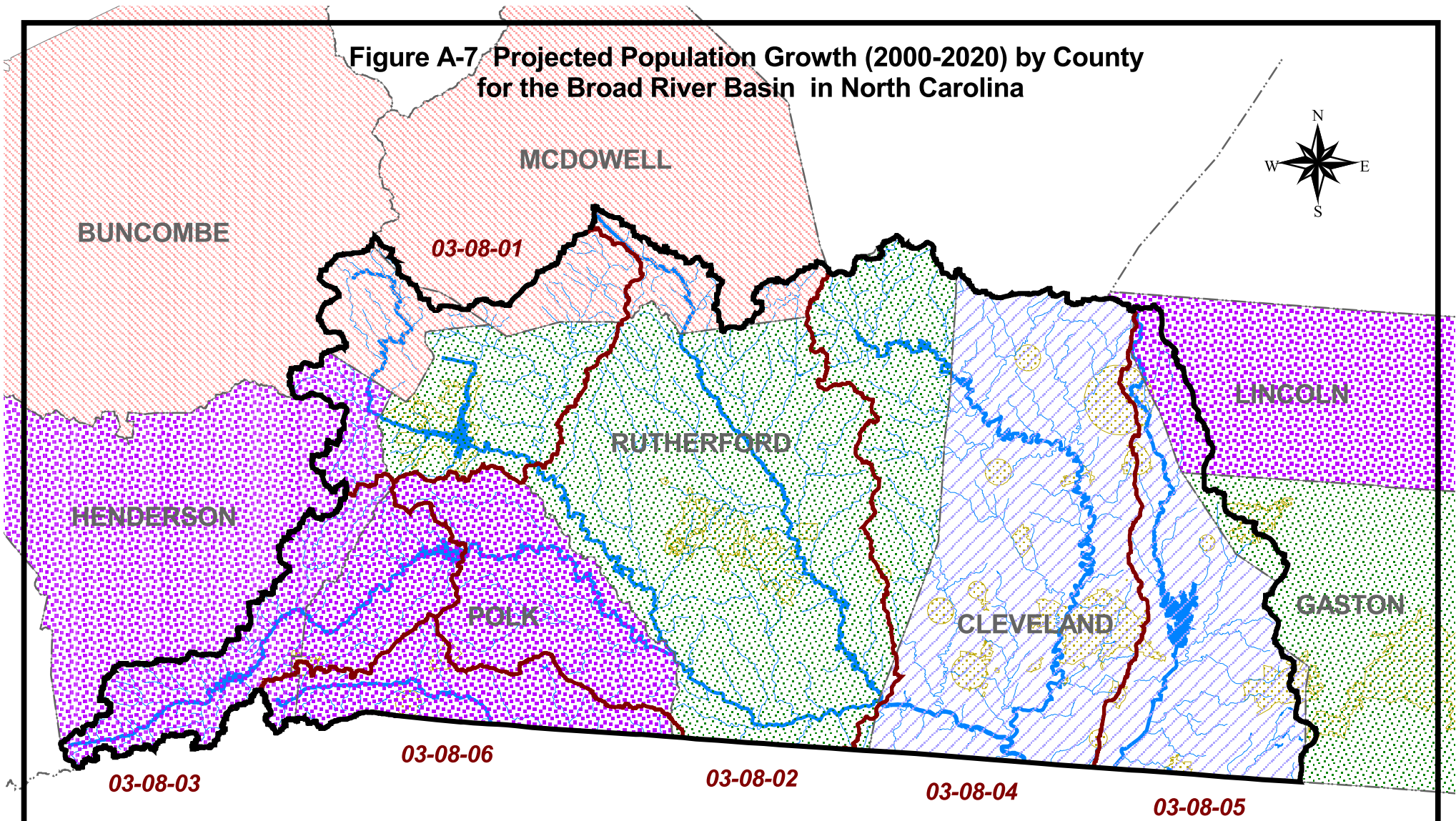
³ Information generated by the NC Center for Geographic Information Analysis, August 2000.

In using these data, it should be noted that 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 in the subbasin. This was done by simply taking the percentage of the census block 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 through the 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.

