Chapter 2 -
Basin Overview

2.1 General Overview

The Cape Fear River basin is the state's largest river basin. The river basin is located entirely within the state's boundaries and flows southeast from the north central piedmont region near Greensboro to the Atlantic Ocean near Wilmington (Figure A-4).

Cape Fear Basin Statistics

Total Area: 9,322 sq. miles
Stream Miles: 6,049
Saltwater Acres: 39,200
No. of Counties: 26
No. of Municipalities: 116
No. of Subbasins: 24
Population (1990): 1,465,451 *
Estimated Pop. (2010): 1,992,128 *
% Increase (1997-2010): 17.8
Pop. Density (1990): 160 persons/sq. mi.

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

The Cape Fear River is formed at the confluence of the Haw and Deep Rivers on the border of Chatham and Lee counties, just below the B. Everett Jordan Reservoir dam. From there, the river flows across the coastal plain past Fayetteville through three locks and dams to Wilmington before entering the ocean. The Black and Northeast Cape Fear Rivers are blackwater rivers that meet the Cape Fear River in Brunswick County.

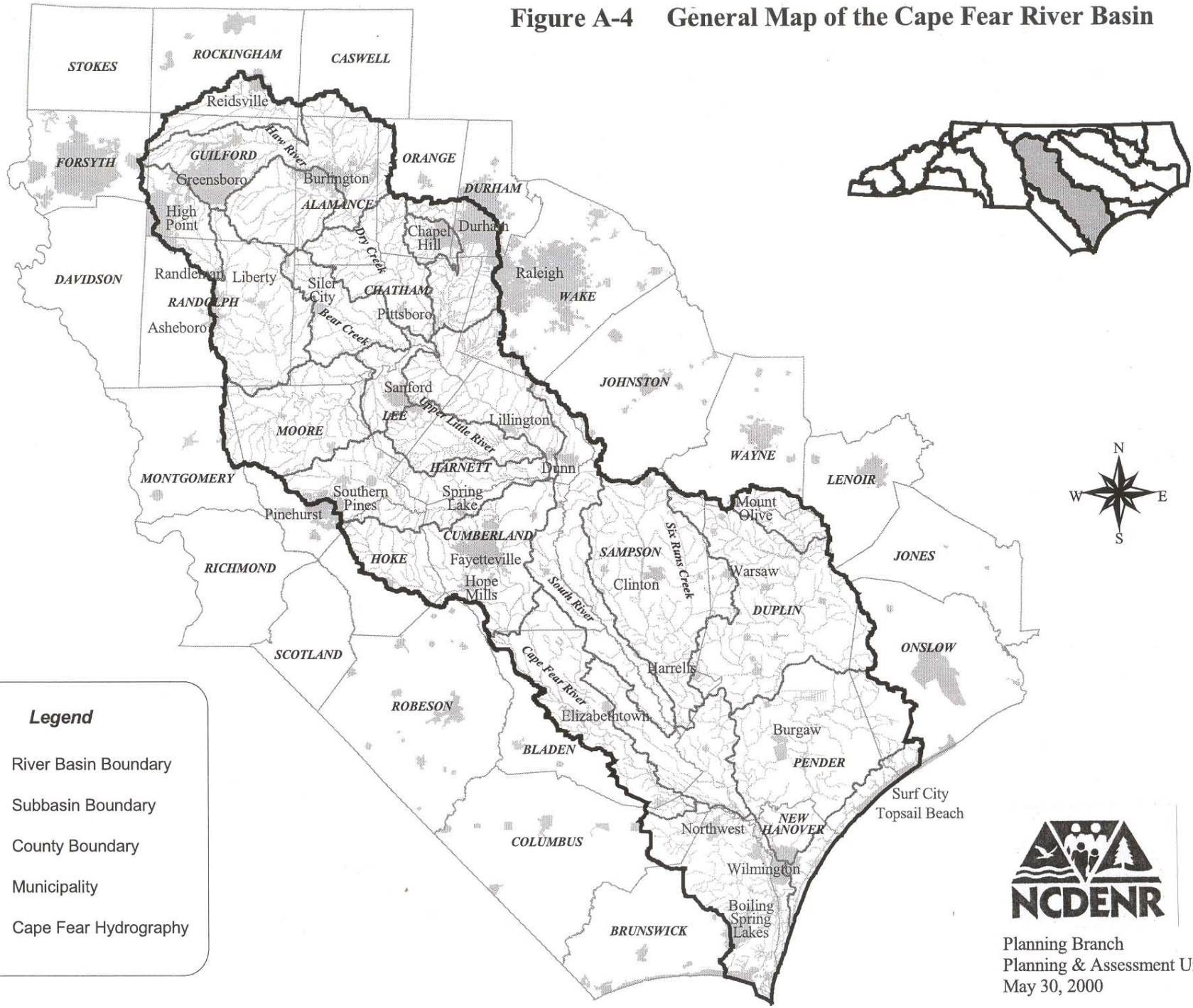
The basin includes four coastal Outstanding Resource Waters (Stump, Middle, Topsail and Masonboro Sounds) and one inland ORW (a portion of the Black River).

The most populated regions of the basin are in and near the Triad area (Greensboro-Burlington-High Point), the Durham-Chapel Hill area and Fayetteville. The overall population density is 160 persons per square mile compared to a statewide average of 139 persons per square mile. The percent population growth over the 7-year period from 1990 to 1997 was 13.2% compared to a statewide increase of 12.0%. Estimated water usage in the basin is expected to increase nearly 95% (193 MGD in 1992 to 376 MGD by 2020).

Over one-half of the land in the river basin is forested. Statistics provided by the US Department of Agriculture, Natural Resources Conservation Service (NRCS), indicate that during the 10-year period from 1982 to 1992, there was a significant increase in the amount of developed land (43%). The basin contains 54% of the state's swine operations, and swine populations in the basin have increased 90% between 1994 and 1998.

There are many different aquatic ecosystems in the Cape Fear River basin that support a wide variety of commercial and recreational fisheries. Wetlands, estuaries, blackwater rivers and rocky streams support 30 endangered species in the basin.

Figure A-4 General Map of the Cape Fear River Basin



2.2 Local Governments and Planning Jurisdictions in the Basin

The basin encompasses all or part of the following 26 counties and 116 municipalities (Table A-3). Lenoir, Jones and Robeson counties have less than 1% of their land areas and no municipalities in the Cape Fear basin. Also included in the table are abbreviations for the Lead Regional Organizations (Councils of Government).

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

County	% of County in Basin *	Council of Government Region	Municipalities
Alamance	100%	G	Alamance, Burlington, Elon College, Gibsonville**, Graham, Green Level, Haw River, Mebane**, Swepsonville
Bladen	69%	N	Dublin, East Arcadia, Elizabethtown, Tar Heel, White Lake
Brunswick	45%	O	Bald Head Island, Belville, Boiling Spring Lakes, Caswell Beach, Leland, Long Beach, Navassa, Northwest, Sandy Creek, Southport, Yaupon Beach
Caswell	10%	G	None
Chatham	100%	J	Goldston, Pittsboro, Siler City
Columbus	11%	O	Bolton, Sandyfield
Cumberland	98%	M	Falcon**, Fayetteville, Godwin, Hope Mills, Linden, Spring Lake, Stedman, Wade
Duplin	100%	P	Beulaville, Calypso, Faison, Greenevers, Harrells**, Kenansville, Magnolia, Mount Olive**, Rose Hill, Teachey, Wallace, Warsaw
Durham	27%	J	Chapel Hill**, Durham
Forsyth	2%	I	Kernersville**
Guilford	97%	G	Archdale**, Gibsonville**, Greensboro, High Point**, Jamestown, Kernersville**, Oak Ridge, Pleasant Garden, Sedalia, Stokesdale, Summerfield, Whitsett
Harnett	100%	M	Angier, Broadway**, Coats, Dunn, Erwin, Lillington
Hoke	57%	N	Raeford
Johnston	2%	J	Benson
Lee	100%	J	Broadway**, Sanford
Montgomery	6%	H	Biscoe, Candor, Star
Moore	79%	H	Cameron, Carthage, Pinehurst, Robbins, Southern Pines, Taylortown, Vass, Whispering Pines
New Hanover	100%	O	Carolina Beach, Kure Beach, Wilmington, Wrightsville Beach
Onslow	22%	P	Holly Ridge, North Topsail Beach, Surf City**
Orange	49%	J	Carrboro, Chapel Hill**, Mebane**
Pender	100%	O	Atkinson, Burgaw, Saint Helena, Surf City**, Topsail Beach, Watha
Randolph	56%	G	Archdale**, Asheboro, Franklinville, High Point**, Liberty, Ramseur, Randleman, Seagrove, Staley
Rockingham	19%	G	Reidsville
Sampson	99%	M	Autreyville, Clinton, Falcon**, Garland, Harrells**, Newton Grove, Roseboro, Salemburg, Turkey
Wake	15%	J	Apex, Cary, Fuquay-Varina, Holly Springs, Morrisville
Wayne	9%	P	Mount Olive**

* Source: North Carolina Center for Geographic Information and Analysis

** Located in more than one county

Key:

Region	Name	Location
G	Piedmont Triad Council of Government	Greensboro
H	Pee Dee Council of Government	Rockingham
I	Northwest Piedmont Council of Government	Winston-Salem
J	Triangle J Council of Government	Research Triangle Park
M	Region M Council of Government	Fayetteville
N	Lumber River Council of Government	Lumberton
O	Cape Fear Council of Government	Wilmington
P	Neuse River Council of Government	New Bern

2.3 Surface Water Hydrology

2.3.1 Major Hydrologic Divisions

The Cape Fear River basin is the largest river basin in North Carolina, and its watershed is contained entirely within the state. The mainstem of the river is formed by the confluence of the Deep and Haw Rivers just downstream of the B. Everett Jordan Reservoir dam. The Deep River originates near High Point and the Haw River near Greensboro. The mainstem of the river flows in a southeasterly direction until it empties into the Atlantic Ocean at Cape Fear, south of Wilmington.

The watershed is divided into 6 major hydrologic areas (*8-digit hydrologic units*) by the US Geologic Survey (USGS). These include the Haw River/Jordan Reservoir watershed, the Deep River, the upper Cape Fear, the Black River, the Northeast Cape Fear and the lower Cape Fear, and coastal waters. These major hydrologic areas are further subdivided by DWQ for management purposes into 24 subbasins (Figures A-5 to A-7) denoted by 6-digit numbers (03-06-01 to 03-06-24). Table A-4 shows the breakdown of USGS hydrologic units and DWQ's corresponding subbasins. Maps of DWQ's subbasins are included in Section B of the basinwide plan.

