

Section A: Chapter 2

Yadkin-Pee Dee River Basin Overview

2.1 General Overview

From its headwaters in northwestern North Carolina and southern Virginia, the Yadkin River flows southeast across North Carolina’s densely populated midsection. Three of the state’s five interstate highways cross the upper half of the basin, carrying people and goods between some of

Yadkin-Pee Dee River Basin Statistics (NC Portion)
Total Area: 7,221 sq. miles
Stream Miles: 5,862
Lake Acres: 22,988
No. of Counties: 21
No. of Municipalities: 93
No. of Subbasins: 17
Population (2000): 1,463,535*
Estimated Pop. (2020): 1,990,838*
% Increase (2000-2020): 36%
Pop. Density (1990): 163 persons/sq. mi.
* Based on % of county land area estimated to be within the basin.

the state’s major municipalities including Winston-Salem, Statesville, Lexington, Salisbury, Kannapolis and Concord. The Yadkin River is impounded several times before merging with the Uwharrie River to become the Pee Dee, creating two of the largest lakes in a chain of six. Ultimately the Pee Dee River empties into the Atlantic Ocean at Winyah Bay near Georgetown and Myrtle Beach, South Carolina. Figure A-4 presents the entire Yadkin-Pee Dee River basin, including the Yadkin-Pee Dee and Lumber River basins in North Carolina and the Pee Dee River basin in South Carolina.

The North Carolina portion of the basin (Figure A-5) includes portions of 21 counties and 93 municipalities. Most of the basin’s estimated 1.5 million people are located along the I-40 and I-85 corridors and in the areas surrounding Winston-Salem, Salisbury and Charlotte. The basin population is projected to increase 36 percent to nearly two million people by 2020.

Approximately 50 percent of land in the basin is forested, and more than 95 percent is in private ownership. Nearly 30 percent is used for agriculture, including cultivated and uncultivated cropland (15.6 percent) and pastureland (14.1 percent). About 13 percent of the land is developed. Comparisons between land use in 1982 and 1997 show significant decreases in the amount of cultivated cropland and forested land in the basin. There were notable increases in the amount of uncultivated cropland and pastureland. However, a substantial increase in the urban/built-up land use category occurred over the 15-year period. In addition, nearly 43 percent of the increase in developed area occurred within a five-year period between 1992 and 1997.

Originating in the Blue Ridge Mountains, and draining portions of North Carolina’s Piedmont, Sandhills and Coastal Plain, it is no surprise that the Yadkin-Pee Dee River basin contains a wide variety of habitat types, as well as many rare plants and animals. The large river serves as a corridor for plants and animals migrating from the mountains to the Coastal Plain, and vice-versa. The basin contains 38 aquatic species that are endangered, threatened, of special concern or significantly rare by the NC Natural Heritage Program.

Figure A-4 General Map of the Entire Yadkin-Pee Dee River Basin

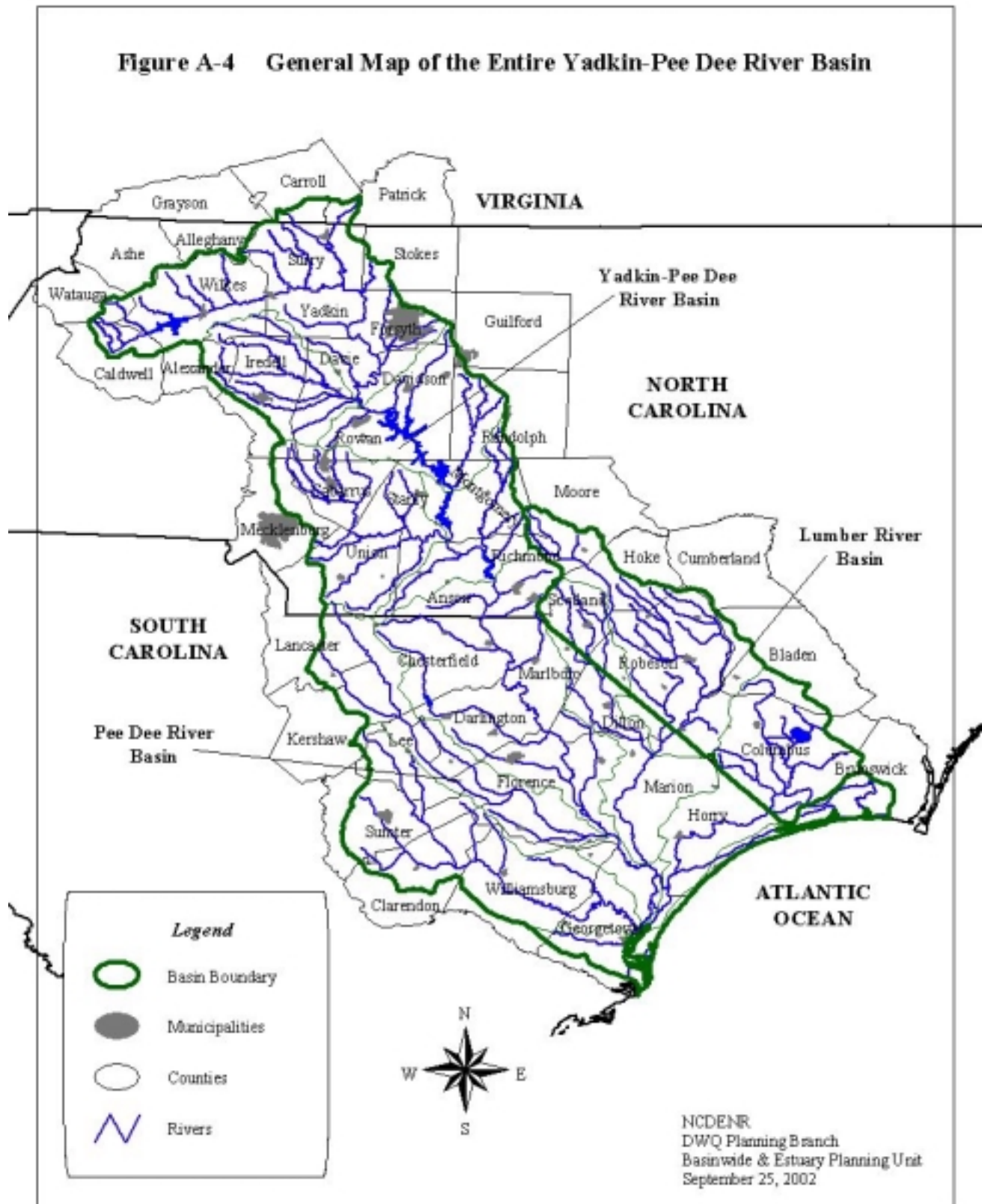
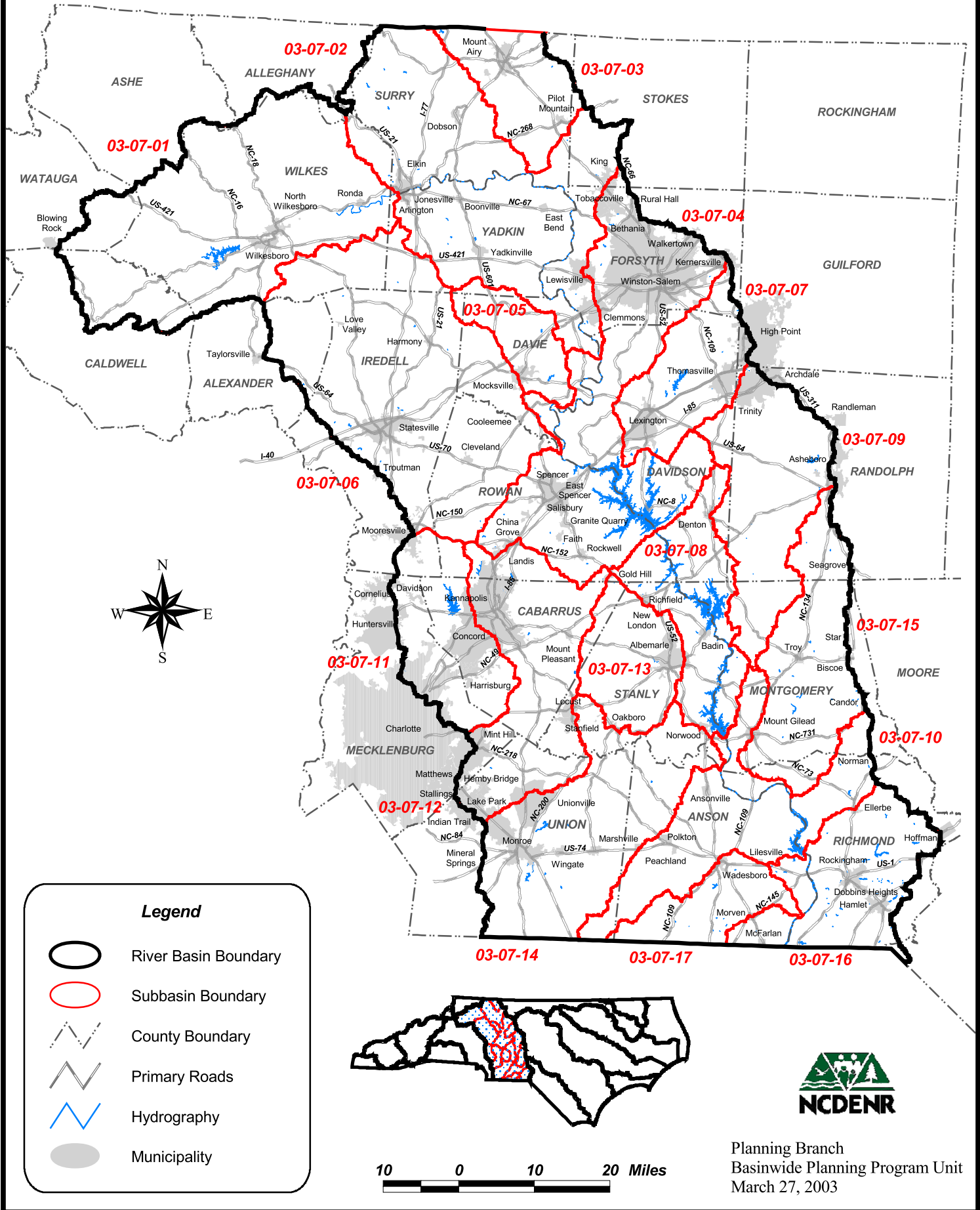








Figure A-4 General Map of the Entire Yadkin-Pee Dee River Basin

Figure A-5 General Map of the Yadkin-Pee Dee River Basin in North Carolina



Legend

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



Planning Branch
 Basinwide Planning Program Unit
 March 27, 2003

10 0 10 20 Miles

2.2 Local Governments and Planning Jurisdictions in the Basin

The North Carolina portion of the Yadkin-Pee Dee River basin encompasses all or portions of 93 municipalities and 21 counties. Table A-3 provides a listing of these local governments, along with the appropriate regional planning jurisdiction (Council of Governments). Twenty-five municipalities are located in more than one major river basin.

Table A-3 Local Governments and Planning Units within the Yadkin-Pee Dee River Basin

County	Region	Municipalities
Alexander	E	Taylorsville ♦
Alleghany	D	None
Anson	H	Ansonville, Lilesville, McFarlan, Morven, Peachland, Polkton, Wadesboro
Cabarrus	F	Concord, Harrisburg, Kannapolis *, Locust *, Mount Pleasant
Caldwell	E	Blowing Rock * ♦
Davidson	G	Denton, High Point * ♦, Lexington, Thomasville *
Davie	I	Bermuda Run, Cooleemee, Mocksville
Forsyth	I	Bethania, Clemmons, High Point * ♦, Kernersville * ♦, King *, Lewisville, Rural Hall ♦, Tobaccoville *, Walkertown ♦, Winston-Salem
Guilford	G	Archdale * ♦, High Point * ♦, Kernersville * ♦
Iredell	F	Davidson * ♦, Harmony, Love Valley, Mooresville ♦, Statesville, Troutman ♦
Mecklenburg	F	Charlotte ♦, Cornelius ♦, Davidson * ♦, Huntersville ♦, Matthews ♦, Mint Hill ♦
Montgomery	H	Biscoe ♦, Candor ♦, Mount Gilead, Star ♦, Troy
Randolph	G	Archdale * ♦, Asheboro ♦, High Point * ♦, Randleman ♦, Seagrove ♦, Thomasville *, Trinity
Richmond	H	Dobbins Heights, Ellerbe, Hamlet, Hoffman ♦, Norman ♦, Rockingham
Rowan	F	China Grove, Cleveland, East Spencer, Faith, Granite Quarry, Kannapolis *, Landis, Rockwell, Salisbury, Spencer
Stanly	F	Albemarle, Badin, Locust *, New London, Norwood, Oakboro, Richfield, Stanfield
Stokes	I	King *, Tobaccoville *
Surry	I	Dobson, Elkin *, Mount Airy, Pilot Mountain
Union	F	Hemby Bridge, Indian Trail ♦, Lake Park, Marshville, Monroe, Stallings ♦, Unionville, Wingate
Watauga	D	Blowing Rock * ♦
Wilkes	D	Elkin *, North Wilkesboro, Ronda, Wilkesboro
Yadkin	I	Arlington, Boonville, East Bend, Jonesville, Yadkinville

* 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 percent) is located in that basin, unless a municipality is located in that county. (Note: Guilford County is only included because of the municipalities, Archdale, High Point and Kernersville.)