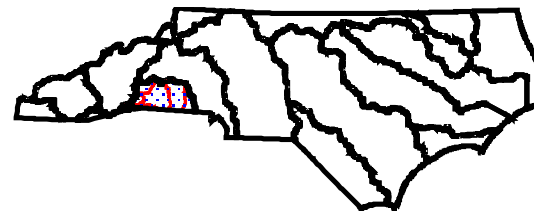
Growth Trends

Population in the North Carolina portion of the Broad River basin over the census period from 1980-1990 increased by 2.1 percent compared to the statewide average growth of 12.7 percent. Figure A-7 presents projected population growth by county (1998-2018) for the Broad River basin in North Carolina. Henderson, Polk and Lincoln counties are growing the fastest, with projections indicating a 20-40 percent increase in population. All of Polk County is contained within the basin, but only 29 percent of Henderson County and 7 percent of Lincoln County fall within the boundary.

Figure A-7 Projected Population Growth (2000-2020) by County for the Broad River Basin in North Carolina



Legend		Projected Population Growth (2000-2020)	
	River Basin Boundary		10 - 15%
	Subbasin Boundary		15 - 20%
	Water		20 - 25%
			25 - 30%



Planning Branch
 Basinwide Planning Program Unit
 March 20, 2003

Table A-10 presents population data for municipalities with populations greater than 2,000 persons, located wholly or partly within the basin. The data indicate that Boiling Springs is currently the fastest growing municipality in the basin with an increase in population of 58 percent from 1990 to 2000. Population in Forest City decreased over the same ten-year period by 7 percent. Population growth in the majority of municipalities in the basin significantly increased between 1990 and 2000.

Table A-10 Population (1980, 1990, 2000) and Population Change for Municipalities Greater Than 2,000 Located Wholly or Partly in the Broad River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	Percent Change (1980-90)	Percent Change (1990-2000)
Boiling Springs	Cleveland	2,381	2,445	3,866	2.7	58.1
Kings Mountain •	Cleveland, Gaston	9,080	8,763	9,693	-3.5	10.6
Shelby	Cleveland	15,310	14,669	19,477	-4.2	32.8
Cherryville •	Gaston	4,844	4,756	5,361	-1.8	12.7
Forest City	Rutherford	7,688	8,137	7,549	5.8	-7.2
Rutherfordton	Rutherford	3,434	3,617	4,131	5.3	14.2
Spindale	Rutherford	4,246	4,040	4,022	-4.9	-0.4

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

Table A-11 shows the projected percent change in growth between 1990, 2000 and 2020 for counties within the basin. Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the Broad River basin. They are instead presented as an estimate of possible countywide population changes. This information was obtained from the Office of State Planning (April and May 2001).

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	Population Change 1990 - 2000	Estimated Pop Change 2000-2020
Buncombe	6%	174,357	206,330	265,457	31,973	59,127
Cleveland	99%	84,958	96,287	115,247	11,329	18,960
Gaston	3%	174,769	190,365	215,587	15,596	25,222
Henderson	29%	69,747	89,173	124,985	19,426	35,812
Lincoln	7%	50,319	63,780	90,778	13,461	26,998
McDowell	14%	35,681	42,151	53,170	6,470	11,019
Polk	100%	14,458	18,324	25,111	3,866	6,787
Rutherford	100%	56,956	62,899	72,952	5,943	10,053
Total		661,245	769,309	963,287	108,064	193,978

* 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.

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

2.6.1 Public Lands in the Broad River Basin

Figure A-8 shows the public lands and significant heritage areas in the Broad River basin. Two NC Wildlife Resources Commission game lands comprise the majority of protected lands in the Broad River basin. The South Mountains Game Land protects almost the entire 17,000-acre Rollins/South Mountains Natural Area, and the Green River Game Land is over 11,000 acres. The Green River Game Land contains four of the five listed Significant Natural Heritage Areas associated with the Green River Headwaters and Gorge.