The Cape Fear River basin, which has a total land area of 9,322 square miles and 6,049 stream miles, has an average drainage area of 1.5 square miles per stream mile. A variety of aquatic systems are represented in the basin as the terrain changes from the piedmont to the coastal plain, including large freshwater rivers, blackwater swamps and estuaries.

General Map of the Upper Cape Fear River Basin

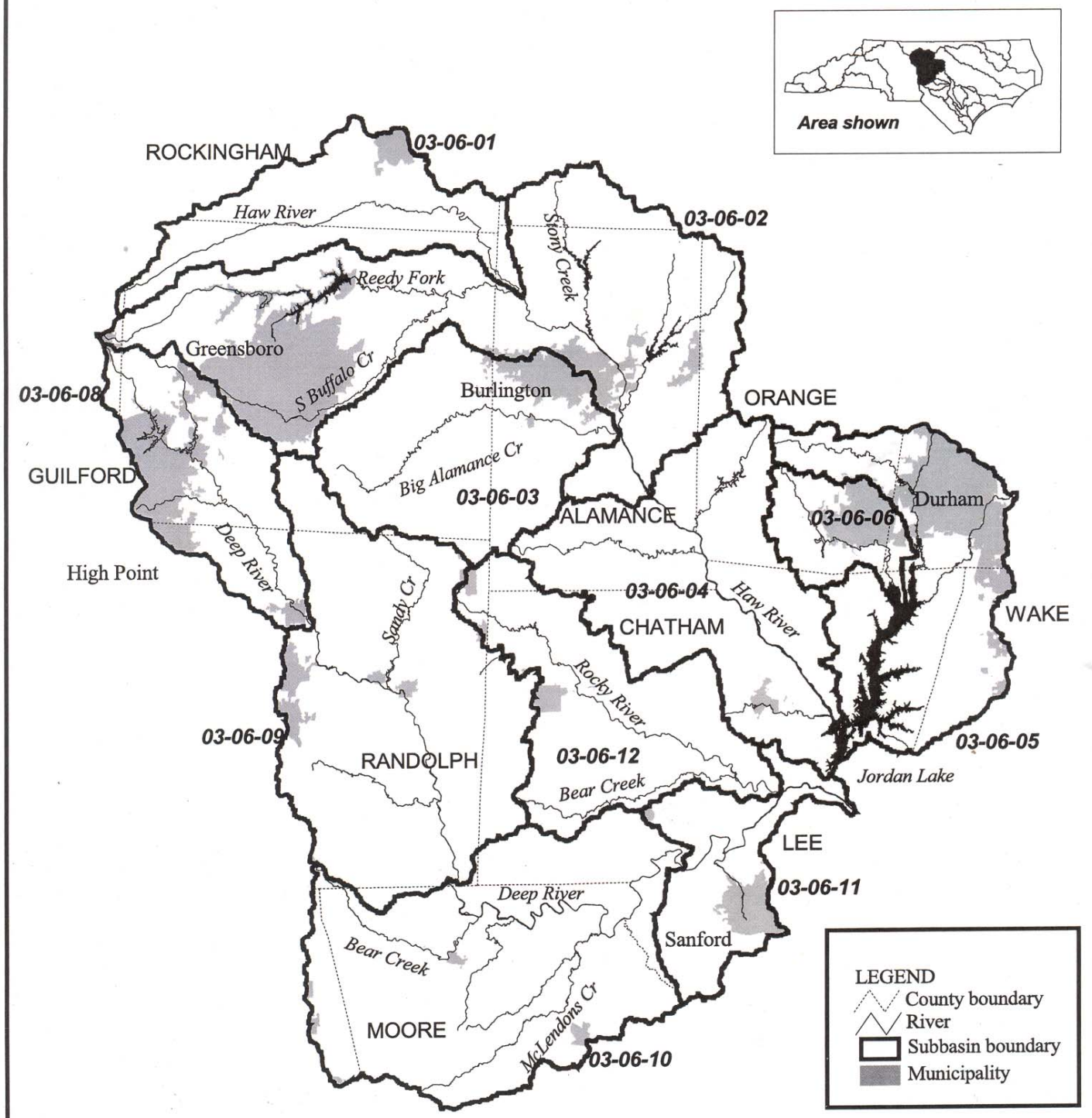


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Figure A-5 General Map of the Upper Cape Fear River Basin