Region	Name	Location
D	Region D Council of Governments	Boone
E	Western Piedmont Council of Governments	Hickory
F	Centralina Council of Governments	Charlotte
G	Piedmont Triad Council of Governments	Greensboro
H	Pee Dee Council of Governments	Rockingham
I	Northwest Piedmont Council of Governments	Winston-Salem

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey and the Natural Resources Conservation Service, 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 Yadkin-Pee Dee River basin is made up of seven hydrologic areas referred to as hydrologic units. These include the Upper Yadkin River, South Yadkin River, Lower Yadkin River, Upper Pee Dee River, Rocky River, Lower Pee Dee River and Lynches River. Each hydrologic unit is defined by an 8-digit number (USDA, November 1995). DWQ has a two-tiered system in which the state is subdivided into river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Yadkin-Pee Dee River basin in North Carolina is subdivided by DWQ into 17 subbasins. Maps of each subbasin are included in Section B.

Table A-4 Hydrologic Subdivisions in the Yadkin-Pee Dee River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ Subbasin 6-digit Codes
<i>Upper Yadkin River</i> Stoney Fork, Reddies Creek and Roaring River Mitchell River, Fisher River and South Deep Creek Ararat River Muddy Creek and South Fork Muddy Creek Dutchman Creek	03040101	03-07-01 03-07-02 03-07-03 03-07-04 03-07-05
<i>South Yadkin River</i> Hunting Creek, Fourth Creek, Third Creek and Second Creek	03040102	03-07-06
<i>Lower Yadkin River</i> High Rock Lake and Grants Creek Abbotts Creek, Rich Fork and Hamby Creek Lower Yadkin River Uwharrie River and Caraway Creek	03040103	03-07-04 03-07-07 03-07-08 03-07-09
<i>Upper Pee Dee River</i> Badin Lake and Lake Tillery Blewett Falls Lake, Brown Creek and Mountain Creek Little River	03040104	03-07-08 03-07-10 03-07-15
<i>Rocky River</i> Coddle Creek Dutch Buffalo Creek and Irish Buffalo Creek Big Bear Creek and Long Creek Richardson Creek	03040105	03-07-11 03-07-12 03-07-13 03-07-14
<i>Lower Pee Dee River</i> Hitchcock Creek Jones Creek	03040201	03-07-16 03-07-17
<i>Lynches River</i> Lanes Creek	03040202	03-07-14

In the North Carolina portion of the Yadkin-Pee Dee River basin (roughly 50 percent of the entire watershed), 5,862 miles of freshwater streams drain 7,221 square miles of terrain. The

uppermost portion of the basin (western part of Wilkes and Caldwell counties in subbasin 03-07-01) lies in the Blue Ridge Physiographic Region. The Blue Ridge region 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 regions of the state.

The vast majority of the Yadkin-Pee Dee River basin in North Carolina lies in the Piedmont Physiographic Region; and likewise, a large portion of North Carolina's Piedmont region is within the Yadkin-Pee Dee River basin boundary. This region is characterized by rolling hills and geologic formations consisting of crystalline or sedimentary rocks. Because of the moderate topography, more streams drain a smaller amount of land, creating moderate drainage density.

Part of the southeastern corner of the basin (Richmond and Montgomery counties in subbasins 03-07-10, 03-07-15 and 03-07-16) lies in the Inner Coastal Plain Physiographic Region. The geology of this area consists of alternating layers of sand, silt, clay and limestone. In this portion of the basin, the land is relatively flat. The slope dips downward at a rate of only a few feet per mile. A smaller number of streams drain a large area of land in the Coastal Plain region.

In addition to low drainage density, the lower portion of the basin also has the lowest potential for sustaining base flow in streams. The low flow frequency, measured by a 7Q10 (annual minimum 7-day consecutive low flow, which on average, will be exceeded 9 out of 10 years) flow calculation, is zero for all but the largest drainages. This very low flow over the warmest months of the year limits streams' ability to maintain high dissolved oxygen levels (increased temperature depletes dissolved oxygen while decreased velocity inhibits reaeration). The capacity for assimilating oxygen-consuming wastes is also limited under these conditions. DWQ limits discharges containing oxygen-consuming wastes into these low base flow streams (refer to page 103 for further information).

Hydrologic Features

Six major reservoirs help make up the mainstem of the Yadkin-Pee Dee River in North Carolina. They are known as the Yadkin Chain Lakes: High Rock Lake, Tuckertown Reservoir, Badin Lake (Narrows), Falls Reservoir, Lake Tillery and Blewett Falls Lake. Yadkin Division of APGI manages the first four of these reservoirs, while Carolina Power and Light (CP&L) manages the lower two. All six dams contain hydroelectric power generation capabilities. There is also a small reservoir in the upper part of the Yadkin River that is managed by the US Army Corps of Engineers: Kerr Scott Reservoir. The way in which all of these reservoirs are managed influences the quality of water in the Yadkin and Pee Dee Rivers.

In addition to these major mainstem reservoirs, there are an abundance of smaller reservoirs on tributaries to the Yadkin-Pee Dee throughout the basin. The majority of these lakes were constructed to store water for drinking water supply. Some statistics for lakes that are monitored by DWQ are provided in Table A-5.

Table A-5 Statistics for Major Lakes in the Yadkin-Pee Dee River Basin

Subbasin/ Lake	County	Classification*	Surface Area (ac)	Mean Depth (ft)	Volume (x 10 ⁶ m ³)	Watershed (mi ²)
03-07-01						
Kerr Scott Reservoir	Wilkes	WS-IV B Tr	1,450	39	189	348
03-07-04						
Winston Lake	Forsyth	C	25	8	0.03	7
Salem Lake	Forsyth	WS-III	360	18	0.8	26
High Rock Lake	Rowan/Davidson	WS-IV B	15,180	16	314	3,929
Lake Wright	Rowan	WS-II HQW	29	10	0.3	2
Lake Corriher	Rowan	WS-IV	17	8	0.2	2
03-07-07						
Lake Thom-A-Lex	Davidson	WS-III	650	26	7.8	39
03-07-08						
Tuckertown Reservoir	Rowan/Davidson	WS-IV B	2,550	99	289	4,210
Badin Lake	Stanly/Montgomery	WS-IV B	5,350	46	344	4,116
Lake Tillery	Stanly/Montgomery	WS-IV B	5,261	23.6	165.6	4,834
03-07-09						
McCrary Lake	Randolph	WS-II HQW	15	10	0.9	1
Lake Bunch	Randolph	WS-II HQW	30	10	0.04	2
Back Creek Lake	Randolph	WS-II HQW	250	13	5	16
Lake Reese	Randolph	WS-III	600	16	0.9	100
03-07-10						
Blewett Falls Lake	Anson/Richmond	WS-IV B	2,570	10.8	38.1	6,784
03-07-12						
Kannapolis Lake	Rowan	WS-III	289	16	5.2	11
Lake Fisher	Cabarrus	WS-IV	277	15	0.01	78
Lake Concord	Cabarrus	WS-IV	131	12	1.3	4
03-07-14						
Lake Monroe	Union	WS-IV	140	18	1.8	9
Lake Lee	Union	WS-IV	125	5	9.5	51
Lake Twitty (Stewart)	Union	WS-III	82	18	7.6	36
03-07-16						
Roberdel Lake	Richmond	WS-III	99	10	10	140
Rockingham City Lake	Richmond	WS-III	27	2	0.02	20
Hamlet City Lake	Richmond	C	100	3	0.04	10
Water Lake	Richmond	WS-II HQW	47	10	0.06	20
03-07-17						
Wadesboro City Pond	Anson	WS-II HQW	100	8	0.1	9

* An index for DWQ freshwater classifications can be found on page 54 of this section (Table A-20).

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, updated June 2001). The 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 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, and compares the coverages to 1982 land cover provided for a comparison of change over 15 years.

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

LAND COVER	MAJOR WATERSHED AREAS														1997		1982		% change since 1982	
	Upper Yadkin River		South Yadkin River		Lower Yadkin River		Upper Pee Dee River		Rocky River		Lower Pee Dee River		Lynches River		TOTALS		TOTALS			
	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL		
Cult. Crop	173.0	11.4	86.3	15.4	70.5	9.3	38.5	7.2	166.2	19.4	34.6	11.7	4.2	18.2	573.3	12.6	903.9	19.7	-36.6	
Uncult. Crop	62.4	4.1	34.7	6.2	9.7	1.3	1.8	0.3	21.3	2.5	7.0	2.4	0.0	0.0	136.9	3.0	91.3	2.0	49.9	
Pasture	214.6	14.2	115.9	20.6	107.8	14.3	30.5	5.7	151.1	17.7	18.9	6.4	2.4	10.4	641.2	14.1	552.6	12.0	16.0	
Forest	797.3	52.7	238.2	42.4	354.2	46.8	380.2	71.0	292.9	34.2	194.7	66.0	13.0	56.3	2270.5	50.0	2378.7	51.7	-4.5	
Urban & Built-Up	167.4	11.1	57.3	10.2	121.9	16.1	31.2	5.8	173.9	20.3	26.7	9.1	2.4	10.4	580.8	12.8	354.3	7.7	63.9	
Federal	10.9	0.7	0.0	0.0	35.8	4.7	21.7	4.1	0.0	0.0	0.0	0.0	0.0	0.0	68.4	1.5	67.4	1.5	1.5	
Other	86.5	5.7	29.8	5.3	56.5	7.5	31.6	5.9	50.4	5.9	13.1	4.4	1.1	4.8	269.0	5.9	250.6	5.4	7.3	
Totals	1512.1	100.0	562.2	100.0	756.4	100.0	535.5	100.0	855.8	100.0	295.0	100.0	23.1	100.0	4540.1	100.0	4598.8	100.0		
% of Total Basin		32.9		12.2		16.4		11.6		18.6		6.4		0.5		98.7				
SUBBASINS	03-07-01	03-07-02	03-07-06		03-07-04	03-07-07	03-07-08		03-07-11	03-07-12	03-07-16		03-07-14							
	03-07-03	03-07-04			03-07-08	03-07-09	03-07-10		03-07-13	03-07-14	03-07-17									
	03-07-05				03-07-15															
8-Digit Hydraulic Units	03040101		03040102		03040103		03040104		03040105		03040201		03040202							

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

Source: USDA, Soil Conservation Service - 1982 and 1997 NRI, updated June 2001.

Fifty percent of land in the basin is forested, and more than 95 percent is in private ownership. Nearly 30 percent is used for agriculture, including cultivated and uncultivated cropland (15.6 percent) and pastureland (14.1 percent). Approximately 13 percent of the land is developed. A description of land cover types, including the "Other" category, to which 6 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	<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>

Figure A-6 presents changes in land cover between 1982 and 1997. Comparisons show significant decreases in the amount of cultivated cropland (-330,600 acres) and forested land (-108,200 acres) in the basin. There were notable increases in the amount of uncultivated cropland (+45,600 acres) and pastureland (+88,600 acres). However, a substantial increase (+226,500 acres) in the urban/built-up land use category occurred over the 15-year period. In addition, nearly 43 percent (+96,600 acres) of this increase in developed area occurred within a five-year period between 1992 and 1997.

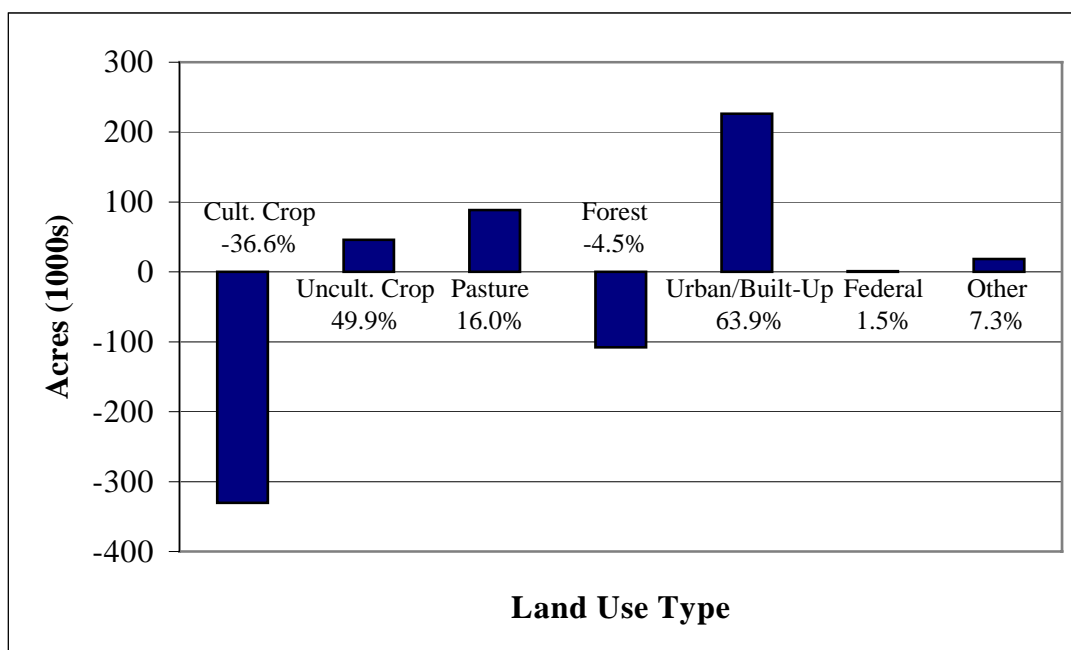


Figure A-6 Land Cover Changes from 1982 to 1997 for the Yadkin-Pee Dee River Basin (Source: USDA-NRCS, NRI, updated June 2001)

Land cover information for the Yadkin-Pee Dee 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 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.