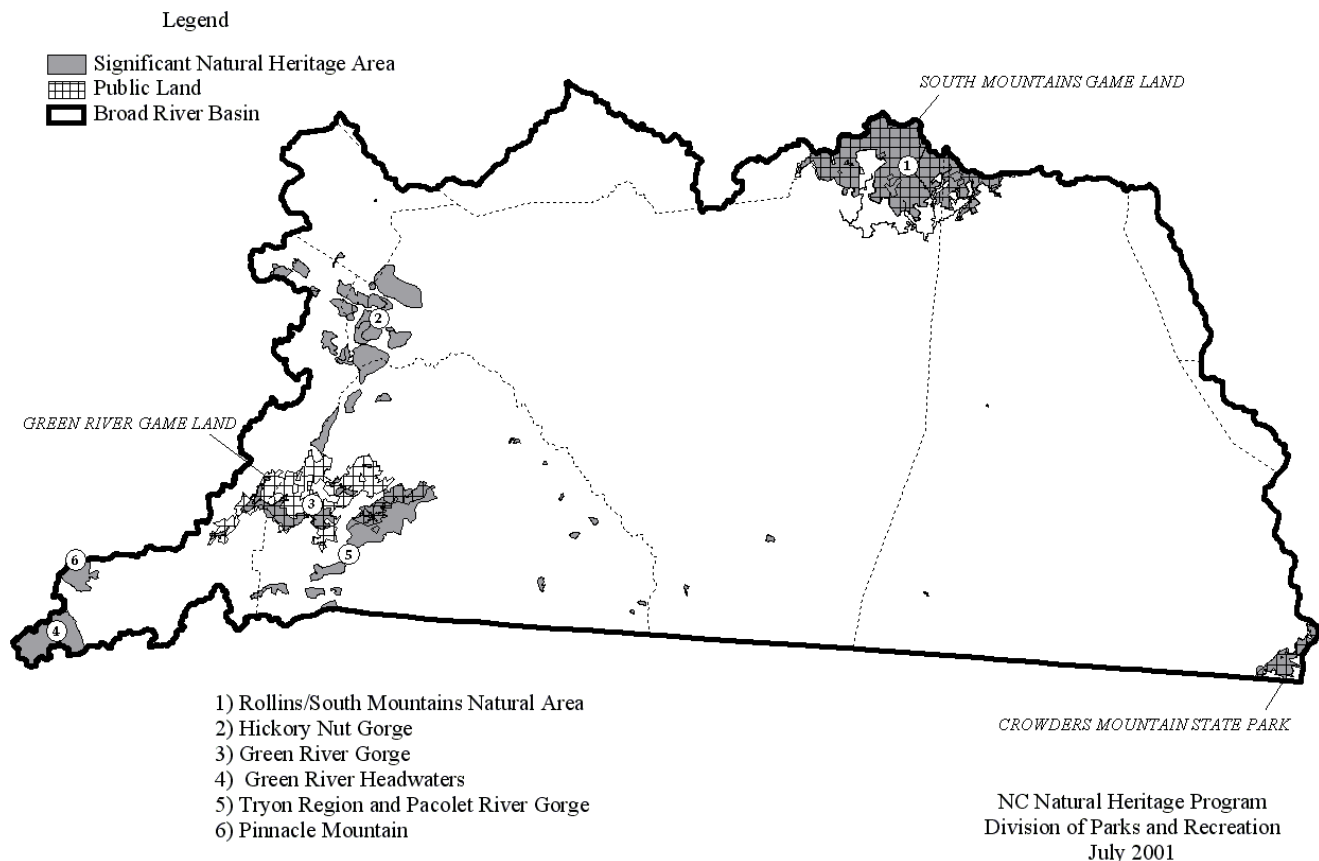


Figure A-8 Public Lands and Significant Natural Heritage Areas of the Broad River Basin

In addition to the extensive game lands, a small proportion of Crowders Mountain State Park lies in the Broad River basin. Crowders Mountain State Park features spectacular vertical ridges that rise nearly 800 feet above the surrounding piedmont hills. Crowders Mountain State Park was established in 1973 as a response to local citizens' desires to protect the ridges from strip mining.

2.6.2 Ecological Significance of the Broad River Basin

The geography of the Broad River basin contributes to its ecological significance. The basin drains a section of the Blue Ridge escarpment, yet the area is predominantly within the Piedmont physiographic province providing a wide range of habitat types in the Broad River basin. The Broad River basin also includes a considerable portion of the South Mountains – a biologically rich area of North Carolina that is considered of national importance for its ecological assemblage.

Wetland Communities

As noted before, the Broad River basin contains a number of habitat types. Some aquatic animals, such as salamanders, are associated with aquatic habitats that are not necessarily riverine. Wetlands in the Broad River basin exist across a range of landscapes, from river channels to isolated hillsides.

One type of wetland found in or adjacent to rivers and streams in the Broad River basin is known as Rocky Bar and Shore. These wetlands are actually rock outcrops and gravel bars which are too rocky, too wet, or too severely flooded to support large trees. Shrubs and herbs such as alder, buttonbush, willow, dogwood, cane, waterwillow, jewelweed and various sedges dominate the vegetation. High quality examples of Rocky Bar and Shore occur along the Broad River and the Green River.