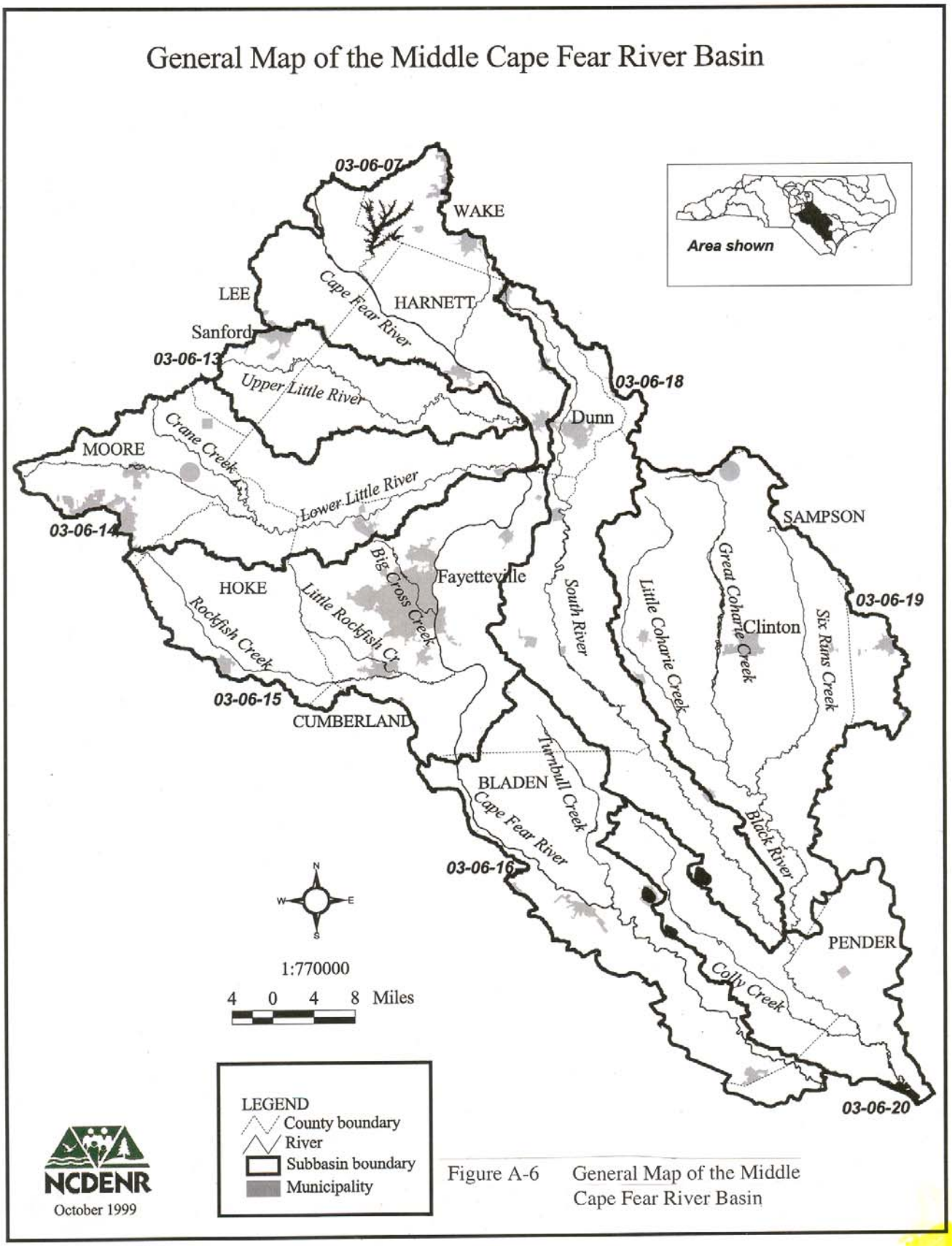

Figure A-6 General Map of the Middle Cape Fear River Basin

General Map of the Lower Cape Fear River Basin

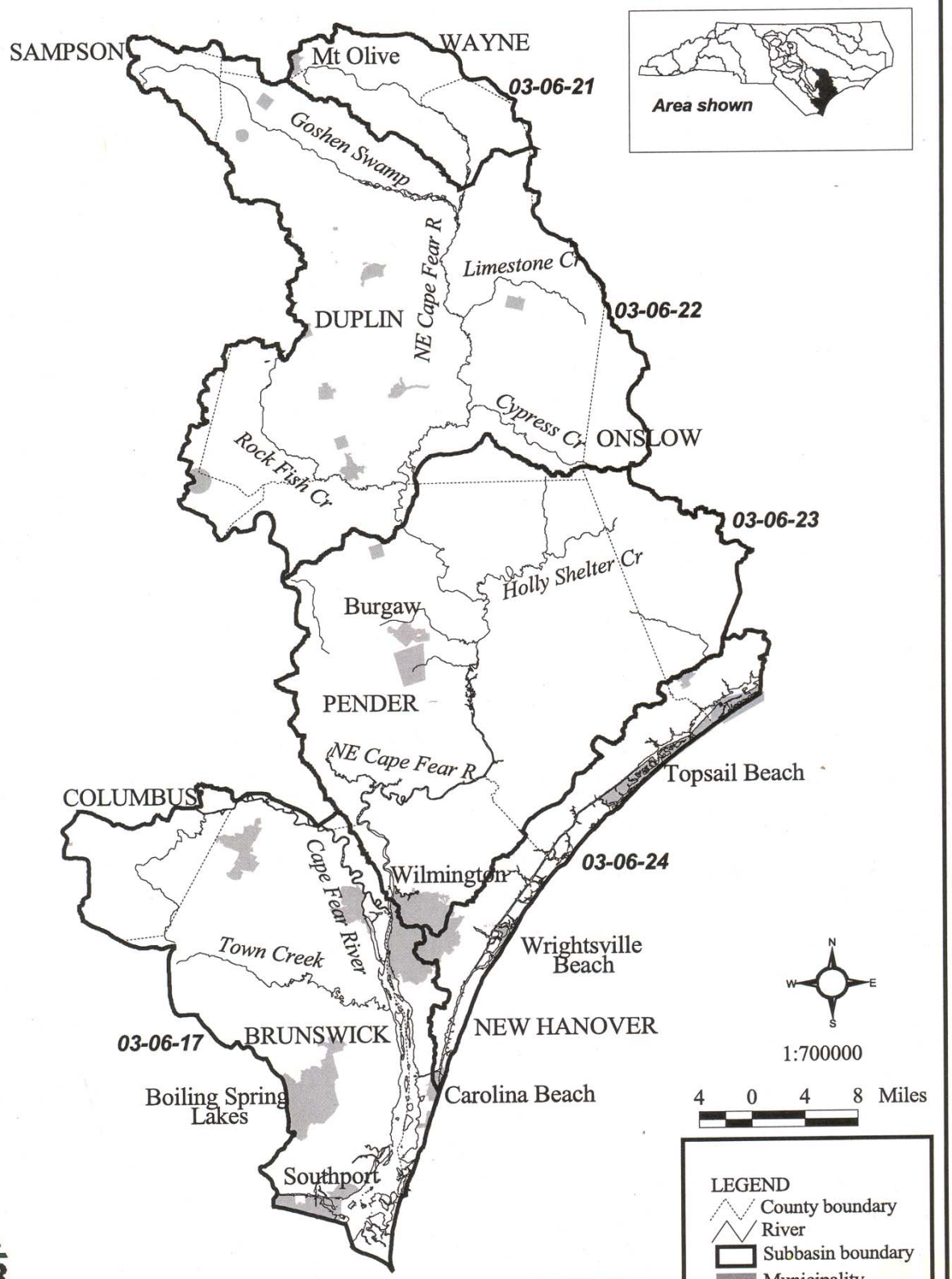

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Figure A-7 General Map of the Lower Cape Fear River Basin

Table A-4 Hydrologic Subdivisions in the Cape Fear River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ 6-digit Subbasin Codes
Haw River and Jordan Reservoir	03030002	030601, 030602, 030603, 030604, 030605, 030606
Upper Haw River	"	01
Reedy Fork, Stony Creek and Haw River (middle)	"	02
Big and Little Alamance Creeks	"	03
Haw River (lower)	"	04
New Hope Creek and Jordan Reservoir	"	05
Morgan Creek and University Lake	"	06
Deep River	03030003	030608, 030609, 030610, 030611, 030612
Deep River (upper) and Muddy Creek	"	08
Deep River (middle) and Richland Creek	"	09
Deep River (middle), Cabin Creek and McLendons Creek	"	10
Deep River (lower)	"	11
Rocky River	"	12
Upper Cape Fear River	03030004	030607, 030613, 030614, 030615
Cape Fear River (upper)	"	07
Upper Little River	"	13
Little River	"	14
Rockfish Creek and Cape Fear River	"	15
Lower Cape Fear River	03030005	030616, 030617, 030624
Cape Fear River	"	16
Town Creek, Brunswick River and Cape Fear River (extreme lower)	"	17
Topsail, Middle, Masonboro and Stump Sounds	"	24
Black River	03030006	030618, 030619, 030620
South River	"	18
Great Coharie Creek, Six Runs Creek and upper Black River	"	19
Black River	"	20
Northeast Cape Fear River	03030007	030621, 030622, 030623
Upper Northeast Cape Fear River	"	21
Middle Northeast Cape Fear River, Goshen Swamp, Rockfish Creek	"	22
Lower Northeast Cape Fear River	"	23

2.3.2 Physiography and Geology of the Cape Fear River Basin

The headwaters of the Cape Fear River are at nearly 1000 feet above sea level in Forsyth County and drain to sea level in Brunswick County before entering the Atlantic Ocean. The upper Cape Fear River basin is mostly in the piedmont, and the lower Cape Fear River basin lies in the coastal plain.

The geology underlying the Cape Fear River basin has an affect on both stream water quality and water quantity. Ten low flow hydrologic areas (HA1-HA10) were defined for North Carolina by USGS (Figure A-8). Areas were defined by relating topography, geology, mean annual

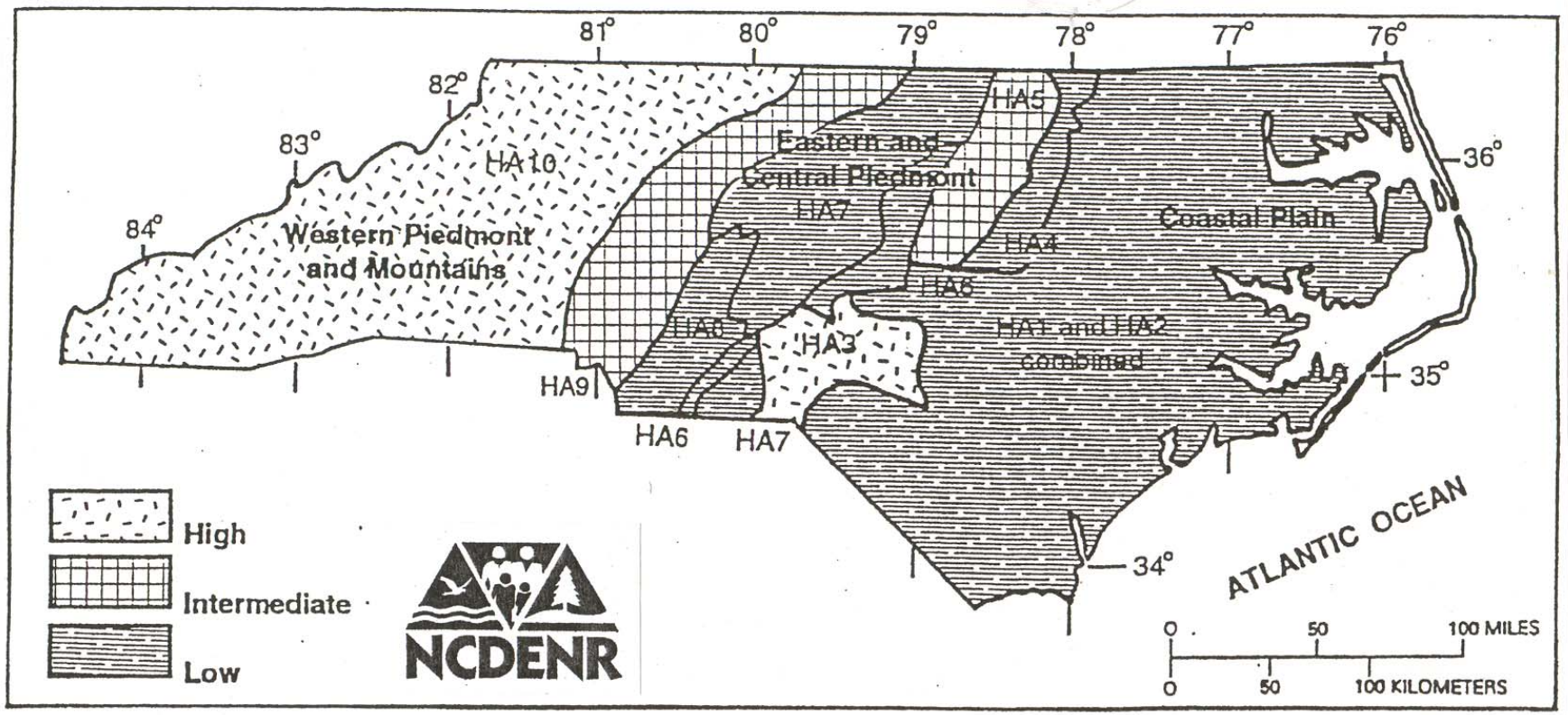


Figure A-8 Hydrologic Areas (HA) of Similar Potential to Sustain Base Flows

runoff, and other features to low flow frequency characteristics including 7Q10 (annual minimum 7-day consecutive low flow, which on average, will be exceeded 9 out of 10 years) and 30Q2 (annual minimum 30-day consecutive low flow, which on average, will be exceeded in 1 out of 2 years). The ten HAs typically form a southwest-northeast band across the state and lie within three physiographic areas – the coastal plain, piedmont and mountains (Giese and Mason, 1993).

In general, the lowest potential for sustaining base flow to streams is in the clay and sandy soils area of the coastal plain (HA1 And HA2) and the eastern and central piedmont (HA4, HA6, HA7 and HA8). The following discussion explains the characteristics that reduce the potential for base flow in these regions.

Coastal Plain Physiographic Area

The geology of this area consists of alternating layers of sand, silt, clay and limestone. This area was divided into three HAs based on soil types and topography. These are clay soils (HA1), sandy soils (HA2) and the Sand Hills (HA3). With the exception of the Sand Hills area (HA3), topographic relief is relatively flat, with the land surface dipping coastward at a rate of only a few feet per mile. Topographic relief and hydraulic gradient in the Sand Hills (HA3) is much higher.

The clay soils have the lowest low flow values of the three HAs (median 7Q10 is 0[ft^3/s]/mi^2); sandy soils (HA2) have intermediate values (median 7Q10 is 0.006[ft^3/s]/mi^2); and the Sand Hills (HA3) have the highest values in the state (median 7Q10 is 0.318[ft^3/s]/mi^2).

The low topographic relief of HA1 and HA2 (1 to 2 feet per mile) reflects the low hydraulic gradient and reduced potential to move water to streams than in areas with greater topographic relief (i.e., HA3). The lower low flow values for clay soils versus sandy soils result from the lower permeability of clay soils and that a higher percentage of precipitation that falls on clay soils is not absorbed and runs off directly into streams. Clay soils also have lower hydraulic conductivity than sandy soils, and thus, contribute less to base flow of streams than sandy soils.

Eastern and Central Piedmont Physiographic Area

Topography in this area is characterized by rolling hills and geologic formations consisting of crystalline or sedimentary rocks. This area was divided into six HAs based on soil types, topography and underlying bedrock type: the Eastern Slate Belt (HA4), the Raleigh Belt (HA5), the Triassic Basin (HA6), the Carolina Slate Belt (HA7 and HA8), and the Charlotte Belt and Milton Belt (HA9).

Of particular interest within this area is the fact that the sedimentary rocks underlying the Triassic Basin have the lowest average yield of water to wells of all rock types in the state. This low yield implies the rocks have low permeability, and thus, result in low base flows of streams in the region.

The 7Q10 values for HA6 are zero for all but the largest drainages. In addition, the Carolina Slate Belt region is associated with low to zero flow streams. DWQ limits discharges of oxygen-consuming wastewater to these low base flow streams.