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

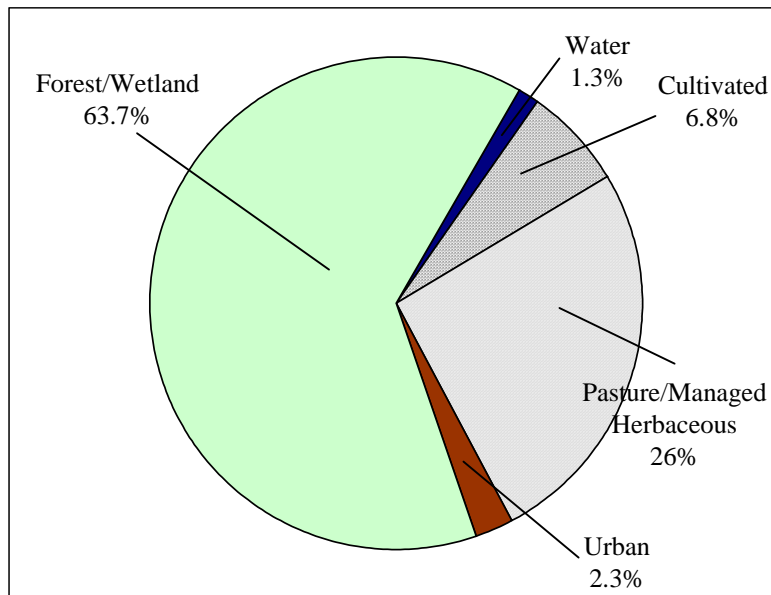


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Yadkin-Pee Dee River Basin

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 Yadkin-Pee Dee River basin had an estimated population of 1,193,353. Table A-9 presents census data, by subbasin, for 1970, 1980 and 1990 census data. It also includes population densities (persons/square mile) based on *land area* (excludes open water) for each subbasin. Approximately 63 percent of the basin’s population is located in the upper portion of the basin draining into High Rock Lake, which comprises only 50 percent of total land area of the basin. The Rocky River watershed (subbasins 03-07-11 through 03-07-14) contains the majority of the population in the lower portion of the basin.

Table A-9 Yadkin-Pee Dee River Subbasin Population, Densities (1970, 1980, 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		Water Area	Land Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
03-07-01	51,090	60,347	62,655	62	73	76	530,783	830	3	827
03-07-02	63,657	81,690	90,781	78	100	111	526,384	822	4	818
03-07-03	31,796	36,036	36,299	161	182	183	126,786	198	0	198
03-07-04	263,246	286,610	325,945	372	405	461	467,120	730	23	707
03-07-05	8,455	10,705	11,800	65	82	91	83,485	130	0	130
03-07-06	78,567	88,267	94,594	87	97	104	580,680	907	1	906
03-07-07	88,845	95,844	101,019	376	406	428	151,885	237	1	236
03-07-08	15,392	19,942	18,811	56	72	68	188,280	294	17	277
03-07-09	29,482	32,081	41,702	77	83	108	248,198	388	3	385
03-07-10	15,015	17,510	15,397	38	44	38	260,499	407	7	400
03-07-11	67,277	64,388	78,047	243	232	282	177,233	277	0	277
03-07-12	107,947	107,706	125,021	249	248	288	278,219	435	1	434
03-07-13	31,261	35,025	37,644	101	113	121	199,743	312	1	311
03-07-14	38,419	43,235	50,084	92	103	120	268,433	420	2	418
03-07-15	16,445	18,307	20,432	47	52	58	224,554	351	1	350
03-07-16	36,295	42,025	41,561	111	129	127	212,141	331	4	327
03-07-17	36,295	42,025	41,561	111	129	127	212,141	331	4	327
TOTALS	979,484	1,081,743	1,193,353	134	148	163	4,736,564	7,400	72	7,328

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 are 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.

Figure A-8 presents population density information by county for 1998. Population density exceeds 400 persons per square mile in the Muddy Creek (03-04-04) and Abbotts Creek (03-07-07) subbasins, which include Forsyth, Guilford and Davidson counties. Population densities in the upper Rocky River watershed exceed 250 persons per square mile. These subbasins (03-07-11 and 03-07-12) include Mecklenburg and Cabarrus counties. Population in the basin is concentrated along interstate corridors, particularly I-85 between Winston-Salem and Charlotte.

Growth Trends

With the exception of the lower southeastern corner of the basin, population in all subbasins increased steadily between 1970 and 1990. Total population of the basin in North Carolina increased almost 20 percent over the 20-year period. Figure A-9 presents projected population growth by county between 2000 and 2020. For the majority of the Yadkin-Pee Dee River basin, population will increase more than 20 percent over the 20-year period. Projected increases are highest for subbasins surrounding High Rock Lake and the Rocky River watershed.

Table A-10 contains data from the most recent US Census (2000) and the projected change in population 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 Yadkin-Pee Dee River basin. Even though 100 percent of eight counties are contained within the basin, only 9 percent of Alleghany County and 15 percent of Stokes are encompassed. They are instead presented as an estimate of possible countywide population changes.

The largest increases are projected for Union (70 percent), Mecklenburg (57 percent), Cabarrus (53 percent) and Iredell (49 percent). Projected population increases for Davie and Randolph counties are 37 percent; however, less than half of Randolph County is located within this basin. Eleven other counties located wholly or partially within the basin will likely increase 20-30 percent over the 20-year period.

Table A-11 presents population data for municipalities with populations greater than 2,000 persons, located wholly or partly within the basin. This information was obtained from the Office of State Planning (April and May 2001).

Figure A-8 1998 Population Density by County for the Yadkin-Pee Dee River Basin in North Carolina

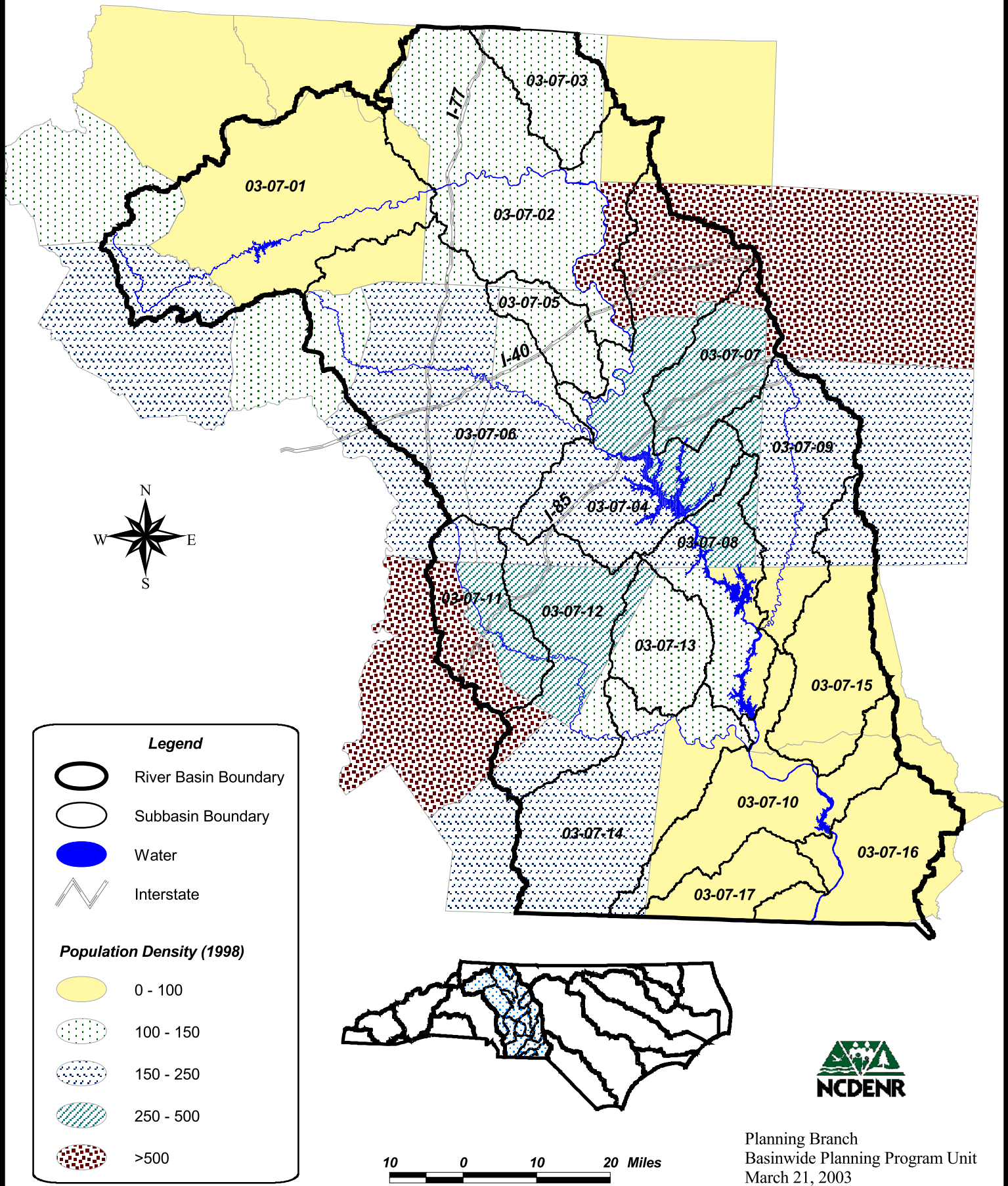
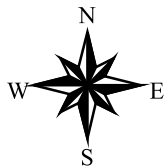
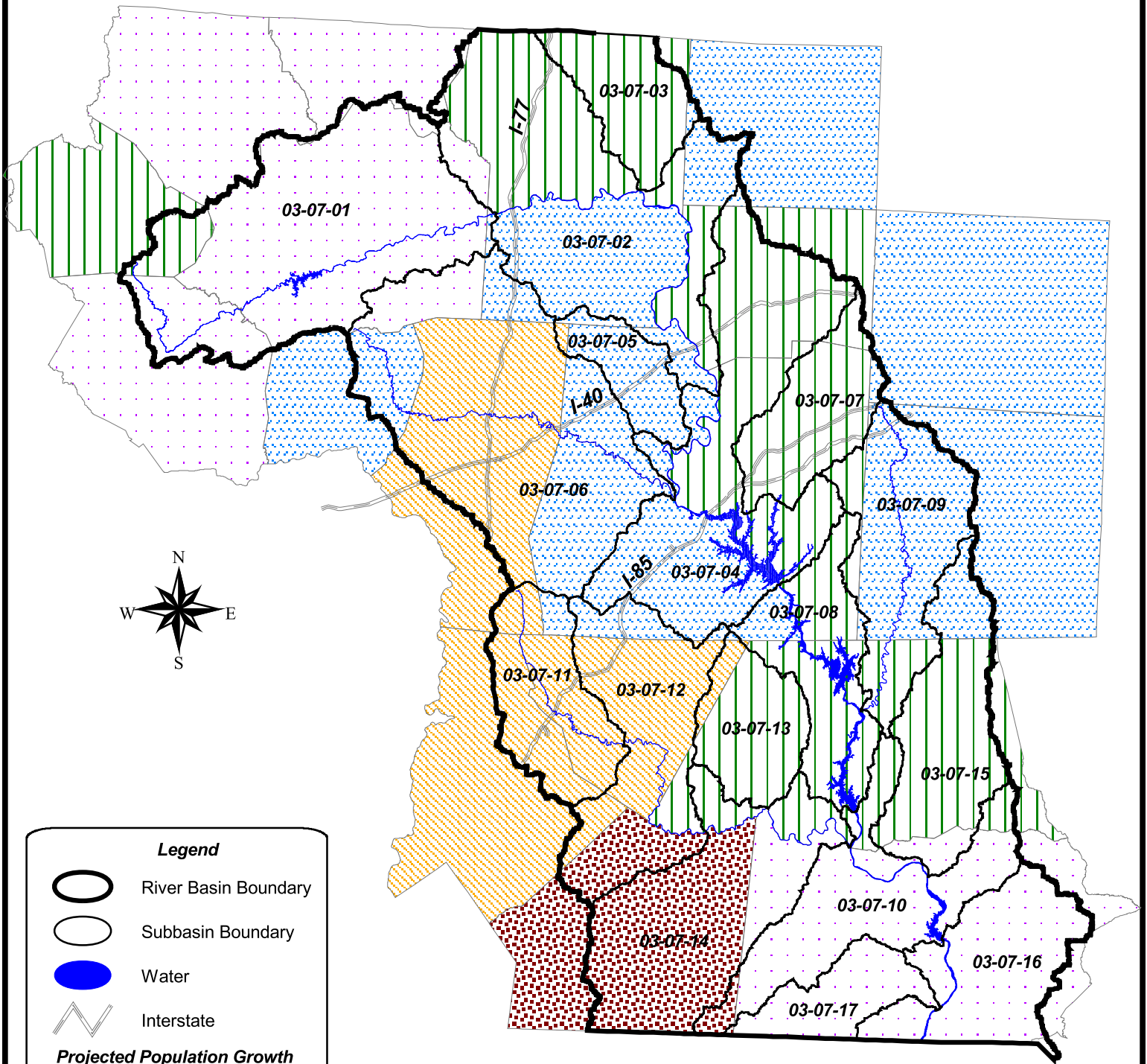