Montane Alluvial Forest wetlands are found in floodplains of the Broad River basin. These forested wetland communities are dominated by trees such as hemlock, sycamore, white oak and tulip poplar, with ironwood, witch hazel and black willow underneath. High quality examples, which are very rare in North Carolina, occur along the Broad River, Green River and Little Sugarloaf Creek.

At the edges of floodplains in the Broad River basin can be found wetland communities known as Low Elevation Seeps. These are often very small wetlands located at the bases of slopes; they are partially shaded by canopies of trees rooted in adjacent communities. Low Elevation Seeps seem to be very important foraging and breeding habitats for amphibians such as salamanders and frogs. Similar to Low Elevation Seeps are wetlands called Hillside Seepage Bogs. These wetland communities are fed by groundwater seepage and typically have trees at the edges of the wet, open interior. Hillside Seepage Bogs, which are very rare in North Carolina, are characterized by well developed *Sphagnum* moss mats and typical bog plant species.

A unique wetland community called Spray Cliff occurs in the Broad River basin in association with waterfalls. Spray Cliff communities are constantly wet from the spray of waterfalls, and the plants -- mostly mosses, liverworts, algae and vascular herbs -- that grow on patches of soil along the rock faces are adapted to moist environments more typical of the tropics. Spray Cliffs support many endemic bryophytes and rare plant species.

2.6.3 Rare Aquatic and Wetland-Dwelling Animal Species

Table A-12 Rare and Threatened Aquatic Species in the Broad River Basin (as of July 2001)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
aq insect	Caddisfly	<i>Triaenodes marginata</i>	SR	
aq insect	Caddisfly	<i>Micrasema sprulesi</i>	SR	
aq insect	Mayfly	<i>Homoeoneuria cahabensis</i>	SR	
mollusk	Creeper	<i>Strophitus undulatus</i>	T	
crustacean	Broad River spiny crayfish	<i>Cambarus spicatus</i>	SR	
crustacean	Broad River stream crayfish	<i>Cambarus lenati</i>	SR	
fish	Closter's brook-hypnum	<i>Hygrohypnum closteri</i>	SR	
fish	Santee chub – Piedmont population	<i>Cyprinella zanema</i>	SR	
reptile	Bog turtle	<i>Clemmys muhlenbergii</i>	T	T
reptile	Green salamander	<i>Aneides aeneus</i>	E	SC
reptile	Mole salamander	<i>Ambystoma talpoideum</i>	SC	
reptile	Crevice salamander	<i>Plethodon yonahlossee</i>	SC	
plant	Mountain sweet pitcher plant	<i>Sarracenia jonesii</i>	E-SC	E
plant	Fen orchid	<i>Liparis loeselii</i>	T-SC	
plant	Gray's lily	<i>Lilium grayi</i>	T-SC	SC

Rare Species Listing Criteria

- E = Endangered (those species in danger of becoming extinct)
- T = Threatened (considered likely to become endangered within the foreseeable future)
- SR = Significantly Rare (those whose numbers are small and whose populations need monitoring)
- SC = Species of Special Concern

Three aquatic insects from the Broad River basin – *Triaenodes marginata*, *Micrasema sprulesi* and *Homoeoneuria cahabensis* – are considered Significantly Rare and do not have common names. The lack of a common name shows the rareness of these aquatic insects. The first two are caddisflies and make their living in the stream by breaking down living plant tissue. The last insect, *Homoeoneuria cahabensis*, is a mayfly. This species burrows into the bottom of larger rivers, sustaining itself by collecting or filtering out food from the water's current.

The **creeper** is a freshwater mussel found throughout both the Atlantic and Mississippi drainages. It is present in most of the Piedmont drainages in North Carolina. Although a wide-ranging species during the last century, the creeper has become quite rare in many areas where it was once considered extremely common.

The **Broad River spiny crayfish** is found in streams of small to medium size with trapped leaf litter, and its range is restricted to only a handful of areas in North and South Carolina. The

species has become threatened range-wide, as its habitat is being converted to urban uses and as streams are dammed to form impoundments for recreational uses. The Broad River spiny crayfish is somewhat resilient. However, it cannot survive impoundments on its habitat streams.

The discovery and description of the **Broad River stream crayfish** is recent enough that little information has been collected and published about its life history. It is endemic to the Broad River basin in North Carolina and only found in about five or six locations.