In addition, the overall low permeability of residual soils derived from the Triassic sedimentary rocks results in low percolation rates for septic systems. This low permeability promotes surface runoff and shallow discharge during storm flow events.

The goal of DWQ for streams determined to be zero flow streams is to remove all discharges, or if removal is not possible, advanced treatment will be required. DWQ management strategies for wastewater discharges into zero flow streams are presented in Section A, Part 4.12.

2.4 Land Cover

Land cover information in this section is derived from the National Resources Inventory (NRI) of 1992 and 1982, as developed by the Natural Resources Conservation Service (USDA, 1994). The NRI is a multi-resource national inventory based on soils and other resource data collected at scientifically selected random sample sites. It is considered accurate to the 8-digit hydrologic unit scale established by the US Geological Survey (USDA, 1994).

Table A-5 summarizes acreages and percentage of land cover from the 1992 NRI for the entire basin and for the major watershed areas within the basin (USGS hydrologic unit 03030001 is not included in the table because only a small portion of the area is within the Cape Fear River basin). Land cover types identified by the NRI as occurring in the Cape Fear River basin are presented in Table A-6.

Land cover in the basin, as presented in Table A-5, is dominated by forestland that covers approximately 56% of the land area. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 24% of the area. The urban category comprises roughly 9% of the area and exhibited the most dramatic change since 1982, with a 43% increase of land area in this category. Other categories that showed substantial changes since 1982 were uncultivated cropland and "other" with increases of 18% and 17%, respectively. These land cover changes are summarized in Figure A-9.

The most recent land cover information for the Cape Fear River basin is based on satellite imagery collected from the North Carolina Corporate Geographic Database. The state's Center for Geographic Information and Analysis (CGIA) developed statewide land cover information based on this 1993-1995 satellite imagery. This land cover data is divided into 24 categories. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-7. Figure A-10 provides an illustration of the relative amount of land area that falls into each major cover type for the Cape Fear River basin.

Table A-5 Land Cover in the Cape Fear River Basin by Major Watersheds (8-Digit USGS Hydrologic Units) (Source: USDA, Soil Conservation Service - 1982 and 1992 NRI)

	MAJOR WATERSHED AREAS																
	Haw River and Jordan Lake		Deep River		Upper Cape Fear River		Lower Cape Fear River		Black River		Northeast Cape Fear River		1992 TOTALS		1982 TOTAL		% change
LAND COVER	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	since 1982
Cult. Crop	140.8	13.0	87.8	9.5	167.9	16.4	73.4	10.7	367.9	36.8	230.5	20.1	1068	18.2	1163	19.8	-8
Uncult. Crop	15.8	1.5	18.3	2.0	13.7	1.3	2.6	0.4	5.4	0.5	10.0	0.8	65.8	1.1	55.7	0.9	+18
Pasture	133.6	12.3	85.8	9.3	31.7	3.1	5.1	0.7	0.0	0.0	24.6	2.2	280.8	4.8	288.3	5.0	-3
Forest	464.5	42.9	577.5	62.7	462.4	45.0	492.0	71.9	550.3	55.0	741.7	64.8	3288	56.1	3444	59.0	-5
Urban & Built-up	186.8	17.3	93.4	10.2	120.3	11.7	35.5	5.2	29.6	2.9	46.4	4.1	512.0	8.8	358.7	6.0	+43
Other	140.5	13.0	57.7	6.3	230.8	22.5	76.0	11.1	47.9	4.8	91.9	8.0	644.8	11.0	550.8	9.3	+17
Totals	1082.0	100.0	920.5	100.0	1027	100.0	684.6	100.0	1001	100.0	1145.1	100.0	5860	100.0	5860	100.0	
% of Total Basin		18.5		15.7		17.5		11.7		17.1		19.5		100.0			
SUBBASINS	01 to 06 and 07*		08 to 12		07*, 13 to 15*		15*, 16 and 17		18, 19 and 20		21, 22 and 23						
8- Digit Hydraulic Units	03030002		03030003		03030004		03030005		03030006		03030007						

* These subbasins are found within more than one 8-Digit Hydraulic Unit.

Table A-6 Description of Land Cover Types (1992 NRI - USDA SCS)

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, and the area must be at least 1,000 feet wide.
Urban and Built-up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	*Rural Transportation*: Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes). *Small Water Areas*: Waterbodies less than 40 acres in size and streams less than one-half mile wide. *Census Water*: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width. *Minor Land*: Lands not in one of the other categories.

Figure A-9 Land Cover Changes from 1982 to 1992 for the Cape Fear River Basin (Source: USDA-NCRS 1992 NRI)

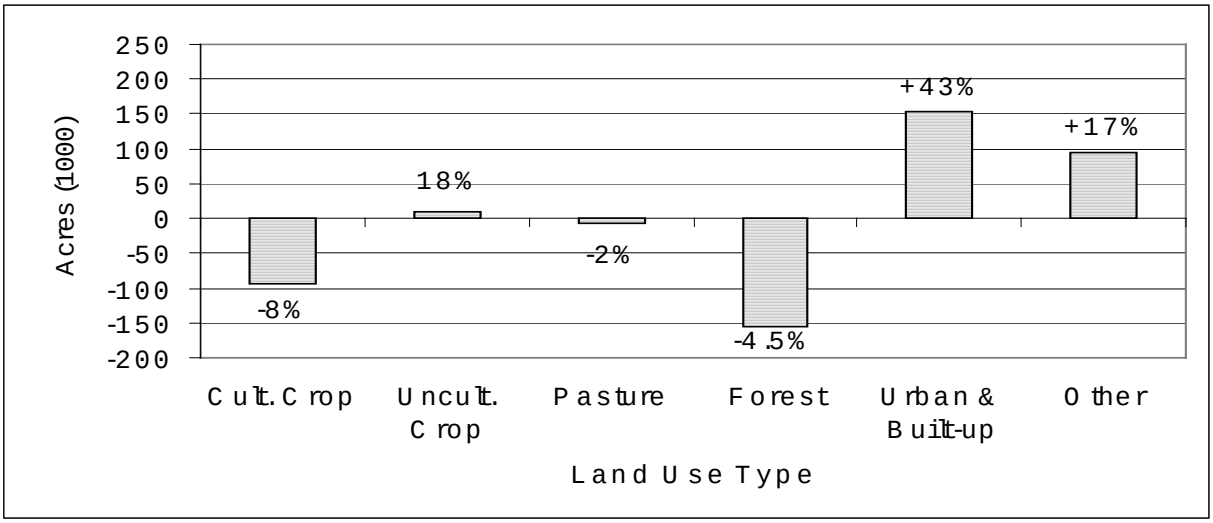
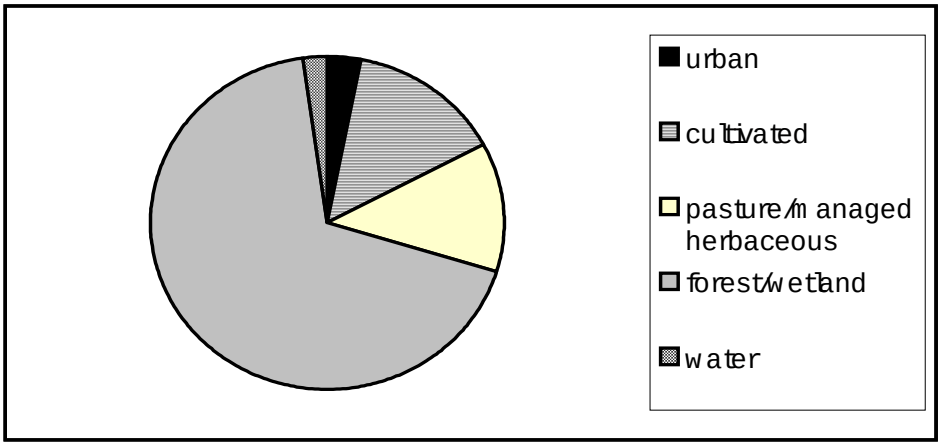


Table A-7 Description of Land Cover Categories

Land Cover Type	Land Cover Description
Urban	Greater than 50% coverage by synthetic land cover (built-upon area) and municipal areas.
Cultivated	Areas that are covered by crops that are cultivated in a distinguishable pattern (such as rows).
Pasture/Managed Herbaceous	Areas used for the production of grass and other forage crops and other managed areas such as golf courses and cemeteries. Also includes upland herbaceous areas not characteristic of riverine and estuarine environments.
Forest/Wetland	Includes salt and freshwater marshes, hardwood swamps, shrublands and all kinds of forested areas (such as needleleaf evergreens, conifers, deciduous hardwoods).
Water	Areas of open surface water, areas of exposed rock, and areas of sand or silt adjacent to tidal waters and lakes.

Figure A-10 Percentages within Major Land Cover Categories in the Cape Fear Basin



2.5 Population and Growth Trends

Population

The Cape Fear River basin has an estimated population of 1,465,451 people based on 1990 census data. Table A-8 presents census data for 1970, 1980 and 1990 for each of the subbasins. It also includes land areas and population densities (persons/square mile) by subbasin based on the land area (excludes open water) for each subbasin. Densely populated areas are scattered across the basin and include the Burlington-Greensboro-High Point area in the upper part of the basin (Figure A-11), the Fayetteville area in the middle part of the basin, and the Wilmington area in the lower portion of the basin (Figure A-12). The subbasin that encircles the Chapel Hill area is the most densely populated with 783 persons/square mile compared to a basinwide average of 160 persons/square mile. This density compares to a statewide average of 139 persons/square mile.

It should be noted that some of the population figures are estimates because the census block group boundaries do not generally coincide with subbasin boundaries. 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 has to be made on the percentage of the population that is located in the subbasin. This is 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 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.

Growth Trends

The percentage increase in population for the entire basin was 29.3% from 1970-1990 and 11.5% from 1980-1990. This latter percentage is almost equal to a statewide increase of 12.7% over the same ten-year period. Population increases by subbasin are presented in Figure A-13 and Table 8.

Table A-9 shows the estimated percent changes in growth between 1990 and 1997 and projected percent change in growth between 1997 and 2010 for counties in the basin (Office of State Planning, 1999). Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the Cape Fear River basin. They are instead presented as an estimate of possible countywide population changes.

Population growth trends for the basin between 1990 and 1997 indicate growth rates for six of the 26 counties of 20 to 30 percent and a basinwide population increase of nearly 13.2%. Projections for population growth from 1997 to 2010 indicate five counties with growth rates in excess of 30 percent and seven counties with growth rates of 20 to 30 percent with a total population increase in the basin of 17.8%.