Figure A-9 Projected Population Growth (2000-2020) by County for the Yadkin-Pee Dee River Basin in North Carolina



Legend

- River Basin Boundary
- Subbasin Boundary
- Water
- Interstate

Projected Population Growth (2000-2020)

- 0 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 60%
- >60%

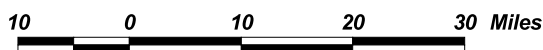
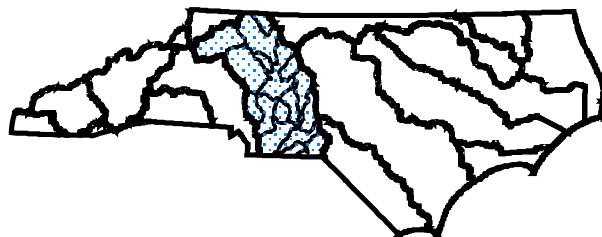


Table A-10 Past and Projected Population (1990, 2000, 2020) and Population Change by County

County	% of County in Basin *	1990	2000	Estimated Population 2020	Population Change 1990-2000	Estimated Pop Change 2000-2020
Alexander	32%	27,544	33,603	45,168	6,059	11,565
Alleghany	9%	9,590	10,677	12,140	1,087	1,463
Anson	100%	23,474	25,275	27,653	1,801	2,378
Cabarrus	100%	98,935	131,063	200,092	32,128	69,029
Caldwell	25%	70,709	77,415	86,577	6,706	9,162
Davidson	100%	126,688	147,246	184,449	20,558	37,203
Davie	100%	27,859	34,835	47,614	6,976	12,779
Forsyth	76%	265,855	306,067	385,079	40,212	79,012
Iredell	78%	93,205	122,660	182,758	29,455	60,098
Mecklenburg	26%	511,211	695,454	1,089,258	184,243	393,804
Montgomery	88%	23,359	26,822	33,247	3,463	6,425
Randolph	44%	106,546	130,454	178,852	23,908	48,398
Richmond	81%	44,511	46,564	49,825	2,053	3,261
Rowan	100%	110,605	130,340	171,889	19,735	41,549
Stanly	100%	51,765	58,100	70,547	6,335	12,447
Stokes	15%	37,224	44,711	58,515	7,487	13,804
Surry	97%	61,704	71,219	88,596	9,515	17,377
Union	75%	84,210	123,677	210,738	39,467	87,061
Watauga	17%	36,952	42,695	51,567	5,743	8,872
Wilkes	100%	59,393	65,632	75,098	6,239	9,466
Yadkin	100%	30,488	36,348	48,041	5,860	11,693

* 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.

Table A-11 Population (1980, 1990, 2000) and Population Change for Municipalities Greater Than 2,000 Located Wholly or Partly in the Yadkin-Pee Dee River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	Percent Change (1980-90)	Percent Change (1990-2000)
Albemarle	Stanly	15,110	14,940	15,680	-1.1	5.0
Archdale •	Guilford, Randolph	5,326	6,975	9,014	31.0	29.2
Asheboro •	Randolph	15,252	16,362	21,672	7.3	32.5
Charlotte •	Mecklenburg	315,474	395,934	540,828	25.5	36.6
China Grove	Rowan	2,081	2,732	3,616	31.3	32.4
Clemmons	Forsyth	4,842	6,020	13,827	24.3	129.7
Concord	Cabarrus	16,942	27,347	55,977	61.4	104.7
Cornelius •	Mecklenburg	1,460	2,581	11,969	76.8	363.7
Davidson •	Iredell, Mecklenburg	3,241	4,046	7,139	24.8	76.4
East Spencer	Rowan	2,150	2,055	1,755	-4.4	-14.6
Elkin	Surry, Wilkes	2,858	3,790	4,109	32.6	8.4
Granite Quarry	Rowan	1,294	1,646	2,175	27.2	32.1
Hamlet	Richmond	4,720	6,324	6,018	34.0	-4.8
Harrisburg	Cabarrus	1,433	1,625	4,493	13.4	176.5
High Point •	Davidson, Forsyth, Guilford, Randolph	63,479	69,428	85,839	9.4	23.6
Huntersville •	Mecklenburg	1,294	3,023	24,960	133.6	725.7
Indian Trail •	Union	811	1,942	11,905	139.5	513.0
Kannapolis	Cabarrus, Rowan	30,303	29,709	36,910	-2.0	24.2
Kernersville •	Forsyth, Guilford	5,875	10,899	17,126	85.5	57.1
King	Forsyth, Stokes	3,811	4,059	5,952	6.5	46.6
Lake Park	Union	.....	4	2,093	.....	52,225.0
Landis	Rowan	2,092	2,333	2,996	11.5	28.4
Lewisville	Forsyth	4,854	6,433	8,826	32.5	37.2
Lexington	Davidson	15,711	16,581	19,953	5.5	20.3
Locust	Cabarrus, Stanly	1,590	1,940	2,416	22.0	24.5
Marshville	Union	2,011	2,160	2,360	7.4	9.3
Matthews •	Mecklenburg	1,648	13,651	22,127	728.3	62.1
Mint Hill •	Mecklenburg	7,915	11,615	14,922	46.7	28.5
Mocksville	Davie	2,637	3,399	4,178	28.9	22.9
Monroe	Union	12,639	16,385	26,228	29.6	60.1
Mooresville •	Iredell	8,575	9,317	18,823	8.7	102.0
Mount Airy	Surry	6,862	7,156	8,484	4.3	18.6
North Wilkesboro	Wilkes	3,275	3,384	4,116	3.3	21.6
Norwood	Stanly	1,818	1,617	2,216	-11.1	37.0
Randleman •	Randolph	2,156	2,612	3,557	21.2	36.2
Rockingham	Richmond	8,300	9,399	9,672	13.2	2.9

Rural Hall •	Forsyth	1,336	1,652	2,464	23.7	49.2
Salisbury	Rowan	22,677	23,626	26,462	4.2	12.0
Spencer	Rowan	2,938	3,195	3,355	8.7	5.0
Stallings •	Union	1,826	2,152	3,189	17.9	48.2
Statesville	Iredell	18,622	17,567	23,320	-5.7	32.7
Thomasville	Davidson, Randolph	14,144	15,915	19,788	12.5	24.3
Tobaccoville	Forsyth, Stokes	646	914	2,209	41.5	141.7
Trinity	Randolph	.....	6,470	6,690	.....	3.4
Troy	Montgomery	2,702	3,387	3,430	25.4	1.3
Unionville	Union	.....	3,039	4,797	.....	57.8
Wadesboro	Anson	4,206	3,862	3,552	-8.2	-8.0
Walkertown •	Forsyth	1,321	1,200	4,009	-9.2	234.1
Wilkesboro	Wilkes	2,335	2,964	3,159	26.9	6.6
Wingate	Union	2,615	2,821	2,406	7.9	-14.7
Winston-Salem	Forsyth	131,885	143,485	185,776	8.8	29.5
Yadkinville	Yadkin	2,216	2,525	2,818	13.9	11.6

- - 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.

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

Originating in the Blue Ridge Mountains, and draining portions of North Carolina’s Piedmont, Sandhills and Coastal Plain, it is no surprise that the Yadkin-Pee Dee River basin contains a wide variety of habitat types, as well as many rare plants and animals. The Yadkin-Pee Dee River serves as a corridor for plants and animals migrating from the mountains to the Coastal Plain, and vice-versa. From an aquatic perspective, the NC Wildlife Resources Program recognizes the Pee Dee River as one of 13 Significant Aquatic Biodiversity Areas in North Carolina (Alderman, 1997).

2.6.1 Public Lands in the Yadkin-Pee Dee River Basin

Although public lands make up less than 5 percent of the Yadkin-Pee Dee River basin in North Carolina, many unique areas are protected. Figure A-10 presents these areas along with significant aquatic habitats, which are discussed in Part 2.6.3 below. Federally-owned lands include much of the 50,000-acre Uwharrie National Forest in Montgomery and Randolph counties and a small part of the Pisgah National Forest in Alexander County. The Blue Ridge Parkway winds in and out along the northwestern edge of the basin in Watauga and Wilkes counties and includes the 4200-acre Doughton Recreation Area. Cumberland Knob, where ground was first broken in the construction of the Parkway in 1935, also lies within the basin. Other federal lands include the Pee Dee National Wildlife Refuge in Anson County, McKinney Lake Fish Hatchery and the US Army Corps of Engineers’ Kerr Scott Reservoir.

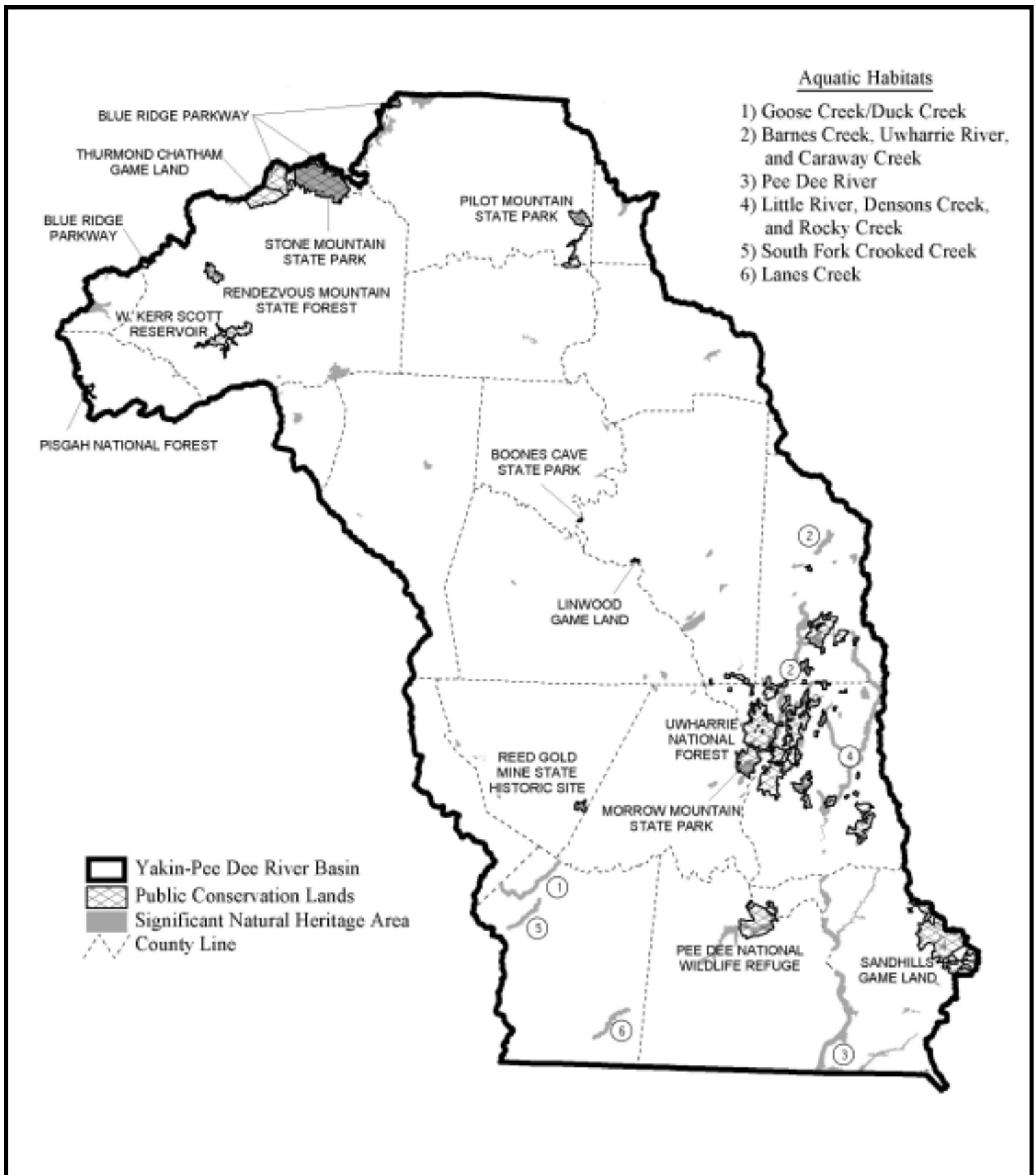


Figure A-10 Public Lands and Significant Natural Heritage Areas of the Yadkin-Pee Dee River Basin

The NC Division of Parks and Recreation manages three state parks in the basin: Stone Mountain State Park, Pilot Mountain State Park and Morrow Mountain State Park. Bullhead Mountain State Natural Area straddles the basin divide between the Yadkin-Pee Dee River and the New River basins in Alleghany County, and a small piece of Hanging Rock State Park is located across the Yadkin-Pee Dee/Roanoke River basin divide. The Wildlife Resources Commission also manages Linwood, Sandhills and Thurmond Chatham Game Lands. Other state-managed lands in the Yadkin-Pee Dee River basin include the NC Zoological Park, the Reed Gold Mine State Historic Site, Rendezvous Mountain State Forest, and the Department of Agriculture's Piedmont Research Station.

Most of these lands are considered to be in conservation ownership, meaning that the intended purpose is for conservation of the resources found within. Therefore, many significant natural heritage areas (discussed in Part 2.6.2 below) are located on public land. Local governments also manage important natural areas, such as Davie County's Boones Cave Park. Private, nonprofit organizations such as LandTrust for Central North Carolina and Piedmont Land Conservancy (refer to Section C for a complete listing of conservation organizations) are also managing land in conservation ownership. Although these lands are not shown in the figure, these organizations have achieved significant protection, particularly of riparian areas, in the Yadkin-Pee Dee River basin.