The **Santee chub** is an interesting fish that occurs in two distinct populations in North Carolina. One population is found only in the Catawba and Broad River drainages of North Carolina's Piedmont, while another population is found in the state's Coastal Plain in the Cape Fear and Lumber River drainages. This species is endemic to portions of North and South Carolina. The Piedmont population usually inhabits moderately high velocity streams over pebbles and gravel.

The **bog turtle** is recognized by the bright orange patches on the side of its head. As its name suggests, the bog turtle makes its home in sphagnum moss bogs, marshy meadows and wet pastures. Burrowing into soft mud, this small and secretive turtle can remain buried for considerable periods of time. In the Broad River basin, bog turtles are found in communities known as Hillside Seepage Bogs and Wet Pastures.

Being amphibians, salamanders require aquatic habitats for at least a portion of their lives. Three rare species of salamander occur in the Broad River basin. The **green salamander** is found in the damp shaded crevices of cliffs or rock outcrops in deciduous forests. The **mole salamander** is a short, stocky salamander typically associated with extensive floodplain forests in the Coastal Plain. However, in the mountains of North Carolina, it is found in upland forests surrounding vernal pools. The aquatic larvae of the mole salamander feed mostly on macroinvertebrates, and many local populations of the salamander have been lost as native forests and their associated wetlands have been converted to agricultural and urban areas. The third rare salamander found in the Broad River basin is sometimes known as the **crevice salamander**. Also known as the Bat Cave Variant, this salamander takes its common name from its tendency to dwell in crevices.

2.6.4 Significant Natural Heritage Areas in the Broad River Basin

Refer again to Figure A-8 for a general location of the areas discussed below.

Rollins/South Mountains Natural Area

Of national ecological significance, the 17,000-acre Rollins/South Mountains Natural Area contains an impressive array of high quality natural communities, rare animal populations, and three federally-listed and 20 state-listed rare plants. This intact forested area, tucked into the northeast corner of Rutherford County and stretching into Cleveland and McDowell counties, shelters the watershed that supplies drinking water to the Town of Shelby. The impressiveness of the Rollins/South Mountains Natural Area is enhanced by its proximity to other protected natural areas, including South Mountains State Park, and Morganton, Broughton and School for the Deaf watersheds. State funding from the Natural Heritage Trust Fund and the North Carolina Clean Water Management Trust Fund led to the acquisition of the Rollins/South Mountains Natural Area by the NC Wildlife Resources Commission. In addition to protecting the water

supply for the Town of Shelby, the Rollins/South Mountains Natural Area will serve as recreation lands and game lands for the citizens of North Carolina.

Hickorynut Gorge

Located near Asheville on the edge of the Blue Ridge Escarpment, Hickorynut Gorge is an area of exceptional ecological significance. Its variety of high quality natural communities and abundance of rare plants and animals is due in part to the area's geology - geologic faults, caves, sheer cliffs, peaks, waterfalls and granitic domes characterize the landscape around the gorge as it drops 1,800 feet from the mountains to the Piedmont. The Hickorynut Gorge area is composed of a number of individual sites that have been identified as having special ecological significance in themselves, and several of the most crucial Significant Natural Heritage Areas are listed below:

- Rumbling Bald and Shumont Mountain
- World's Edge/Sugarloaf Mountain
- Bald Mountain/Rainbow Falls
- Bat Cave
- Cane Creek Mountain
- Chimney Rock Natural Area
- Cloven Cliffs/The Pinnacles
- Little Bearwallow Mountain

Green River Headwaters and Gorge

The Green River Headwaters and Gorge are composed of two sets of Significant Natural Heritage Areas, those in the headwaters of the Green River, and those downstream in the Narrows of the gorge. The assemblages of plants, animals and natural communities along the Green River are among the highest quality occurrences in North Carolina. The headwaters are buffered by intact, good quality forest communities which help to protect the integrity of the Green River. Additionally, the 4,000-acre headwaters area is valuable for its landscape role connecting an adjacent natural area in South Carolina (Mountain Bridge) to Stone Mountain and Pinnacle Mountain to the north. At the Narrows, the gorge is 1,000 feet deep. The following Significant Natural Heritage Areas constitute the highest quality sites along the Green River and should be considered for preservation both for water quality and ecosystem functions:

- Cove Creek/Bradley Falls Natural Area
- Green River Gorge
- Green River Headwaters
- Laurel Branch Creek Gorge/Buckeye Ford
- Lower Hungry River Gorge