Table A-8 Cape Fear Subbasin Population (1970, 1980 and 1990) and Land Area Summaries

SUBBASIN	POPULATION (Number of Persons)			POPULATION DENSITY (Persons/Square Mile)			LAND AND WATER AREAS			
							Total Land and Water Area		Water Area	Land Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
03-06-01	20,250	21,894	25,897	108	117	138	120,794	189	2	187
03-06-02	222,954	254,617	279,034	402	459	503	359,634	562	7	555
03-06-03	61,354	59,377	66,593	235	227	255	167,494	262	1	261
03-06-04	13,600	18,949	20,213	42	58	62	211,750	331	4	327
03-06-05	69,772	77,357	102,058	278	308	407	171,940	269	18	251
03-06-06	37,469	47,017	57,917	506	635	783	47,695	75	1	74
03-06-07	35,520	37,704	39,713	88	94	99	266,019	415	12	403
03-06-08	87,537	91,778	101,430	495	519	573	114,385	179	2	177
03-06-09	40,171	51,405	55,755	90	116	125	285,450	446	1	445
03-06-10	19,222	21,691	21,107	43	49	47	287,088	448	2	446
03-06-11	14,599	21,083	22,221	111	160	168	84,842	133	1	132
03-06-12	14,622	14,326	16,015	60	59	66	155,909	244	1	243
03-06-13	15,743	16,443	23,913	72	75	109	141,134	221	2	219
03-06-14	51,713	60,635	67,587	108	127	141	309,699	484	6	478
03-06-15	186,209	222,582	247,765	313	374	416	384,138	600	5	595
03-06-16	12,424	15,992	14,811	29	37	34	280,559	438	8	430
03-06-17	38,646	48,954	56,467	78	98	113	349,828	547	49	498
03-06-18	32,256	38,068	39,895	65	77	81	316,587	495	2	493
03-06-19	39,703	43,577	40,575	54	59	55	473,136	739	2	737
03-06-20	4,556	5,229	5,231	13	15	15	219,740	343	5	338
03-06-21	7,076	9,271	7,582	59	78	64	76,297	119	0	119
03-06-22	35,696	39,552	39,144	43	48	47	530,335	829	1	828
03-06-23	41,623	60,632	64,540	53	77	82	508,688	795	6	789
03-06-24	33,295	36,748	49,988	234	259	352	103,962	162	20	142
TOTALS	1,136,010	1,314,881	1,465,451	124	143	160	5,967,103	9,325	158	9,167

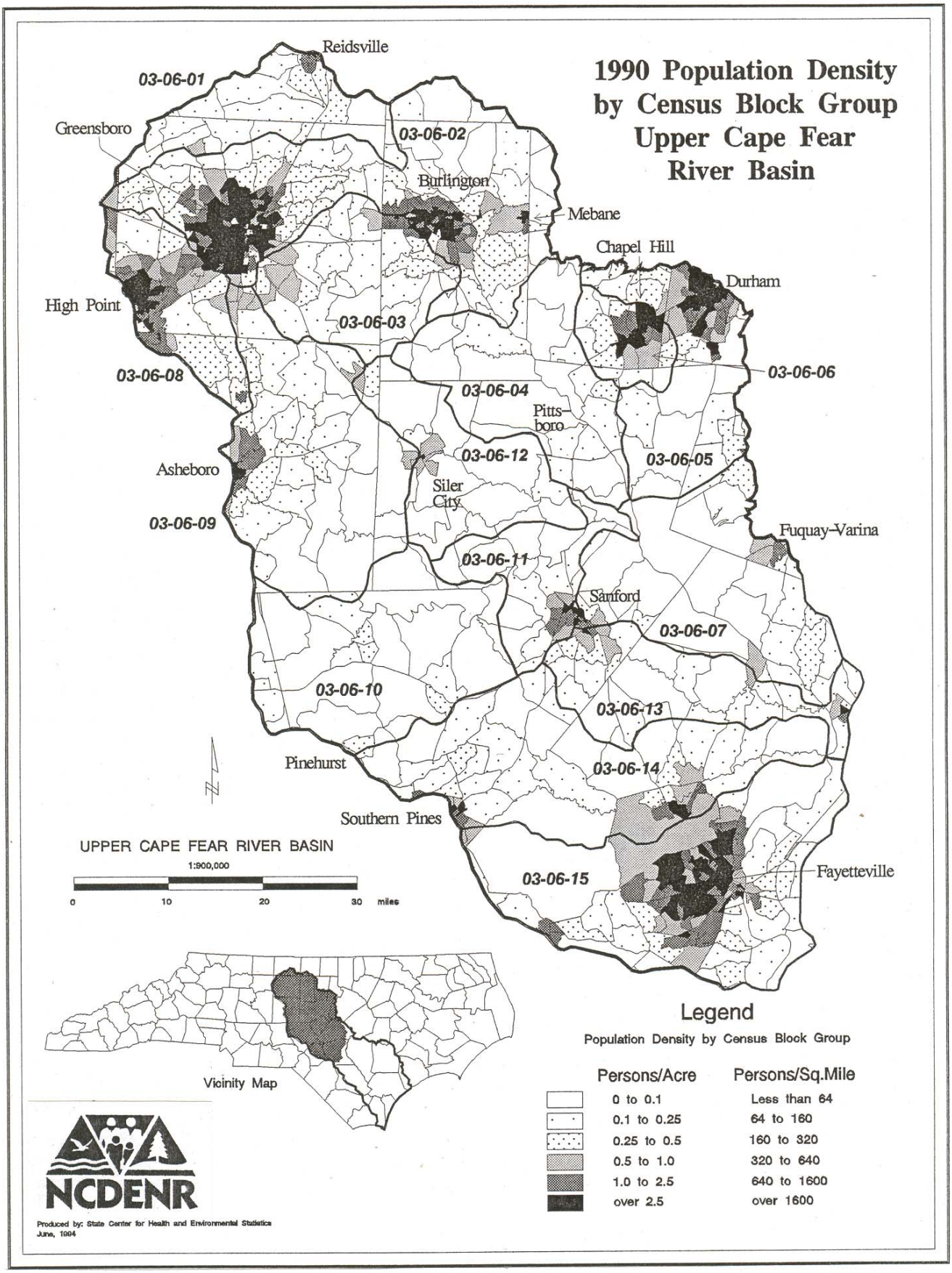


Figure A-11 1990 Population Density by Census Block Group Upper Cape Fear River Basin

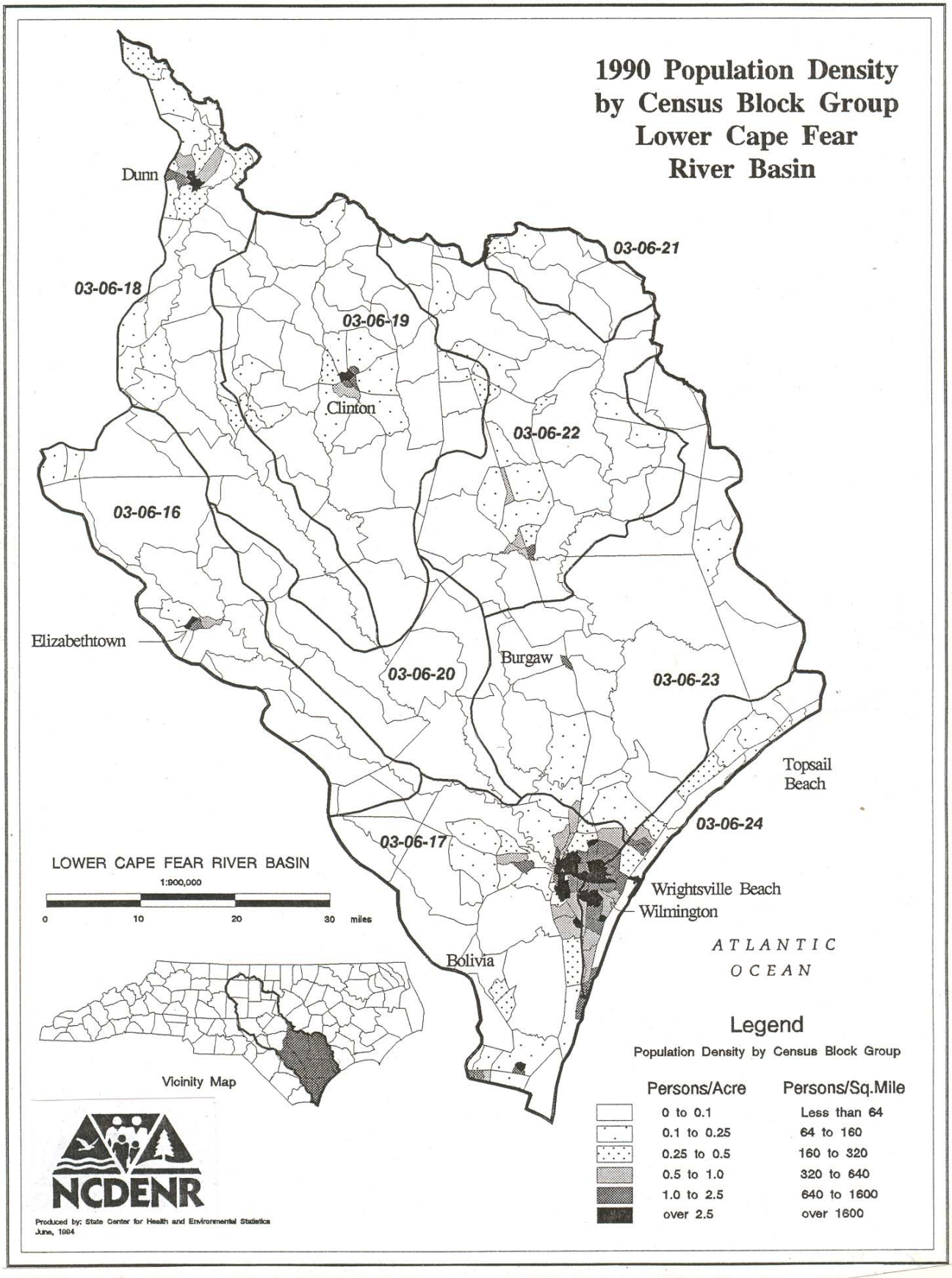


Figure A-12 1990 Population Density by Census Block Group Lower Cape Fear River B