2.6.2 Significant Natural Heritage Areas within the Yadkin-Pee Dee 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 Yadkin-Pee Dee River basin contains more than 250 individual significant natural heritage areas (aquatic and terrestrial). It is beyond the scope of this report to discuss even a large fraction of these areas; however, some of the more impressive ones are mentioned.

Stone Mountain Escarpment Complex

An area of rugged land along the Blue Ridge escarpment encompasses several significant natural heritage areas, together forming a large forested wildland complex along the border of Alleghany and Wilkes counties. The area spans the elevational range from the base to the top of the escarpment and includes good examples of typical communities and excellent examples of rare communities such as Low Elevation Granitic Dome and Low and High Elevation Rocky Summit. A number of rare plant species are present, including Keever's bristle moss. Public land within this cluster includes Stone Mountain State Park, Doughton Park and Thurmond Chatham Game Land.

Brushy Mountains

The Brushy Mountains, located in the northeast corner of Alexander County and adjacent to Wilkes County, contain a cluster of Low Elevation Granitic Domes. Included in this cluster are the Nationally Significant Little Mountain, Nationally Significant Joe/Little Joe Mountains and Rocky Face Mountain. The state endangered Keever's bristle-moss and other rare plants occur here and represent the majority of this plant's global population.

Sauratown Mountains

The Sauratown Mountains are a cluster of monadnocks composed largely of quartzite in west central Stokes County and eastern Surry County. Standing conspicuously above the surrounding piedmont landscape, these mountains contain a mixture of montane and piedmont biota. Two state parks, Hanging Rock State Park and Pilot Mountain State Park, protect a few important areas; however, much is not currently in conservation ownership.

Beaverdam Creek/Grassy Fork Creek

Bearverdam Creek is a small slate-bottomed stream in the upper Yadkin River watershed located in the central Piedmont of North Carolina. The gravel bars and banks of this stream support the largest known population of the endangered heart-leaf plantain in North Carolina. More than 1,500 plants have been found in clumped populations in sites of ideal habitat for this aquatic plant. This particular site is of National Significance, but is not associated with a cluster of identified significant natural heritage areas.

Montgomery County

Roughly between the Uwharrie River and Badin Lake in northwestern Montgomery County lies the Badin Mafic cluster of natural areas – a rugged landscape along the east side of the Badin Lake, one of the most mountainous parts of the Uwharrie Mountains. Much of the area is underlain by mafic volcanic rocks, and the largest contiguous piece of Uwharrie National Forest lies in this area. A large number of natural areas have been identified, many containing high quality and rare natural communities associated with the unusual terrain and geology. Plants of particular note are the Yadkin River goldenrod, present in one of only two occurrences globally; and the ravine sedge, which in North Carolina, is only found here. Two of the significant natural heritage areas found in the area of national significance: the Yadkin River Scour Banks Natural Area, and the Badin Upland Depression Swamps and Xeric Woodland Natural Area. Montgomery County also contains several significant aquatic habitats discussed in Part 2.6.3 below.

Pee Dee River Riparian Area

Important natural heritage areas are located along the entire western boundary of Richmond County, from (and including) the Pee Dee National Wildlife Refuge down to the South Carolina border, as well as on adjacent lands in Anson County. Part of the area includes a large power generating reservoir, Blewett Falls Lake, but the rest of the river is free-flowing. This area contains some of the best remaining examples of riverine environments along the Pee Dee River in North Carolina, including floodplain and bottomland forests, extensive beaver ponds, a wild rice marsh and a unique oxbow lake. Adjacent slopes and ledges support a variety of forested and semi-forested communities. Historically, the Pee Dee River has been an important corridor for the movement of plants and animals in both directions, and today is a dynamic meeting ground for coastal plain and piedmont/mountain species.

As was mentioned previously, there are many upland, riparian and wetland Significant Natural Heritage Areas which are not discussed within the scope of this report. Please contact the NC Natural Heritage Program by calling (919) 715-8697 to obtain information about these natural areas. You may also visit the website at <http://www.ils.unc.edu/parkproject/nhp/>.

2.6.3 Significant Aquatic Habitats within the Yadkin-Pee Dee River Basin

Six watersheds in the North Carolina portion of the Yadkin-Pee Dee River basin contain Significant Aquatic Habitats (Figure A-10). In addition, there are three unique (and rare) types of wetlands found within the basin. Status of rare species mentioned here is contained in Table A-12 (page 31).

Goose Creek/Duck Creek Watershed

The Goose Creek watershed, including Duck Creek, is a Nationally Significant Aquatic Habitat located in Union County. Six rare mollusks are found in portions of the two streams: Carolina heelsplitter (federally endangered), creeper, notched rainbow, eastern creekshell, Carolina creekshell and Atlantic pigtoe. This watershed is one of only four sites globally in which the imperiled Carolina heelsplitter is still found.

Uwharrie River Watershed

The streams and rivers of the Uwharrie National Forest and vicinity (Montgomery County and southwestern Randolph County) host large numbers of rare mollusks, as well as the Carolina darter. Whether these streams were originally more diverse than other streams in the basin is open to speculation, but it is likely that species have survived in these waters due to the relatively undeveloped watershed upstream and the protection offered by the National Forest. They may be the last strongholds for some species as the Piedmont becomes even more heavily impacted by humans.

There are three identified Significant Aquatic Habitats in this watershed. The State Significant Barnes Creek Aquatic Habitat flows southwestward through the Uwharrie Mountains and ends at the Uwharrie River. Five rare mollusks inhabit this stretch of Barnes Creek: brook floater, creeper, notched rainbow, eastern creekshell and Carolina creekshell. Also, in this region is the State Significant Uwharrie River Aquatic Habitat. The Uwharrie River flows south-southwest into the Pee Dee River, passing through the heart of the Uwharrie Mountains. The lower portion contains several rare mussels, including Roanoke slabshell, Atlantic pigtoe, eastern lampmussel, notched rainbow and eastern creekshell. Another notable aquatic site is the State Significant Caraway Creek Aquatic Habitat. This stream contains a cluster of six rare mollusk species, including Atlantic pigtoe, brook floater and Carolina creekshell.

Pee Dee River in North Carolina

The State Significant Pee Dee River Aquatic Habitat extends from the Blewett Falls Dam to the South Carolina state line. This short stretch of river is host to several rare fishes, including the shortnose sturgeon (federally endangered) and the robust redhorse.

Little River Watershed

A number of aquatic habitats are associated with the Little River of Montgomery and Randolph counties. The State Significant Little River Aquatic Habitat flows southward through central Montgomery County and empties into the Pee Dee River. This stretch of the Little River has a very diverse array of rare mollusks including the triangle floater, Atlantic pigtoe, Savannah lilliput, notched rainbow, eastern creekshell and Carolina creekshell. With headwaters in the Uwharrie National Forest, the State Significant Densons Creek Aquatic Habitat flows into the Little River. Located within Montgomery County, this creek is home to five rare mollusks,

including Savannah lilliput and Carolina creekshell. Also, found here is the Regionally Significant Little River/Rocky Creek Aquatic Habitat. Downstream of the confluence of Densons Creek and Little River, this site harbors four rare mussels, including Carolina creekshell and the Carolina darter. This area also contains the most extensive remnants of Piedmont Longleaf Pine Forest left globally.

South Fork Crooked Creek

South Fork Crooked Creek Aquatic Habitat is a state significant site in Union County harboring an assemblage of three rare mussel species, with Carolina creekshell (federal species of concern, state endangered) and Savannah lilliput being highly significant.

Lanes Creek

Lanes Creek is a tributary of the Rocky River in the lower part of the basin. The Regionally Significant aquatic habitats of this site host several rare species, including one rare mayfly, the Carolina darter and the Carolina creekshell.

Wetlands

Wetlands are transitional areas between land and water, such as swamps and marshes. Some are connected to streams; and others, such as low lying pine plantations and pocosins, are not. Wetlands provide a variety of benefits to society and are very important in watershed planning because of the functions they perform. Wetlands provide retention of floodwaters to protect property values; streambank stabilization to prevent erosion and downstream sedimentation; water purification and pollutant removal (especially for nitrogen and phosphorus); habitat for aquatic life; and wildlife and endangered species protection. These values vary greatly with wetland type. Wetlands adjacent to intermittent and permanent streams are most important to protecting water quality in those streams, as well as downstream lakes and estuaries. However, wetlands located landward or away from streams also have important water storage capacity and pollutant removal potential.

A number of wetland (palustrine) natural communities are found in the Yadkin-Pee Dee River basin, but three are especially notable. The Hillside Seepage Bog is an extremely rare natural community, considered globally imperiled. Nearly all of the places where this bog is found are in the Yadkin-Pee Dee River basin. Some are clustered in northern Iredell County, and others are clustered in Montgomery County. In general, these are very small sites (some are less than an acre) on gentle slopes where groundwater seepage wets the land surface. Species typical of both montane bogs and Coastal Plain savannas may be found here, such as pitcher plants and "savanna" orchids. None of the Iredell County sites are in conservation ownership, and only a few of the Montgomery sites are protected through ownership by US Forest Service or The Nature Conservancy.

The Upland Pool and Upland Depression Swamp Forest natural communities are sites that hold water for all or part of the year. These are sites removed from riverine areas, generally over gabbro or other mafic rocks that have poor drainage, and thus, pond water. Upland Pools are extremely rare, and two of the few known examples are contained within the Uwharrie National Forest. These sites generally have few, if any, trees and feature shrubs and herbs as dominant vegetation. On the other hand, Upland Depression Swamp Forest features a forested canopy of

wetland trees over pools. These communities are scattered throughout the Yadkin-Pee Dee River basin, particularly on Iredell soil types.

2.6.4 Rare Aquatic and Wetland-Dwelling Animal Species

Table A-12 presents rare aquatic and wetland-dwelling species found in the Yadkin-Pee Dee River basin.

Table A-12 Rare Aquatic and Wetland-Dwelling Species (as of November 2002)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
Fish	Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	E	E
Fish	Highfin Carpsucker	<i>Carpionodes velifer</i>	SC	-
Fish	Santee Chub - Piedmont population	<i>Cyprinella zanema pop 1</i>	SR	-
Fish	Carolina Darter - central Piedmont population	<i>Etheostoma collis pop 1</i>	SC	FSC
Fish	Robust Redhorse	<i>Moxostoma robustum</i>	SC	FSC
Fish	Carolina Redhorse	<i>Moxostoma sp 2</i>	SR	FSC
Fish	Sandhills Chub	<i>Semotilus lumbee</i>	SC	-
Insect	a mayfly	<i>Choroterpes basalis</i>	SR	-
Insect	a caddisfly	<i>Dibusa angata</i>	SR	-
Insect	Cahaba Sand-Filtering Mayfly	<i>Homoeoneuria cahabensis</i>	SR	-
Insect	a mayfly	<i>Macdunnoa brunnea</i>	SR	-
Insect	a caddisfly	<i>Micrasema sprulesi</i>	SR	-
Insect	White Sand-River Mayfly	<i>Pseudiron centralis</i>	SR	-
Insect	a rhyacophilan caddisfly	<i>Rhyacophila vibox</i>	SR	-
Insect	a triaenode caddisfly	<i>Triaenodes marginata</i>	SR	-
Insect	a mayfly	<i>Tricorythodes robacki</i>	SR	-
mollusk	Triangle Floater	<i>Alasmidonta undulata</i>	T	-
mollusk	Brook Floater	<i>Alasmidonta varicosa</i>	E*	FSC
mollusk	Roanoke Slabshell	<i>Elliptio roanokensis</i>	T	-
mollusk	Atlantic Pigtoe	<i>Fusconaia masoni</i>	E*	FSC
mollusk	Yellow Lampmussel	<i>Lampsilis cariosa</i>	E*	FSC
mollusk	Carolina Fatmucket	<i>Lampsilis radiata conspicua</i>	T*	-
mollusk	Eastern Lampmussel	<i>Lampsilis radiata radiata</i>	T*	-
mollusk	Carolina Heelsplitter	<i>Lasmigona decorata</i>	E	E
mollusk	Creeper	<i>Strophitus undulatus</i>	T	-
mollusk	Savannah Lilliput	<i>Toxolasma pullus</i>	E*	FSC
mollusk	a valvatid snail	<i>Valvata cf sincera</i>	SR	-
mollusk	Notched Rainbow	<i>Villosa constricta</i>	SC*	-

mollusk	Eastern Creekshell	<i>Villosa delumbis</i>	SR	-
mollusk	Carolina Creekshell	<i>Villosa vaughaniana</i>	E*	FSC
Aq Plant	Giant Peatmoss	<i>Sphagnum torreyanum</i>	SR	-
Aq Plant	Water Purslane	<i>Didiplis diandra</i>	SR	-
Aq Plant	Southern Water Grass	<i>Luziola fluitans</i>	SR	-
Aq Plant	Heart-Leaf Plantain	<i>Plantago cordata</i>	E	-
Aq Plant	Conferva Pondweed	<i>Potamogeton confervoides</i>	SR	FSC
Aq Plant	Canby's Bulrush	<i>Schoenoplectus etuberculatus</i>	SR	-
Aq Plant	Swaying Bulrush	<i>Schoenoplectus subterminalis</i>	SR	-

* New ranking in effect July 1, 2002.