Tryon Region and Pacolet River Gorge

A collection of Significant Natural Heritage Areas in south-central Polk County is noted for its natural communities and rare plants. Well developed rich forests on slopes of Tryon Peak and unique cliff communities are interspersed with caves, streams, ridges and valleys. Dominated by

White Oak Mountain, the Tryon Region encompasses several high quality natural areas, including:

- White Oak Mountain/Tryon Peak
- Tryon Reservoir/Twin Lakes/Big Fall Creek Natural Area
- Cedar Cliff/Warrior Mountains
- Melrose Mountain
- Pearsons Falls Glen/Pacolet River Bluffs

Pinnacle Mountain

Also known as Wolf’s Lair, Pinnacle Mountain is part of a larger landscape of natural areas (along with the Green River Headwaters and Gorge) known as Buck Forest. One of the richest sites (in total species) in the Green River drainage, Pinnacle Mountain’s habitats include rock outcrops and cliffs, rich high elevation communities, open mixed hardwoods, rich cove hardwoods, Canada hemlock ravines, nonforested open land, and a wetland pond/bog/marsh complex.

2.7 Permitted Wastewater and Stormwater Discharge Facilities

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities 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
- * color
- * toxic substances including chlorine, ammonia and metals

2.7.1 Wastewater Discharges in the Broad River Basin

Currently, there are 48 permitted wastewater discharges in the Broad River basin. Table A-13 provides summary information (numbers of facilities and permitted flows) about the discharges by subbasin and type. Subbasin maps in Section B depict the locations of NPDES permitted discharges. Detailed information, including a key to discharge location numbers, is provided in Appendix I.

Table A-13 Summary of NPDES Dischargers and Permitted Flows

Facility Categories	Broad River Subbasin						TOTAL
	03-08-01	03-08-02	03-08-03	03-08-04	03-08-05	03-08-06	
Total Facilities	1	16	1	14	8	8	48
Total Permitted Flow (MGD)	0.995	18.6	0.02	8.8	7.3	2.3	38.0
Major Discharges	0	6	0	3	3	2	14
Total Permitted Flow (MGD)	0.0	15.9	0.0	8.1	7.2	1.9	33.1
Minor Discharges	1	10	1	11	5	6	34
Total Permitted Flow (MGD)	0.995	2.7	0.02	0.7	0.1	0.4	4.9
100% Domestic Waste	0	6	1	5	1	3	16
Total Permitted Flow (MGD)	0.0	0.1	0.02	0.1	0.01	0.03	0.3
Municipal Facilities	1	5	0	2	2	2	12
Total Permitted Flow (MGD)	0.995	13.3	0.0	6.6	6.1	1.6	28.6
Nonmunicipal Facilities	0	11	1	12	6	6	36
Total Permitted Flow (MGD)	0.0	5.2	0.02	2.2	1.2	0.7	9.3

The majority of NPDES permitted discharges in the Broad River basin are from wastewater treatment plants serving communities and schools. Many of them are small facilities with less than one million gallons of flow per day. However, there are a few larger discharges in the basin as well. Facilities, large or small, where recent data show problems with a discharge are listed and discussed in each subbasin chapter in Section B.

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, and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

2.7.2 Stormwater Discharges in the Broad River Basin

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.

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.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. No municipalities in the Broad 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. However, Shelby will be considered for inclusion under the Phase II rules because of a population greater than 10,000 and/or a population density greater than 1000 persons per square mile. DWQ is currently developing criteria that will be used to determine whether these and other municipalities should be required to obtain a NPDES 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 construction stormwater general permits, there are no general stormwater permits and two individual permits active within the Broad River basin. Individual permit holders are presented in Appendix I.

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 may also be required to conduct analytical monitoring to characterize pollutants in stormwater discharges.

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

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.

Table A-14 summarizes, by subbasin, the number of registered livestock operations, total number of animals, total acres in operation, and total steady state live weight as of January 2000. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

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

Table A-14 Registered Animal Operations in the Broad River Basin (as of December 5, 2001)

Subbasin	Cattle			Poultry			Swine		
	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight
03-08-01	1	150	210,000	--	--	--	--	--	--
03-08-02	2	380	532,000	--	--	--	--	--	--
03-08-03	--	--	--	--	--	--	--	--	--
03-08-04	3	765	813,000	--	--	--	1	4,000	566,800
03-08-05	1	640	896,000	--	--	--	--	--	--
03-08-06	--	--	--	--	--	--	--	--	--
Totals	7	1,935	2,451,000	--	--	--	1	4,000	566,800

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 Broad River basin. Overall, swine and dairy production in the Broad River basin decreased this decade while poultry production has increased.