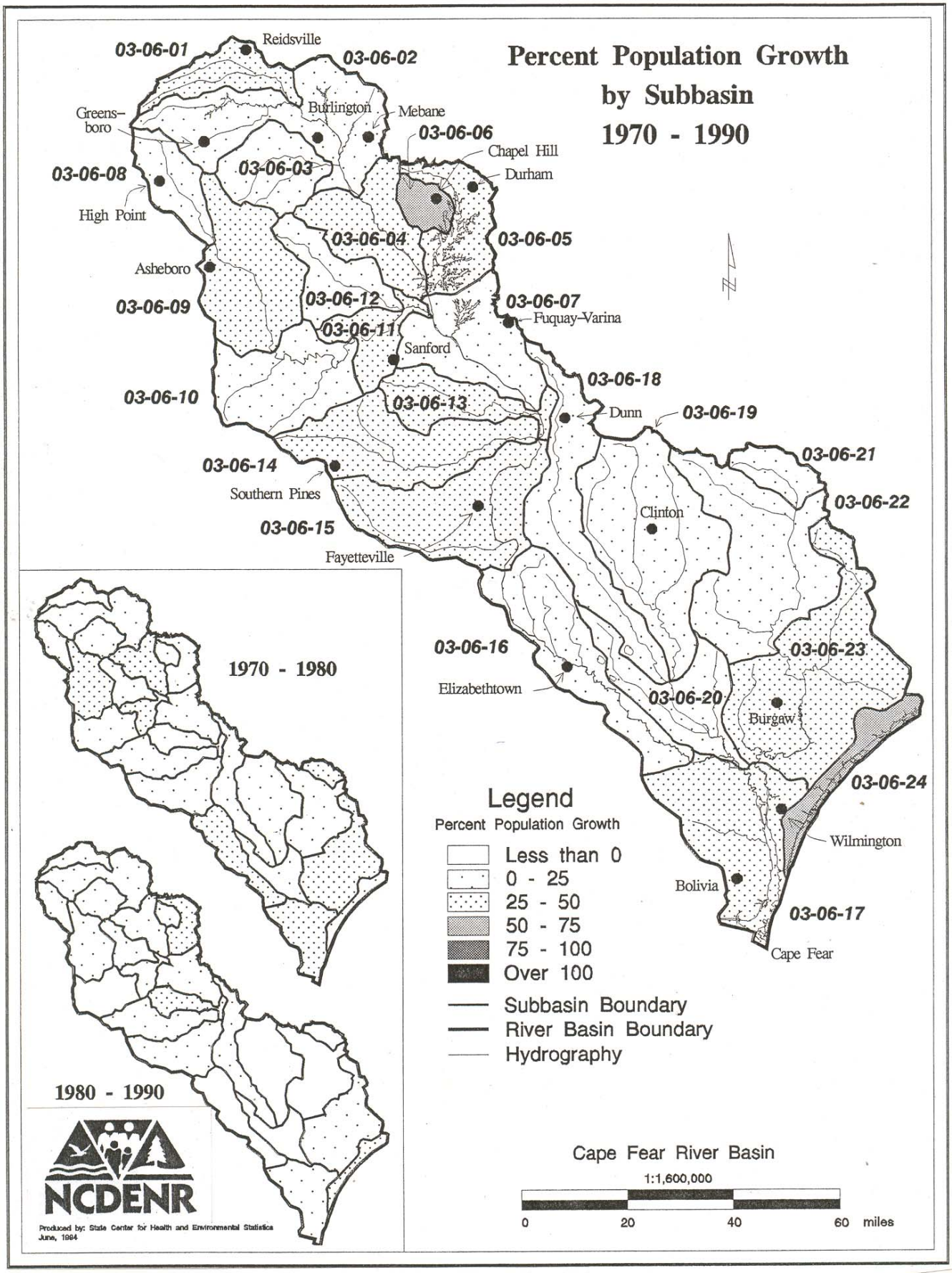


Figure A-13 Population Growth by Subbasin (1970 to 1990)

Table A-9 Estimated Population Statistics for the Years 1990, 1997 and 2010 for Counties in the Cape Fear River Basin

County	Population in 1990	Population in 1997	Estimated % Growth 1990-1997	Estimated Population in 2010	Estimated % growth 1997-2010
Alamance	108,213	119,820	10.7	135,794	13.3
Bladen	19,777	20,917	5.8	21,698	3.7
Brunswick	22,943	29,340	27.9	39,317	34.0
Caswell	2,069	2,206	6.6	2,336	5.9
Chatham	38,759	45,130	16.4	54,433	20.6
Columbus	5,455	5,714	4.7	5,874	2.8
Cumberland	269,219	289,350	7.5	321,450	11.1
Duplin	39,995	44,080	10.2	48,786	10.7
Durham	49,101	53,382	8.7	61,512	15.2
Forsyth	5,318	5,743	8.0	6,387	11.2
Guilford	336,997	371,690	10.3	420,591	13.2
Harnett	67,833	81,358	19.9	102,301	25.7
Hoke	13,028	16,463	26.4	21,621	31.3
Johnston	1,626	2,064	26.9	2,747	33.1
Lee	41,370	48,369	16.9	58,645	21.2
Montgomery	1,401	1,468	4.8	1,554	5.8
Moore	46,610	54,907	17.8	66,068	20.3
New Hanover	120,284	146,601	21.9	183,112	24.9
Onslow	32,964	32,417	-1.7	38,629	19.2
Orange	45,987	52,554	14.3	63,882	21.6
Pender	28,855	37,208	28.9	49,954	34.3
Randolph	59,666	68,068	14.1	81,927	20.4
Rockingham	16,352	16,940	3.6	17,489	3.2
Sampson	46,824	52,124	11.3	58,317	11.9
Wake	63,945	83,528	30.6	116,602	39.6
Wayne	9,420	10,186	8.1	11,102	9.0
Totals	1,494,011	1,691,627	13.2	1,992,128	17.8

2.6 Natural Resources

2.6.1 Lakes

There are 32 reservoirs in the Cape Fear River basin monitored by DWQ. Over half the total lakes are located in the upper portion of the basin (subbasins 03-06-01 through 03-06-08). These impoundments serve as water supplies for communities such as Greensboro, Burlington, Durham and Chapel Hill.

B. Everett Jordon Reservoir, located mostly in Chatham County south of Durham and west of Raleigh, is the largest lake in the basin and is used for water supply, flood control and recreation area in one of the fastest growing regions of the state.

There are five natural lakes, (the Carolina Bays), in the lower portion of the basin. Carolina Bays are of unknown origin located along the East Coast. The lakes are between 30,000 and 100,000 years old and, because of the unique chemistry and productivity, are home to many endemic species. The lakes are shallow, fed by surface and shallow groundwater, and function as wetlands. Agricultural and forestry practices, prior to 1970, have left undisturbed only about 10 percent of these lakes (Krajick, 1997).

2.6.2 Fish and Shellfish

Over 95 fish species have been found in the Cape Fear River basin including a variety with recreational and commercial importance. Popular sportfish species found in the freshwater portion of the river and reservoirs include largemouth bass, sunfish, crappie, catfish and pickerel. Recreationally and commercially important anadromous species, including striped bass, American and hickory shad and herring, migrate into freshwater portions of the Cape Fear River and tributaries to spawn during the spring. The Cape Fear River below Wilmington supports valuable recreational and commercial fisheries for striped bass, speckled sea trout, croaker, flounder and spot. Commercial finfish landings within the Cape Fear River basin have declined since 1996 from 108,764 pounds valued at $117,990 to 74,514 pounds valued at $64,191 (Figure A-14). Non-finfish commercial landings within the Cape Fear River basin include shrimp, blue crabs, squid, scallops and oysters. This fishery has had similar declines in recent years (Figure A-15). Figure A-16 shows shellfish growing areas in the Cape Fear River basin.

A total of 30 endangered, threatened or special concern species, including fish, amphibians, mammals, crustaceans and mollusks, are listed by federal and state agencies for the Cape Fear River basin. Atlantic and shortnose sturgeon were once plentiful in the Cape Fear River, but the population levels for both species are currently at low levels, with the few remaining individuals located primarily in the lower Cape Fear and Brunswick Rivers. The last shortnose sturgeon to be captured in the Cape Fear River was collected in 1993 (Fisheries Management Plan for the Cape Fear River, March 1998).

Figure A-14 Recent Overall Trends in Commercial Landings of Finfish in the Cape Fear River Basin Coastal Areas by Total Pounds and Total Value Per Year (1994-1998) Source: NC Division of Marine Fisheries

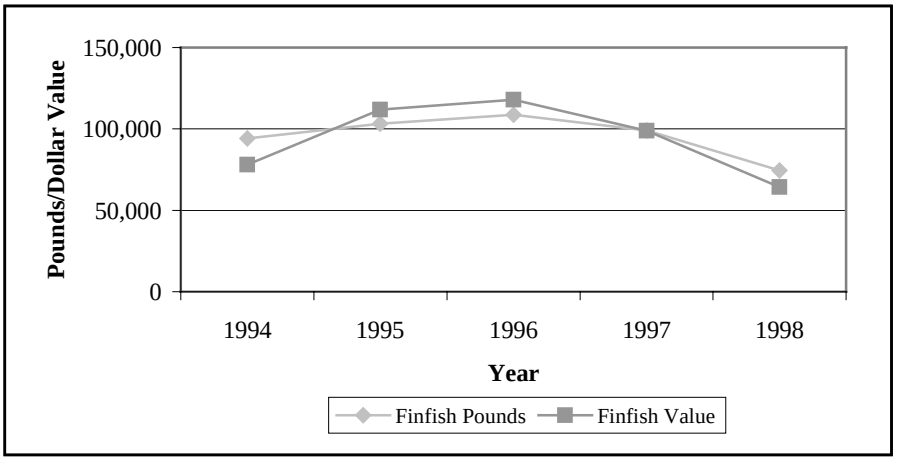
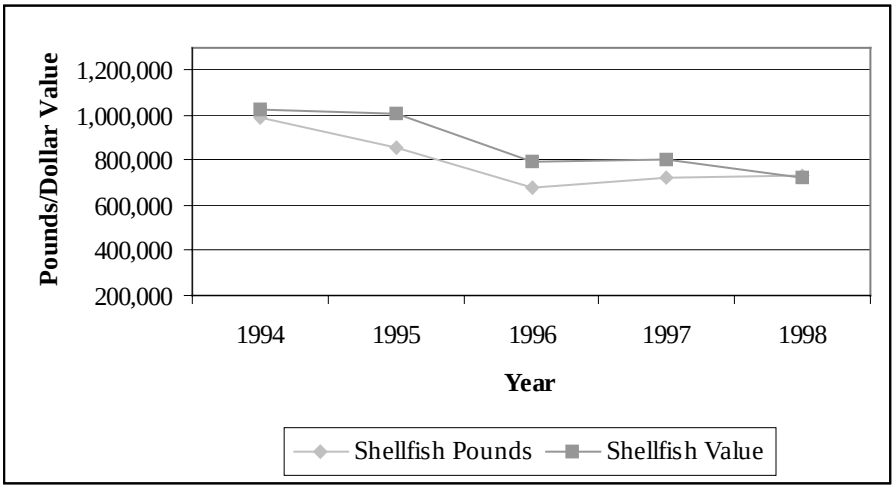


Figure A-15 Recent Overall Trends in Commercial Landings of Non-Finfish in the Cape Fear River Basin Coastal Areas by Total Pounds and Total Value Per Year (1994-1998) Source: NC Division of Marine Fisheries



2.6.3 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. Over the years, however, approximately half of North Carolina's wetlands have been lost to development, farming and forestry practices. Wetlands now only cover about 25 percent of the state's land area.