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 (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

Because the Carolina heelsplitter is a federally-listed endangered mussel species and the Shortnose sturgeon is a federally-listed threatened fish species, certain waters within the Yadkin-Pee Dee 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 is to provide for maintenance and recovery of the water quality conditions required to sustain these species.

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 is necessary for the US Fish and Wildlife Service, the NC Wildlife Resources Commission, the NC Natural Heritage Program and other interested parties to collaborate on a process that will ensure successful development and implementation of appropriate management strategies to protect these species. DWQ held an initial meeting in July 2002 between the agencies to discuss the rule and its applications to the Yadkin-Pee Dee River basin. As long as agencies continue to work together, management strategies will be developed for the Goose Creek watershed and the Pee Dee River below Blewett Falls Lake during the current basinwide planning cycle.

2.6.5 Yadkin-Pee Dee River Basin Fisheries

The fish communities of the Yadkin-Pee Dee River and tributaries vary considerably throughout the basin. Adequate conditions to support wild populations of brook, brown and rainbow trout are found in the coldwaters of many of the tributaries to the upper Yadkin River which originate along the Blue Ridge escarpment in Alleghany, Caldwell, Surry, Watauga and Wilkes counties. Many of these tributaries also contain considerable coolwater habitat in the lower reaches. These

include Elk Creek, Reddies River, Roaring River, Mitchell River, Fisher River and Ararat River. Primary sportfishes in these streams include smallmouth and spotted bass, redbreast sunfish and rock bass. Downstream of the confluence with the Ararat River, tributaries contain primarily warmwater habitat, with stream bottoms containing more sand and less exposed bedrock. Some tributaries in the lower portion of the basin are similar to the sandy-bottomed, blackwater streams typical of the coastal plain of North Carolina. Limited fisheries for largemouth and spotted bass, catfishes, redbreast sunfish and bluegill are found in these streams.

River Fisheries

Sportfishes in the Yadkin River upstream of W. Kerr Scott Reservoir include smallmouth bass, redbreast sunfish and bullhead catfishes. Between W. Kerr Scott Reservoir and the headwaters of High Rock Lake, the river is wide and shallow, with depths averaging less than three feet. Smallmouth, spotted and largemouth bass, redbreast sunfish, bullhead catfishes, channel catfish and flathead catfish are popular with anglers in this section of the Yadkin.

The Pee Dee River below Blewett Falls Dam flows for 16 miles before entering South Carolina. Although streamflow is regulated by releases from Blewett Falls Dam, there are no other dams between this section and Georgetown, South Carolina where the Pee Dee enters the Atlantic Ocean. The habitat in this section contains large boulders, bedrock shelves and sandbars as the river transitions from the Piedmont to the Coastal Plain physiographic regions. Fisheries for American shad, striped mullet and striped bass occur each spring during the spawning runs of these species. Anglers in this section of the river also capture resident species such as flathead catfish, blue catfish, smallmouth buffalo and sunfish.

Lake Fisheries

W. Kerr Scott Reservoir in Wilkesboro is the first major impoundment on the Yadkin River. The reservoir is operated by the US Army Corps of Engineers and is primarily used for flood control. The fish community is dominated by warmwater/coolwater sportfish species, including largemouth bass, spotted bass, sunfish, black and white crappie, and striped bass hybrids.

Idols Dam, formerly used to generate hydropower, is located west of Clemmons and is owned by the City of Winston-Salem. Although the powerhouse is no longer operational, the Winston-Salem Utility Commission intends to maintain the dam to protect their water intake just upstream of the dam. A considerable white and striped bass fishery exists below the dam in the spring when the fish migrate from downstream reservoirs to spawn.

The "Chain Lakes" of the Yadkin-Pee Dee River (High Rock Lake, Tuckertown, Badin Lake, Falls Reservoir, Lake Tillery and Blewett Falls) support fisheries for largemouth bass, sunfish, black and white crappie, several catfish species and, with the exception of Falls Reservoir, striped bass. In addition to being important natural resources, these reservoir fisheries also help make the basin a popular place for recreation, significantly boosting the local economy.

2.6.6 Forestry in the Yadkin-Pee Dee River Basin

Forest Resources

The overwhelming majority of timberland in the basin, nearly 90 percent, is owned by nonindustrial private landowners. Approximately, 5 percent of the timberland is owned by forest products companies, with the remaining 5 percent under public ownership. Most of the timberland in public ownership consists of the Uwharrie National Forest. These ownership data come from the most recent study by the USDA Forest Service, conducted in 1990 (North Carolina's Forests, 1990, *Southeastern Forest Experiment Station Resource Bulletin SE-142*).

For the period July 1998 through June 2002, nearly 59,000 acres of private land in the Yadkin-Pee Dee River basin were planted in trees, with nearly 80 percent of these acres utilizing cost shared funding through various state or federal programs. From the most recent data available at year-end 2002, 69 different businesses in the basin are considered as "Primary Processors" of forestry-related raw material, which represents nearly one-quarter of the total number of primary processors (285) located in North Carolina. A primary processor may include a sawmill, veneer mill, chip mill or paper mill.

In Wilkes County, the Division of Forest Resources ("DFR", also known as the NC Forest Service) manages approximately 3,000 acres of land at the Rendezvous Mountain Educational State Forest. The forest is managed as an outdoor classroom for school groups and the general public, as well as for sustainable forestry while protecting the headwaters of Purlar Creek, a tributary of North Prong Lewis Fork. In addition, the forest is located within the view-shed of the Blue Ridge Parkway.

Long-term goals of the DFR include the creation of additional Educational State Forests within the Yadkin-Pee Dee River basin, with the highest priority focused on serving the rapidly expanding area around Winston-Salem, Thomasville and Lexington. The southern area of the basin is also targeted for the establishment of an Educational State Forest.

In Davidson, Montgomery and Randolph counties, the US Forest Service manages over 50,000 acres in the Uwharrie National Forest, which provides water quality protection for Basin Lake and Lake Tillary.

More information is available on the North Carolina Division of Forest Resources website at <http://www.dfr.state.nc.us> or the US Forest Service website at <http://www.fs.fed.us>.

Forestry Regulation in North Carolina

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (G.S. Chapter 113A, Article 4 referred to as "SPCA"). However, forestry operations may be exempted from the permit requirements in the SPCA, if the operations meet compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A NCAC II .0101-.0209, referred to as "FPGs") and General Statutes regarding stream obstruction (G.S. 77-13 and G.S. 77-14). Detailed information is available on the Water Quality Section of the DFR's website at <http://www.dfr.state.nc.us>.

DFR is delegated the authority, by the Division of Land Resources, to monitor and evaluate forestry operations for compliance with these laws. In addition, DFR works to resolve identified FPG compliance questions. Violations of the FPG performance standards that cannot be resolved by DFR are referred to the Division of Land Resources for enforcement action.

During the calendar years of 1998 through 2002, DFR conducted 2,674 FPG inspections of forestry and/or timber harvesting activities in the Yadkin-Pee Dee River basin; 92 percent of the sites inspected were in compliance.

The western portion of the Yadkin-Pee Dee River basin falls within the coverage area for two of the DFR Water Quality Foresters. The Water Quality Foresters conduct FPG inspections, develop preharvest plans, and provide training opportunities for landowners, loggers and the public regarding water quality issues related to forestry. Service Foresters and/or County Rangers handle water quality issues in the remainder of the basin, along with their other forest management and fire control responsibilities. Contact information for each district and/or county can be found on the DFR's website at <http://www.dfr.state.nc.us>.

Forestry Best Management Practices

The implementation of Forestry Best Management Practices ("BMPs") is encouraged by DFR to protect water resources. The *Forestry Best Management Practices Manual* describes recommended techniques that may be used to comply with the state's forestry laws and help protect water quality. The BMP Manual is being revised; publication of the new edition of the BMP Manual is expected in 2003-2004. The new version of the manual will be printed in a pocket-sized version and a full-sized desktop version. The smaller sized, condensed version will allow for greater distribution and on-site use by loggers and equipment operators.

Among the BMP's promoted for timber harvesting is the use of bridgemats for establishing temporary stream crossings. At this time in the Yadkin-Pee Dee River basin, DFR provides bridgemats for short-term loan to loggers for use in those counties located along the western portion of the basin. Purchase of additional bridgemats, scheduled in 2003, will provide bridgemats for use in all of DFR's districts in the Yadkin-Pee Dee River basin. DFR's Bridgemat Loan and Education Program is an educational and protection project which promotes the benefits of using portable bridges for stream crossings, in lieu of using other techniques such as culverts or hard-surface crossings, which both have a greater potential to result in sedimentation. All bridgemat purchases for DFR's program are funded by grant awards from the US EPA's Nonpoint Source Pollution Management Program.

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 Yadkin-Pee Dee 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, 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 240 permitted discharges in the Yadkin-Pee Dee River basin. Table A-13 provides summary information (numbers of facilities and permitted flows) regarding the discharges by types and subbasin. 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.

The majority of NPDES permitted discharges in the Yadkin-Pee Dee 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 several 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.

Table A-13 Summary of NPDES Dischargers and Permitted Flows

Facility Categories	Subbasin																	
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	TOTAL
Total Facilities	28	31	11	40	2	29	14	10	5	4	24	17	8	8	2	7	0	240
Total Permitted Flow (MGD)	9.1	10.4	8.7	65.8	0.7	15.0	15.9	0.9	0.1	1.2	13.2	25.5	16.6	11.7	1.4	11.7	0.0	207.9
Major Discharges	3	3	3	5	0	6	3	1	0	0	3	1	1	3	0	4	0	36
Total Permitted Flow (MGD)	7.9	8.3	8.6	62.8	0.0	13.5	15.7	0.0	0.0	0.0	11.2	24.0	16.0	10.9	0.0	11.7	0.0	190.6
Minor Discharges	25	28	8	35	2	23	11	9	5	4	21	16	7	5	2	3	0	204
Total Permitted Flow (MGD)	1.2	2.1	0.1	3.0	0.7	1.5	0.2	0.9	0.1	1.1	1.9	1.5	0.6	0.8	1.4	0.0	0.0	17.1
100% Domestic Waste	18	17	6	22	1	13	10	1	3	0	19	9	1	2	0	0	0	122
Total Permitted Flow (MGD)	0.2	0.4	0.1	0.5	0.01	0.2	0.2	0.01	0.04	0.0	2.0	1.3	0.003	0.01	0.0	0.0	0.0	4.9
Municipal Facilities	3	7	2	4	1	7	3	2	0	3	2	4	2	3	2	3	0	48
Total Permitted Flow (MGD)	6.9	5.5	8.5	59.3	0.7	10.3	15.7	0.8	0.0	1.2	11.2	24.2	16.5	11.7	1.4	10.5	0.0	184.4
Nonmunicipal Facilities	25	24	9	36	1	22	11	8	5	1	22	13	6	5	0	4	0	192
Total Permitted Flow (MGD)	2.2	5.0	0.2	6.6	0.01	4.7	0.2	0.01	0.1	0.0	2.0	1.4	0.7	0.01	0.0	1.2	0.0	24.3

2.7.2 Stormwater Discharges in the Yadkin-Pee Dee 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 five 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 one acre or more.

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. Winston-Salem and Charlotte were required to obtain a NPDES permit for stormwater sewer systems under the Phase I rules.

Table A-14 presents 10 counties and 33 municipalities in the basin which are within US Census-Designated Urban Areas. A listed governmental entity is required to obtain a NPDES stormwater permit under the Phase II rules if it operates a small MS4 within the US Census-Designated Urbanized Area boundary. Local governments which were designated under the 1990 census have an application deadline of March 2003; governments designated under the 2000 census have an application deadline of May 2004. Entities such as military bases, large hospitals, prison complexes, universities, sewer districts and highway departments that operate a small MS4 within an urbanized area are also subject to the permitting regulations.

***NPDES Stormwater Sewer System
Permit Requirements under Phase II***

Six Minimum Measures

- Public education and outreach on stormwater impacts
- Public involvement/participation
- Illicit discharge detection and elimination
- Construction site stormwater runoff control
- Post-construction stormwater management for new development and redevelopment
- Pollution prevention/good housekeeping for municipal operations

At least five additional municipalities (Lexington, Statesville, Mooresville, Asheboro and Albemarle) within the basin will be considered for inclusion under the Phase II rules during the next basinwide planning cycle because of a population greater than 10,000 and/or a population density greater than 1,000 persons per square mile. DWQ is currently developing state designation criteria that will be used to determine whether other local governments should be required to obtain a NPDES permit. In addition, DWQ can be petitioned to include a particular local government if there are significant water quality concerns associated with that community. Detailed maps of the Urbanized Area boundaries along with more detailed information about the Phase II program are available on the DWQ Stormwater and General Permits Unit website at http://h2o.enr.state.nc.us/su/NPDES_Phase_II_Stormwater_Program.htm.

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 639 general stormwater permits and 27 individual permits active within the Yadkin-Pee Dee River basin. Facilities with individual NPDES stormwater permits are presented in Appendix I.

In addition to the NPDES Phase I and II stormwater programs, the state stormwater management rules (15A NCAC 2H .1000) currently 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. Surface waters in the Yadkin-Pee Dee River basin, where development activities are regulated under these special rules, are presented on Figures A-12 and A-13 (page 58).