Table A-15 Estimated Populations of Swine, Dairy and Poultry in the Broad 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 (%)
03-08-01	7	263	-97	--	--	--	23,000	--	100+
03-08-02	73	1,743	-96	1,263	1,782	-29	342,454	149,454	129
03-08-03	36	49	-27	--	--	--	--	--	--
03-08-04	5,167	5,319	-3	1,148	910	26	1,230,261	1,234,161	--
03-08-05	74	354	-79	--	9	-100	403,476	165,459	144
03-08-06	2	2	--	115	115	--	13,300	13,300	--
TOTALS	5,359	7,730	-31	2,526	2,816	-10	2,012,491	1,562,374	29
% of State Total	<1%	<1%		3%	2%		<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 the majority of overall water needs in the North Carolina portion of the Broad River basin (approximately 83 percent of estimated total water use). In 1997, 15 public water systems used water from the basin providing 26 million gallons of water per day to 100,887 people in the basin. Water demand from these public systems is projected to increase 56 percent by 2020. Four of the 19 systems (21 percent) reported that available supply was not adequate to meet estimated demand through 2020, and one other system (5.2 percent) reported that by 2020 demand levels will exceed 80 percent of available supply.

Not everyone gets water from public water supply systems. Many households and some commercial and industrial operations supply their own water from both surface water and groundwater sources in the basin. The US Geological Survey estimates that self-supplied users, excluding power-generating facilities, account for 51.2 percent of the total water used in the

Broad River basin. Water used for industrial and irrigation purposes comprises the majority of self-supplied water use in the basin (Figure A-9).

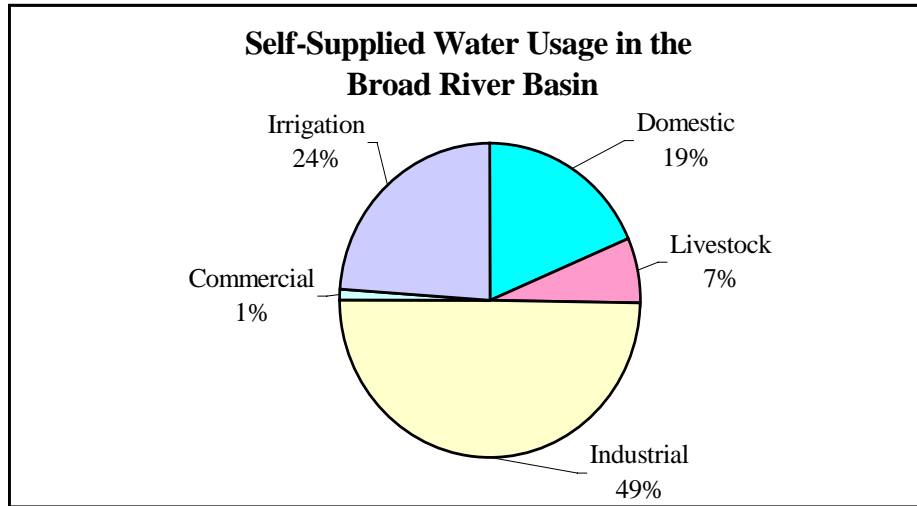


Figure A-9 Estimated Self-Supplied Water Use in the Broad River Basin (NCDENR-DWR, January 2001)

The State Water Supply Plan is a compilation of over 500 LWSPs developed by local government water systems in North Carolina. More detailed information is available in the plan about water supply and water usage in the Broad River basin. This plan 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 (DWR) only if the amount was 1,000,000 gallons or more of surface water or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 gallons per day. Table A-16 presents registered withdrawals.

There are 16 registered water withdrawals in the North Carolina portion of the Broad River basin. Nine of these (56 percent) are surface water withdrawals. Excluding power generating facilities, there is a cumulative permitted capacity to withdraw 4.4 million gallons of water per day.