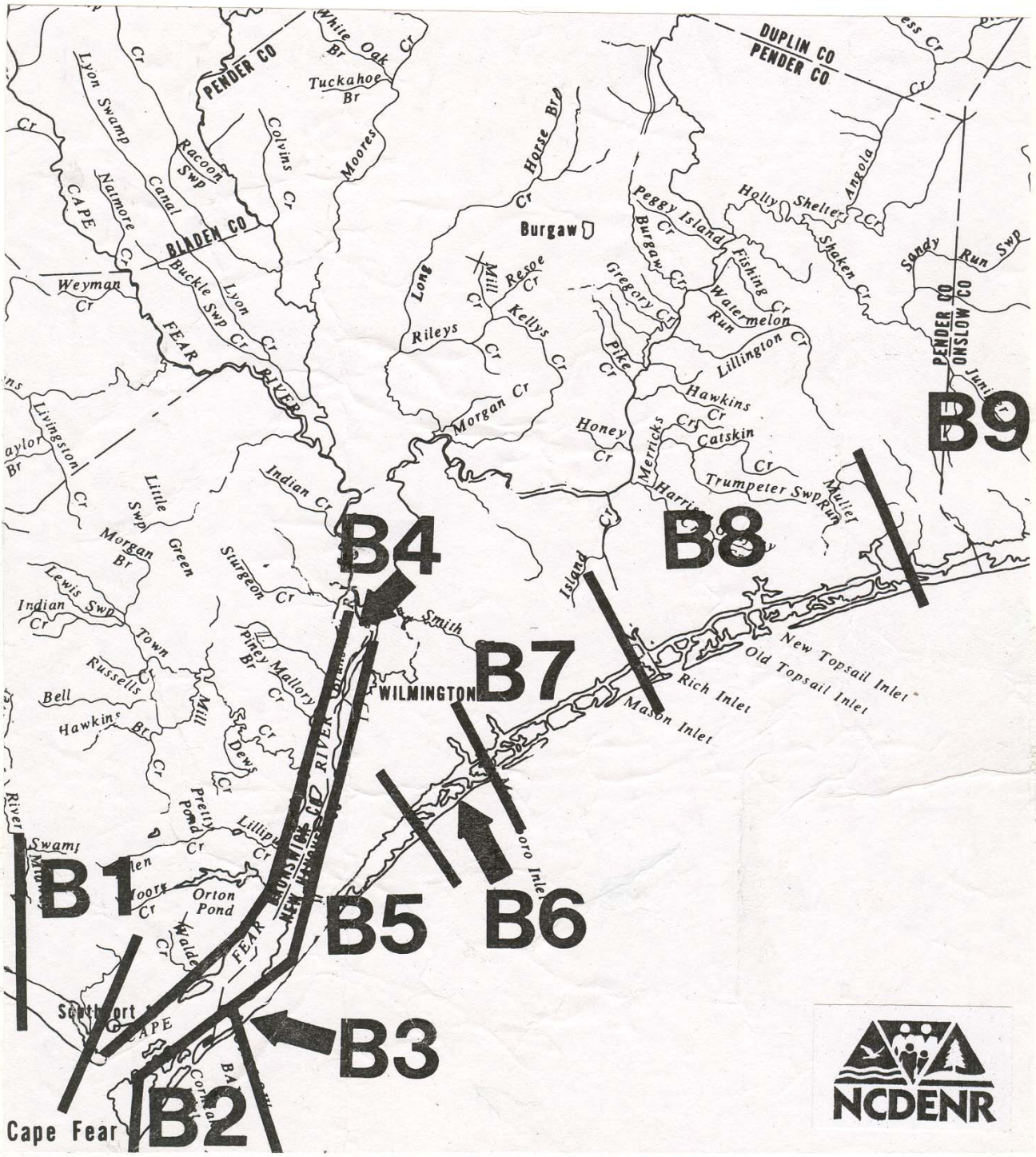


Figure A-16 Shellfish Growing Areas in the Cape Fear River Basin

Wetlands provide a variety of benefits to society and are very important in watershed planning because of the functions they perform. Wetlands provide important protection for flood prevention 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.

Wetland Fill Activities

In 1989, the Environmental Management Commission passed a rule directing DWQ to review wetland fill using a review sequence of avoidance, minimization and mitigation of wetland fill. After extensive public review, the EMC passed rules, effective October 1, 1996, to restructure the 401 Water Quality Certification Program. These rules are not a new regulatory program since DWQ has issued approvals for wetland fill since the mid-1980s. The rules consider wetland values - whether or not the wetland is providing significant uses or whether the activity would remove or degrade uses. The rules also specify mitigation ratios, locations and types to make the mitigation process more predictable and certain for the regulated community. DWQ's emphasis continues to be on water quality and the essential role that wetlands play in maintaining water quality. Table A-10 shows wetland fill activities by subbasin.

Wetland Draining and Ditching Activities

Ditching and draining of wetlands in North Carolina have been a restricted activity under oversight from both state and federal environmental regulations since the early 1990s. Generally, approvals have been required from DWQ and the United States Army Corps of Engineers (ACOE) for draining activities that impact one third of an acre or more of wetlands.

A federal court ruling in June 1998 overturned the authority of the ACOE to require permitting for wetlands draining. This decision effectively removed regulatory review of draining unless dirt spoil from a ditch is dumped into jurisdictional wetlands.

The State of North Carolina has since determined that wetland ditching and draining still fall under its authority and are an illegal activity if proper approval is not acquired. That authority applies when the hydrology or biology of the wetland is altered or the draining violates downstream water quality standards such as turbidity, salinity and dissolved oxygen. DWQ developed and began implementing the wetland draining policy on March 1, 1999.

Wetland draining activities include both ditching and installation of ground pumping systems. Other activities also covered under this policy include pond construction in wetlands, filling of isolated wetlands, and off-site sediment erosion into wetlands.

Table A-10 Wetland Fill Activities (in Acres) Permitted in the Cape Fear River Basin by Subbasin and Year

Subbasin Number	1994	1995	1996	1997	Total
03-06-01	5.27	0.68	4.69	0	10.64
03-06-02	1.42	9.08	10.85	3.74	25.09
03-06-03	3.3	0.25	0.33	0.83	4.71
03-06-04	0	0.56	3.28	0	3.84
03-06-05	20.23	7.44	5.99	8.57	42.23
03-06-06	0.89	0.5	5.91	0	7.3
03-06-07	1.88	5.08	1.59	1.24	9.79
03-06-08	9.68	8.94	4.72	0.18	23.52
03-06-09	1.97	1.53	0	1.15	4.65
03-06-10	0	8.95	0	3.19	12.14
03-06-11	0	0.29	0	0	0.29
03-06-12	0	0	0.54	0.35	0.89
03-06-13	0.09	4.03	1.15	2.58	7.85
03-06-14	13.55	30.26	20.54	2.93	67.28
03-06-15	20.18	48.1	13.17	12.02	93.47
03-06-16	27.48	3.8	3.76	0.7	35.74
03-06-17	31.67	53.68	57.83	30.37	173.55
03-06-18	1.83	1.69	0.4	1.46	5.38
03-06-19	7.26	17.28	7.38	2.54	34.46
03-06-20	7	0.01	0.66	0.91	8.58
03-06-21	2.6	4.57	1.3	0	8.47
03-06-22	62.68	22.58	4.67	7.05	96.98
03-06-23	31.21	6.43	7.85	18.14	63.63
03-06-24	6.05	28.76	94.9	13.06	142.77
Total Acres	256.24	264.49	251.51	111.01	883.25

When DWQ discovers any such draining activities, it will notify the landowner in writing that the activity has or is likely to violate the state's wetland standards. The landowner will be given an opportunity to refute the finding. If DWQ determines that a violation has occurred, it can seek enforcement action and require that the natural hydrology or biology be restored. In some instances, the filling of ditches may require a federal 404 wetland fill permit.

Ditch maintenance is allowed as long as written documentation can be provided on the ditch's original height and width dimensions. Both DWQ and the Division of Land Resources will review such activities. Ditches created for forestry purposes are allowed if they are designed, constructed and maintained properly to retain the natural wetland hydrology. Refer to *Best Management Practices for Forestry in the Wetlands of North Carolina.*

DWQ has the authority to review specific wetland draining projects that began prior to March 1, 1999 to determine whether the draining activities impaired downstream water quality. The Division of Land Resources will check various projects to make sure they have complied with Sedimentation and Erosion Control Plans.

The Department of Environment and Natural Resources is using a multiagency approach to implement the draining policy, to seek compliance and to pursue enforcement. Involved DENR agencies include DWQ, Division of Land Resources, Forest Resources, Soil and Water Conservation, and Coastal Management. The US Natural Resources Conservation Service will also participate.

When violations are found, regulators can seek injunction relief to cease the draining activity and to restore the wetland on-site, civil penalties of up to $10,000 per day, and possible prosecution.

The Division of Forest Resources is flying reconnaissance missions, with various regulatory personnel, to identify and assess draining sites. Satellite imagery is also used to target problem areas. To further assist in wetland protection, the public is encouraged to report possible sites where illegal draining has occurred.

To report possible wetlands draining violations in the Cape Fear River basin, the public can contact the appropriate DWQ regional office: Fayetteville (910) 486-1541, Wilmington (910) 395-3900, Raleigh (919) 571-7400 and Winston-Salem (336) 771-4600.