Table A-14 Communities in the Yadkin-Pee Dee River Basin with Stormwater Requirements

Census-Designated Urban Area	Automatically Designated Local Governments*	Phase I	Phase II 1990 Census	Phase II 2000 Census
Winston-Salem	Winston-Salem	X	X	
	Bermuda Run			X
	Bethania			X
	Clemmons		X	
	Davidson			X
	Kernersville			X
	King			X
	Lewisville			X
	Rural Hall		X	
	Tobaccoville			X
	Walkertown		X	
	Davie County			X
	Forsyth County		X	
	Stokes County			X
High Point	High Point		X	
	Archdale		X	
	Thomasville		X	
	Trinity			X
	Davidson County		X	
	Guilford County		X	
	Randolph County		X	
Concord	Concord		X	
	China Grove		X	
	Harrisburg			X
	Kannapolis		X	
	Landis		X	
	Salisbury			X
	Cabarrus County		X	
Rowan County		X		
Charlotte	Charlotte	X	X	
	Cornelius			X
	Davidson		X	
	Harrisburg		X	
	Hemby Bridge			X
	Huntersville			X
	Indian Trail		X	
	Lake Park			X
	Matthews		X	
	Mint Hill		X	
	Monroe			X
	Stallings			X
	Mecklenburg County			X
Union County			X	

* More local governments will likely be included once designation criteria are completed by the state.

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 (see text box).

Key Animal Operation Legislation (1995-2000)

- 1995 – Senate Bill 974 requires owners of swine facilities with 250 or more animals to hire a certified operator. Operators are required to attend a six-hour training course and pass an examination for certification. Senate Bill 1080 established buffer requirements for swine houses, lagoons and land application areas for farms sited after October 1, 1995.
- 1996 – Senate Bill 1217 required all facilities (above threshold populations) to obtain coverage under a general permit, beginning in January 1997, for all new and expanding facilities. DWQ was directed to conduct annual inspections of all animal waste management facilities. Poultry facilities with 30,000+ birds and a liquid waste management system were required to hire a certified operator by January 1997 and facilities with dry litter animal waste management systems were required to develop an animal waste management plan by January 1998. The plan must address three specific items: 1) periodic testing of soils where waste is applied; 2) development of waste utilization plans; and 3) completion and maintenance of records on-site for three years. Additionally, anyone wishing to construct a new, or expand an existing, swine farm must notify all adjoining property owners.
- 1997 – House Bill 515 placed a moratorium on new or existing swine farm operations and allows counties to adopt zoning ordinances for swine farms with a design capacity of 600,000 pounds (SSLW) or more. In addition, owners of potential new and expanding operations are required to notify the county (manager or chair of commission) and local health department, as well as adjoining landowners. NCDENR was required to develop and adopt economically feasible odor control standards by March 1, 1999.
- 1998 – House Bill 1480 extended the moratorium on construction or expansion of swine farms. The bill also requires owners of swine operations to register with DWQ any contractual relationship with an integrator.
- 1999 – House Bill 1160 extended (again) the moratorium on new construction or expansion of swine farms, required NCDENR to develop an inventory of inactive lagoons. The Bill requires owners/operators of an animal waste treatment system to notify the public in the event of a discharge to surface waters of the state of 1,000 gallons or more of untreated wastewater.
- 2000 – Attorney General Easley reached a landmark agreement with Smithfield Foods, Inc. to phase out hog lagoons and implement new technologies that will substantially reduce pollutants from hog farms. The agreement commits Smithfield to phase out all anaerobic lagoon systems on 276 company-owned farms. Legislation will be required to phase out the remaining systems statewide within a 5-year period (State of Environment Report 2000).

Table A-15 summarizes, by subbasin, the number of registered livestock operations, total number of animals, and total steady state live weight as of February 2002. 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. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

There are 128 registered animal operations in the Yadkin-Pee Dee River basin. Approximately 67 percent are cattle operations, 26 percent are swine, and 7 percent are poultry. Subbasin 03-07-06 contains the largest number of registered animal operations with 40 cattle operations and one swine operation. Subbasin 03-07-14 also contains a large number of registered operations with four cattle, five poultry and five swine operations. Overall the majority of registered animal operations are found in the upper portion of the basin (above High Rock Lake). Registered animal operations where recent data show problems are discussed in the appropriate subbasin chapter in Section B.

Information on animal capacity by subbasin (Table A-16) was provided by the USDA. Despite a 28 percent decrease in dairy production between 1994 and 1998, more than 40 percent of the state's total capacity for dairy production is found in the Yadkin-Pee Dee River basin. The basin also contains 35 percent of the state capacity for poultry. Overall, swine and poultry production in the basin increased over the past five years by 47 and 13 percent, respectively.

Table A-15 Registered Animal Operations in the Yadkin-Pee Dee River Basin
(February 2002)

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
03-07-01	6	2,185	2,594,000	0	0	0	0	0	0
03-07-02	10	2,665	3,731,000	0	0	0	3	21,330	2,302,350
03-07-03	2	425	595,000	0	0	0	1	1,600	212,400
03-07-04	6	1,526	2,136,400	0	0	0	2	6,250	958,900
03-07-05	2	625	875,000	0	0	0	1	2,250	318,825
03-07-06	40	33,202	15,590,800	0	0	0	1	2,120	285,620
03-07-07	2	570	798,000	0	0	0	0	0	0
03-07-08	1	215	301,000	0	0	0	0	0	0
03-07-09	4	950	1,330,000	1	52,000	208,000	2	2,687	362,745
03-07-10	0	0	0	0	0	0	6	35,922	3,529,660
03-07-11	3	560	784,000	0	0	0	0	0	0
03-07-12	5	1,250	1,750,000	0	0	0	2	6,100	1,014,500
03-07-13	1	275	385,000	3	320,000	1,168,000	1	3,790	373,650
03-07-14	4	858	1,201,200	5	389,000	1,443,000	5	32,752	4,199,460
03-07-15	0	0	0	0	0	0	3	18,604	1,336,620
03-07-16	0	0	0	0	0	0	1	325	43,875
03-07-17	0	0	0	0	0	0	5	20,653	1,542,514
Totals	86	45,306	32,071,400	9	761,000	2,819,000	33	154,383	16,481,119

Table A-16 Estimated Populations of Swine, Dairy and Poultry in the Yadkin-Pee Dee 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 (%)
03-07-01	537	768	-30	806	1,243	-35	18,398,350	16,876,946	9
03-07-02	13,585	6,245	118	4,523	6,703	-33	6,781,475	5,198,900	30
03-07-03	835	873	-4	1,153	1,153	0	323,900	325,250	0
03-07-04	2,373	4,553	-48	3,574	4,150	-14	31,410	25,810	22
03-07-05	2,269	2,522	-10	1,355	2,506	-46	325,150	210,900	54
03-07-06	3,607	6,908	-48	20,815	28,394	-27	7,263,805	6,579,030	10
03-07-07	771	719	7	963	1,203	-20	85,600	85,100	1
03-07-08	740	2,655	-72	260	1,942	-87	1,536,200	1,022,700	50
03-07-09	2,445	3,392	-28	1,384	2,469	-44	1,559,115	1,140,557	37
03-07-10	23,384	13,029	79	138	138	0	4,269,000	4,208,680	1
03-07-11	332	677	-51	3,173	1,642	93	210,794	220,594	-4
03-07-12	7,260	15,513	-53	515	1,336	-61	6,085,444	5,210,044	17
03-07-13	17,437	3,710	370	1,025	1,747	-41	3,674,750	3,260,295	13
03-07-14	31,811	23,483	35	969	1,161	-17	16,050,832	13,961,182	15
03-07-15	21,097	14,985	41	0	360	-100	3,789,753	3,435,300	10
03-07-16	12,902	4,694	175	0	2	-100	3,406,420	3,352,036	2
03-07-17	15,432	2,199	602	150	249	-40	1,123,800	918,800	22
TOTALS	156,817	106,925	47	40,803	56,398	-28	74,915,798	66,032,124	13
% of State Total	2%	2%		41%	42%		35%	36%	

2.9 Water Quantity Issues

In 1995, the USGS estimated that total water use in the Yadkin-Pee Dee River basin was 306 million gallons per day, with almost 80 percent supplied from surface water sources.

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.

In 1997, 70 public water systems used water from the basin providing 149 million gallons of water per day to 803,281 people in the basin. Water demand from these public systems is projected to increase 36 percent by 2020. In 1997, 17 systems (24 percent) reported that available supply was not adequate to meet estimated demand through 2020, and 21 systems (30 percent) report 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 50 percent of the total water used in the Yadkin-Pee Dee River basin. Water used for industrial and livestock purposes comprises the majority of self-supplied water use in the basin (Figure A-11).

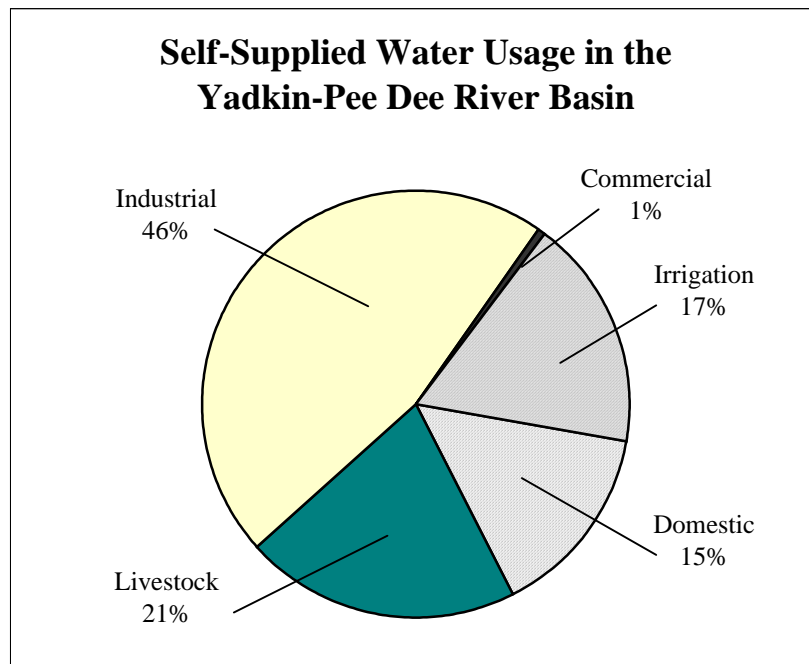


Figure A-11 Estimated Self-Supplied Water Use in the Yadkin-Pee Dee River Basin (NCDENR-DWR, January 2001)

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 Yadkin-Pee Dee 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-17 presents registered withdrawals.

Table A-17 Registered Water Withdrawals in the Yadkin-Pee Dee River Basin (1997)

County	1999 Average (MGD)	1999 Maximum (MGD)	Source of Withdrawal*	Facility
Anson	0.4	3.4	Island Creek	Hedrich Industries, Inc.
Anson	5.0	5.0	<i>Bonsal-owned ponds</i>	W.R. Bonsal Co., Mining Division – Lilesville Mine
Anson	0.0	0.0	Pee Dee River	Martin Marietta Materials, Inc.
Anson	1.3	2.2	Pee Dee River	US Pipeline for Progree Energy – pipeline testing
Cabarrus	0.07	0.07	<i>Gold Hill Quarry</i>	Vulcan Construction Materials, L.P.
Davidson	0.13	0.6	Lake on course	Sapona Country Club
Davidson	0.01	0.01	<i>Thomasville Quarry</i>	Martin Marietta Materials, Inc.
Davie	0.03	0.04	<i>Smith Grove Quarry</i>	Vulcan Construction Materials, L.P.
Forsyth	0.01	0.01	<i>East Forsyth Quarry</i>	Vulcan Construction Materials, L.P.
Forsyth	0.04	0.09	<i>North Quarry</i>	Vulcan Construction Materials, L.P.
Forsyth	0.01	0.01	<i>Salem Quarry</i>	Martin Marietta Materials, Inc.
Iredell	0.0	0.0	Big Kennedy Creek Hunting Creek	Ha-Ho Dairy Farm
Iredell	0.01	0.03	<i>Statesville Quarry</i>	Martin Marietta Materials, Inc.
Richmond	0.04	0.07	<i>Rockingham Quarry</i>	Vulcan Construction Materials, L.P.
Rowan	255.0	407.5	High Rock Lake	Duke Energy Corporation – Buck Steam Station
Rowan	1.1	1.3	Second Creek	Arteva Specialties SARL d/b/a KOSA – Salisbury
Rowan	1.8	2.9	Yadkin River	Color-Tex, NC Finishing Corp.
Rowan	0.0	0.0	<i>Woodleaf Quarry</i>	Martin Marietta Materials, Inc.
Surry	1.7	3.0	Big Elkin Creek	Chatham, Inc.
Surry	0.03	0.03	Yadkin River Elkin Quarry	Vulcan Construction Materials, L.P.
Wilkes	0.06	0.06	<i>115 Quarry</i>	Vulcan Construction Materials, L.P.
Wilkes	0.6	0.6	Yadkin River	Frontier Energy, LLC – pipeline testing
Wilkes	1.4	1.8	Yadkin River	Abt Co. at LP Company
Yadkin	0.0	0.0	<i>Yadkin Quarry</i>	Martin Marietta Materials, Inc.

* Quarries often contain connections to groundwater, but do not frequently contain direct surface water connections.

There are 24 registered water withdrawals in the North Carolina portion of the Yadkin-Pee Dee River basin. Twelve of these (50 percent) are surface water withdrawals from streams or lakes with a direct surface water connection. Excluding public water systems or power generating facilities (because the water is returned almost immediately), there is a cumulative permitted capacity to withdraw 15.2 million gallons of surface water per day.