Table A-16 Registered Water Withdrawals in the Broad River Basin (August 2000)

County	2000 Average for Days Used (MGD)	2000 Maximum for Days Used (MGD)	Source Of Withdrawal	Facility
Rutherford	1.2	2.4	Second Broad River	Burlington Industries – J.C. Cowan Plant
Cleveland	170.89	288	Broad River	Duke Energy Corp. – Cliffside Steam Station
Henderson	54	188	Lake Summit	Duke Energy Corp. – Tuxedo Hydro-Electric Facility
Cleveland	0.01	0.024	Quarry	Martin Marietta Materials Inc. – Kings Mountain Quarry
Rutherford	0.017	0.017	Groundwater	Heater Utilities, Inc. – Mid-South-Bridges CWS
Rutherford	0.006	0.006	Groundwater	Heater Utilities, Inc. – Mid-South-Holly Hills
Henderson	0.013	0.013	Groundwater	Heater Utilities, Inc. – Mid-South-Tuxedo
Polk	0.003	0.003	Groundwater	Heater Utilities, Inc. – Mid-South-Valley Court Estates
Henderson	0.49	0.816	King Creek	Kenmure Country Club – Kenmure Golf Course
Cleveland	0.138	0.226	Lake or Pond	Cleveland Country Club Golf Course
Cleveland	0.686	1.09	Buffalo Creek	CNA Holings, Inc. – Ticona-Shelby Facility
Cleveland	0.56	0.92	First Broad River	Cleveland-Caroknit
Polk	Not Reported	Not Reported	Green River	Northbrook Carolina Hydro LLC – Turner Shoals Plant
Cleveland	Not Reported	Not Reported	First Broad River	Northbrook Carolina Hydro LLC – Spencer Mountain
Rutherford	0.053	0.11	Groundwater	Carolina Water Service Inc. of NC – Fairfield Apple Valley
Rutherford	0.103	0.199	Groundwater	Carolina Water Service Inc. of NC – Fairfield Mountain

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 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. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

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 Broad River basin.

Table A-17 lists five known potential transfers involving the North Carolina portion of the Broad River basin (not required to be certified). Approximately 1.5 MGD is transferred out of the basin to the Catawba River basin, and a relatively small unknown quantity is transferred into the basin for an estimated net loss of water. Please note that all local water systems are now required to report existing and anticipated interbasin transfers as part of the Local Water Supply Planning process. This information will be available for future updates of this basinwide plan and will allow for a better assessment of cumulative impacts.

Table A-17 Interbasin Transfers in the Broad River Basin (1997)

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD)
Kings Mountain	Kings Mountain	Broad River	Catawba River	0.288
Kings Mountain	Gastonia WWTP	Broad River	S. Fork Catawba River	1.186
Cherryville	Cherryville	S. Fork Catawba River	Broad River	Unknown
Hendersonville	Hendersonville	French Broad River	Broad River	<0.1
Hendersonville	Saluda	French Broad River	Broad River	0.151

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

Table A-18 Hydropower Dams and Dams with a Minimum Streamflow Requirement in the Broad River Basin

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release (cu. ft/sec)
<i>Dams associated with Hydropower Production</i>				
Stice Shoals	South of Shelby, NC	First Broad River	288.0	None
Cliffside	At the Town of Cliffside, NC	Second Broad River	220.0	None
Henrietta*	At the Town of Henrietta, NC	Second Broad River	206.0	60
Caroleen	At the Town of Caroleen, NC	Second Broad River	199.0	None ¹
Lake Lure	At the Town of Lake Lure, NC	Broad River	95.0	None ²
Gaston Shoal	North of Gaffney, SC ³	Broad River	1250.0	150 (Jun-Feb) 350 (Mar-May)
Lake Adger	South of Lake Lure, NC	Green River	138.0	None
Lake Summit	South of Zirconia, NC	Green River	42.6	None
<i>Other Impoundments</i>				
Kings Mountain Reservoir	At the Town of Stubbs, NC	Buffalo Creek	68.1	12.0
Pavillon	South of Lake Lure, NC	Britten Creek	4.1	2.0

* Project is not yet complete.

Notes

- ¹ Even though there is no minimum flow, the project must operate in a run-of-river mode; i.e., instantaneous inflow equals outflow. Note: A noncompliant project can noticeably alter the streamflow.
- ² Although no minimum flow requirement is attached to Lake Lure dam safety permit, a flow of 6.6 cfs is required at the town's wastewater treatment plant located downstream of the dam.
- ³ Impounds water upstream into NC.

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'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.

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 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. Restoration projects are also funded through the Wetland Restoration Program (WRP), Section 319 Program, Clean Water Management Trust Fund and Division of Water Resources Grant Program that can help offset stream and wetland impacts.

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. The magnitude of unauthorized impacts to wetlands and streams is not known.