Consumption of water from the Yadkin-Pee Dee River basin through direct withdrawals, along with interbasin transfers (discussed in the following section), has the potential to affect the salinity of the lower Pee Dee River near Myrtle Beach, SC. Consideration of the cumulative effects of saltwater intrusion on the lower Pee Dee River should be considered when additional water withdrawals are proposed.

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. 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.

Table A-18 lists interbasin transfers for the Yadkin-Pee Dee River basin. The DWR map of major river basins, which is used for determining interbasin transfers, considers the South Yadkin River, Rocky River and Uwharrie River (several subbasins under the DWQ system) as major river basins in and of themselves. Therefore, 13 (43 percent) of the transfers listed in the table are between these major tributaries and the Yadkin-Pee Dee River and are still within the hydrologic boundaries of the Yadkin-Pee Dee River basin.

Table A-18 Interbasin Transfers in the Yadkin-Pee Dee River Basin (1997)

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfers (MGD)
Anson County	Anson County	Yadkin	Rocky	0.6
Anson County	Marshville	Yadkin	Rocky	0.3
Anson County	Union County	Yadkin	Rocky	0.8
Asheboro	Asheboro	Uwharrie	Deep	4.6
Davidson Water	Davidson Water	Yadkin	Uwharrie	1.1
Davidson Water	Davidson Water	Yadkin	Deep	0.4
Davidson Water	Archdale	Yadkin	Deep	0.2
Winston-Salem	Winston-Salem	Yadkin	Roanoke	0.4
High Point	High Point	Deep	Yadkin	4.4
Montgomery County	Montgomery County	Yadkin	Deep, Lumber, Uwharrie	1.7 (total)
Montgomery County	Star	Yadkin	Deep	Unknown
Salisbury	Salisbury	Yadkin	South Yadkin	0.3
Salisbury	Rowan County	Yadkin	South Yadkin	0.1
Albemarle	Albemarle	Yadkin	Rocky	5.8
Albemarle	Stanly County	Yadkin	Rocky	0.8
Albemarle	Pfeiffer – North Stanly	Yadkin	Rocky	0.1
Norwood	Norwood	Yadkin	Rocky	0.4
Alexander County WC	Taylorsville	South Yadkin	Catawba	0.4
Statesville	West Iredell WC	South Yadkin	Catawba	Unknown
Asheboro	Asheboro	Uwharrie	Deep	4.6
Kannapolis	Kannapolis	Yadkin	Rocky	4.5
Union County	Union County	Catawba	Rocky	3.6
Union County	Monroe	Catawba	Rocky	2
Mooresville	Mooresville	Catawba	Rocky	Unknown
Mooresville	Mooresville	Catawba	South Yadkin	Unknown
Charlotte-Mecklenburg	Charlotte-Mecklenburg	Catawba	Rocky	16.1*
Mocksville	Mocksville	South Yadkin	Yadkin	0.6
Burlington Industries	Mooresville	Catawba	Rocky	0.4

* In March 2002, a Certificate was approved increasing this transfer to 33.0 MGD.

There are 10 transfers out of the Yadkin-Pee Dee River basin which are estimated to be more than 12 MGD. These transfers are primarily into the Deep River which is in the Cape Fear River basin. There are seven transfers into the Yadkin-Pee Dee River basin, primarily from the Catawba River basin. These transfers are estimated at more than 26 MGD. Through interbasin transfer, there is currently a net gain of approximately 14 MGD into the Yadkin-Pee Dee River

basin as the boundary is defined by DWQ. Although this gain in volume could be considered a benefit, sometimes there are environmental impacts, such as the introduction of harmful non-native species and the transfer of excess pollution, associated with interbasin transfers.

In August 2001, the Charlotte-Mecklenburg Utilities District (CMUD) petitioned the Environmental Management Commission for an increase in its interbasin transfer from the Catawba River basin to the Yadkin-Pee Dee River basin (Rocky River). CMUD requested an increase from the existing 16.1 MGD to 33 MGD. The need for the increase is due to increasing demand for water supply in eastern Mecklenburg County and an increase in existing discharges at the Mallard Creek WWTP and the Rocky River Regional WWTP in the Yadkin-Pee Dee River basin. The increase to 33 MGD will allow CMUD to meet projected water supply demands through the year 2030 in eastern Mecklenburg County. This interbasin transfer does not include transfers associated with water or wastewater service provided to the Town of Mint Hill in Mecklenburg County. The certificate was approved by the EMC at its regular meeting on March 14, 2002.

Several interbasin transfer requests involving the Yadkin-Pee Dee River basin are being considered by the state. One is for a regional water reclamation facility (Three-County). Plans for this facility include a request by Charlotte-Mecklenburg Utilities for a 12 MGD increase in the transfer from the Catawba River basin to the Yadkin-Pee Dee River basin (Rocky River). This would bring the total transfer amount to 45 MGD. Plans also include a request by Union County to increase its existing transfer of 5 MGD to 30 MGD. This transfer is also from the Catawba River basin into the Rocky River in the Yadkin-Pee Dee. A draft Environmental Impact Statement is currently being considered by DWQ and DWR regarding the Three-County Regional Water Reclamation Facility project. Union County has additional transfer issues from the Catawba River basin to the Yadkin-Pee Dee River basin (Rocky River) which are not associated with the Three-County Regional Water Reclamation Facility. However, additional transfer amounts have not been determined at this time.

Development of alternative water supplies for Concord and Kannapolis will involve interbasin transfers between the Catawba and Yadkin-Pee Dee River basins (Rocky River). There is potential in this exchange for Concord to need two transfer certificates and Kannapolis to need one. However, the alternatives are still being evaluated.

2.9.4 Minimum Streamflow

One of the purposes of the NC 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, 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-19 summarizes minimum flow requirements below dams in the Yadkin-Pee Dee River basin.

Table A-19 Minimum Streamflow Requirements in the Yadkin-Pee Dee River Basin

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release (cfs)
<i>Dams associated with Power Production</i>				
W. Kerr Scott		Yadkin River	367	125-400 ¹
Idols	Near Clemmons	Yadkin River	1,945	554 ²
<i>Yadkin Division of APGI FERC Project No. 2197</i>				
High Rock	Near Denton	Yadkin River	3,973	See Footnote ³
Tuckertown	Near Richfield	Yadkin River	4,080	Run-of River ⁴
Narrows (Badin)	Near Badin	Yadkin River	4,180	See Footnote ³
Falls	Near Badin	Yadkin River	4,190	Run-of River ⁴
<i>Progress Energy-CP&L FERC Project No. 2206</i>				
Tillery		Yadkin River	4,638	40 ⁵
Blewett Falls		Yadkin River	6,821	150
Cooleemee	Near Cooleemee	South Yadkin River		124 ⁶
Ledbetter				6.5-9.5 ⁷
<i>Other Impoundments</i>				
Big Warrior Creek		Big Warrior Creek		0.8
Stewarts Creek	Near Mount Airy	Stewarts Creek		19
Lake Howell		Coddle Creek		6

¹ Minimum flow ranges from 125 cfs when reservoir pool level is 1000.0-1003.99 feet to 400 cfs when pool level is at or above 1029 feet.

² The hydropower facility burned in 1998. See text for further details on minimum flow release, etc.

³ Minimum discharge requirements for the Yadkin Project are measured at the Narrows Powerhouse and vary based on time of year. March 6-May 14: 1,500 CFS; May 15-July 1: 1,610 CFS; July 2-September 15: 1,400 CFS; September 16-March 5: 0 CFS, or streamflow into High Rock Reservoir as requested by Progress Energy – CP&L, FERC Project No. 2206. High Rock Reservoir is the primary storage reservoir for the Yadkin Project. Narrows Reservoir also offers some storage. A drawdown schedule calling first on High Rock Reservoir then Narrows Reservoir is followed during abnormally dry and drought periods. The minimum discharges and drawdown schedule are subject to modification during extended periods of drought.

⁴ The development usually operates in a run-of-river mode (i.e., inflow equals outflow).

⁵ Leakage from the dam has been measured by the USGS at 112 cfs.

⁶ This flow is required in the bypass reach below the dam. Project should operate in a run-of-river mode such that inflow to the dam equals outflow from the powerhouse.

⁷ Minimum flow requirements are 6.5 cfs when reservoir pool level is more than five feet below the crest and 9.5 cfs when reservoir pool level is less than five feet below the crest.

The Steeles Mill (FERC Project No. 8282) hydropower facility, located near Cordova, is no longer in operation. The request to surrender the federal exemption to operate was granted in 2001. The dam has been mentioned as a candidate for removal by resource agencies.

Instream Flow Studies

The Town of Yadkinville plans to expand water supply withdrawals from South Deep Creek to a capacity of 5.5 MGD and develop off-stream storage to draw from during periods of low flow. The intake is downstream of Highway 601. An instream flow study established a flow target of 15 cfs below the intake. An agreement between DWR and the town establishes a withdrawal limit of 1.7 cfs when streamflow is less than or equal to the 7Q10 (8.4 cfs). The town can withdraw up to the 5.5 MGD capacity when streamflow exceeds 8.4 cfs.

Also in the South Deep Creek watershed, the Yadkin County Soil and Water Conservation District and the Yadkin County Board of Commissioners are sponsoring a proposal for an impoundment upstream of Cranberry Creek. The dam will be subject to the NC Dam Safety Law and will be required to provide a minimum flow of 4.0 cfs (equal to the 7Q10 flow). All permits have been secured and design is underway. Land rights acquisition is in progress with a completion target of September 2002.

The City of Winston-Salem is constructing a new water intake and low-head weir in the Yadkin River to meet future water supply demands. The city will construct riffle habitat downstream of the weir to mitigate the loss of aquatic habitat. A canoe-access primitive camp will also be provided. The city will also coordinate their withdrawals with the US Army Corps of Engineers so as to maintain the river flow target of 554 cfs below Idols dam. The Idols hydropower facility, located near Clemmons, burned in 1998. The City of Winston-Salem and Forsyth County Utility Commission are expected to purchase the dam from the project licensee.

The Town of Pilot Mountain plans to expand water supply withdrawals from Toms Creek to a capacity of 2.25 MGD and develop off-stream storage to draw from during periods of low flow. An agreement between DWR and the town establishes a withdrawal limit of 1.6 MGD when streamflow is less than or equal to the 7Q10 (7.6 cfs). The town can withdraw up to the 2.25 MGD capacity when streamflow exceeds 7.6 cfs.

The City of Statesville proposed to increase their water supply withdrawal from the South Yadkin River. Currently, flow at 23.3 cfs is required downstream of the intake when withdrawals exceed 9 MGD. However, the city also has approval to withdraw 15 MGD of water from Lookout Shoals Reservoir on the Catawba River. When the Lookout Shoals connection is complete, 23.3 cfs will be required continually in the South Yadkin River below the intake.

Hydroelectric Project Relicensing

The license issued by the Federal Energy Regulatory Commission (FERC) to Alcoa Power Generating, Inc. for the operation of the Yadkin Hydroelectric Project (No. 2197) and the license issued to Progress Energy-Carolina Power and Light Company for the operation of the Yadkin-Pee Dee Hydroelectric Project (No. 2206) expire in 2008. The relicensing process is currently in the early stages. Extensive studies related to instream flow and water quality will be completed and the results used to make management decisions regarding these six reservoirs (listed in Table A-19).

2.10 Physical Impacts to Wetlands and Streams

DWQ and the Division of Land Resources 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 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 required 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.

Permitted Impacts and Mitigation

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 impacts 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.

Table A-20 presents permitted wetland and stream impacts by subbasin for the Yadkin-Pee Dee River basin from the DWQ Wetlands/401 Unit database. Miles and acres of required stream and wetland mitigation are also presented. A total of 196 acres of wetland impacts were permitted in the basin between 1997 and 2001. During that period, 276 acres of wetland mitigation were required to compensate for these impacts. About 40 percent of the permitted wetland impacts resulted from road improvement and maintenance projects, including the Rockingham Bypass. The majority of the remaining impacts were permitted for utility projects, construction of farm ponds and subdivision development.

Permitted stream impacts in the basin during the five-year period totaled 88,585 linear feet with 63,003 linear feet of stream restoration required to mitigate for permitted losses during that period. More than 50 percent of these permitted impacts resulted from road improvement and maintenance projects, including the I-85 and US 421 widening projects and the Northern Beltway around Winston-Salem. The remaining impacts are attributed to sewer and utility improvements resulting from new subdivision development.

Table A-20 Permitted Wetland and Stream Impacts and Required Mitigation in the Yadkin-Pee Dee River Basin (1997-2001)

Subbasin	Permitted Wetland Impacts (acres)	Wetland Mitigation (acres)	Permitted Stream Impacts (feet)	Stream Mitigation (acres)
03-07-01	2.1	0.0	2,464	385
03-07-02	16.1	23.1	11,373	10,218
03-07-03	0.2	0.0	270	0
03-07-04	14.2	17.4	44,714	39,958
03-07-05	64.8	0.0	90	0
03-07-06	0.9	1.2	3,115	300
03-07-07	2.4	0.0	2,992	1,332
03-07-08	1.3	0.0	3,421	125
03-07-09	0.2	0.0	2,682	3,100
03-07-10	1.5	0.0	1,059	242
03-07-11	18.4	8.5	10,400	4,428
03-07-12	6.7	0.0	4,215	2,167
03-07-13	0.3	0.0	1,095	748
03-07-14	3.2	0.0	142	0
03-07-15	3.5	1.5	165	0
03-07-16	60.0	224.4	318	0
03-07-17	0.0	0.0	70	0
Total	195.8	276.1	88,585	63,003