Wetland draining project acres and types are summarized in Table A-11. Figure A-17 shows the locations of project areas in the Cape Fear River basin.

Table A-11 Wetland Acreage Impacted by Wetland Ditching and Draining Activities in the Cape Fear River Basin Separated by Wetland Type (September 1999)

Wetland Type	Acres	% of Total
Wet Flat	3,559	54%
Pocosin	2,769	42%
Bottomland Hardwood/Swamp Forest	254	4%
Human Impacted Wetland	22	minor
Freshwater Marsh	8	minor
Total Wetlands	**6,612**	
Non-Wetland	2,419	

Note: These boundaries and associated acreage values are approximate and are intended to give general location information only. The wetland data used in this analysis were developed by the Division of Coastal Management and are *not* intended to represent jurisdictional wetland boundaries.

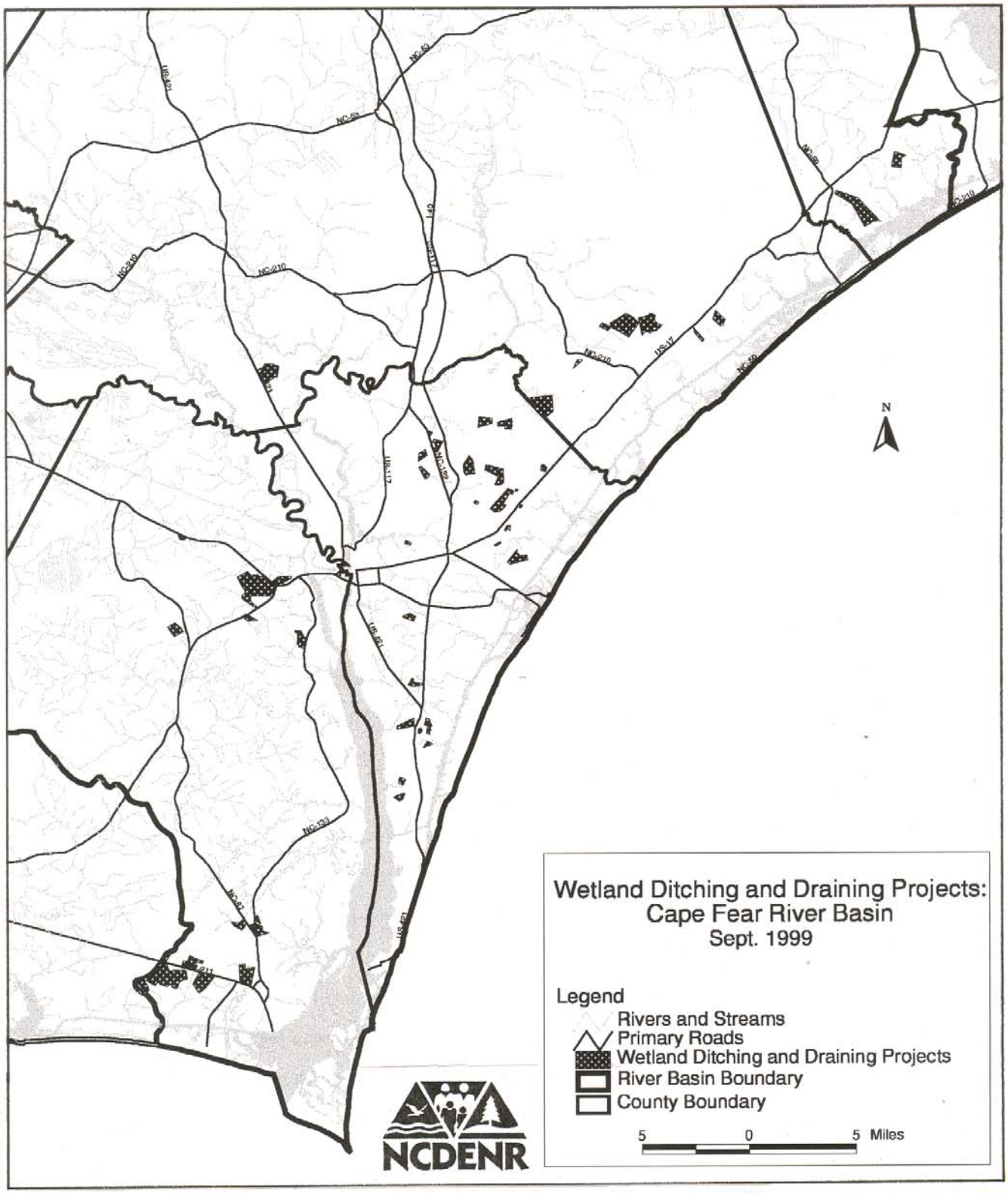


Figure A-17 Cape Fear River Basin Wetland Draining Projects as of September 1999

There are several uses and limitations that should be considered when reviewing the wetland draining project data in the above tables. These include:

1. Project boundaries were compiled from NC Division of Land Resource's permit file information, aerial surveys conducted by regional office staff, low altitude color infrared photography, and on-site investigations. These methods created inherent and varied inaccuracies in the data.
2. Project boundaries represent approximate size and location only; more precise information will require more extensive individual site visits.
3. Wetland data used in this analysis were obtained from NC Division of Coastal Management. For more information on mapping procedures and data accuracy, contact Jim Stanfill of the Division of Coastal Management at (919) 733-2293.
4. The numbers provided in this analysis represent potential wetland impacts, not actual wetland "loss".

Wetland Restoration Efforts

The North Carolina Wetlands Restoration Program (NCWRP) is responsible for implementing wetland and stream restoration projects on a basinwide scale throughout the state. The focus of the program is to enhance water quality, flood prevention, fisheries, wildlife habitat and recreational opportunities. The NCWRP is not a grant program. However, it can compliment grant programs like the Section 319 program by taking on restoration projects identified through Section 319 grant applications. Alternatively, studies funded by Section 319 to identify suitable stream or wetland restoration sites can then be implemented by the NCWRP. The NCWRP can also directly fund other stream or wetland restoration sites provided those sites are located within a priority subbasin, as determined by the NCWRP. Finally, the NCWRP can perform restoration projects cooperatively with other state or federal programs or with environmental groups.

The NCWRP has identified priority subbasins for the Cape Fear River basin through the *Basinwide Wetlands and Riparian Restoration Plan for the Cape Fear River Basin*. For more information on this document or the NCWRP, call (919) 733-5208 or visit http://h2o.enr.state.nc.us/wrp/index.htm.

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 and stormwater discharges associated with certain industrial activities. Point source dischargers in North Carolina must apply for and obtain a National

The primary pollutants associated with point source discharges are:

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

Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are issued under the NPDES program, delegated to DWQ by the Environmental Protection Agency.

2.7.1 Wastewater Discharges in the Cape Fear River Basin

Types of Wastewater Discharges

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: Facilities that serve a municipality. Can treat waste from homes and industries.
Industrial Facilities: Facilities with wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation.
Other Facilities: This category includes a variety of facilities such as schools, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

There are 280 permitted wastewater discharges in the Cape Fear River basin. Table A-12 provides summary information (numbers of facilities and permitted flows) regarding the discharges by type and subbasin. The various types of dischargers characterized in the table are described in the inset box. A summary of all dischargers can be found in Appendix I.

Figures A-18, A-19 and A-20 show the location of major and minor permitted wastewater discharges within the basin. The number of triangles on the map depicting major discharges do not correspond exactly to the number of major facilities listed in Table A-12, since some major facilities have more than one outfall point. Each outfall point received its own triangle.

2.7.2 Stormwater Discharges in the Cape Fear River Basin

Amendments to the Clean Water Act in 1990 provided requirements for NPDES stormwater permits for municipal, industrial and construction activities (Phase I of the NPDES stormwater program). Permit requirements were established for ten categories of industrial activity ranging from vehicle maintenance facilities to textile manufacturers. Permit requirements were also established for construction activities which disturb 5 or more acres of land area. Permit application requirements were established for municipalities with a population of 100,000 or more. The focus of the NPDES stormwater program is pollution prevention and source control.

The primary concern with runoff from industrial facilities is the contamination of stormwater from contact with exposed materials. In addition, poor housekeeping can lead to significant contributions of sediment and other water quality pollutants. To address these issues, each NPDES stormwater permitted facility must develop a Stormwater Pollution Prevention Plan (SPPP) that addresses the facility's potential impacts on water quality. Facilities or activities identified as having significant potential to impact water quality are also required to perform analytical monitoring to characterize the pollutants in their stormwater discharges under individual NPDES stormwater permits.

Table A-12 Summary of NPDES Dischargers and Permitted Flows for the Cape Fear River Basin (as of April 1999)

	Subbasin																							
Facility Categories	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
Total Facilities	13	35	8	8	9	8	15	27	15	6	7	4	6	11	6	8	55	3	7	2	3	14	6	4	280
Total Permitted Flow (MGD)	5.4	69.9	0.1	0.8	26.3	8.3	13.9	28.0	9.8	1.6	6.0	4.0	9.0	3.0	39.9	14.0	93.0	0.1	4.7	0.0	1.4	10.6	2.5	0.1	352.6
Major Discharges	2	8	0	0	2	2	5	2	1	1	2	1	3	2	4	3	13	0	1	0	2	3	1	0	58
Total Permitted Flow (MGD)	5.2	67.3	0.0	0.0	26.0	8.0	11.6	17.7	9.0	1.0	6.0	4.0	6.7	1.5	39.9	7.5	88.9	0.0	3.0	0.0	1.4	8.0	1.1	0.0	313.7
Minor Discharges	11	27	8	8	7	6	10	25	14	5	5	3	3	9	2	5	42	3	6	2	1	11	5	4	222
Total Permitted Flow (MGD)	0.2	2.6	0.1	0.8	0.3	0.3	2.4	10.3	0.8	0.6	0.0	0.0	2.3	1.5	0.0	6.5	4.1	0.1	1.7	0.0	0.0	2.6	1.4	0.1	38.8
100% Domestic Waste	9	14	6	5	4	3	8	10	8	5	2	4	2	7	2	2	21	1	6	2	1	4	4	1	131
Total Permitted Flow (MGD)	0.2	0.5	0.1	0.8	0.3	0.2	3.0	0.2	9.2	1.0	0.0	4.0	1.5	3.0	14.0	0.8	9.9	0.1	1.7	0.0	1.0	2.0	0.7	0.1	54.4
Municipal Facilities	1	6	0	2	2	1	5	2	3	2	1	1	2	2	3	2	6	0	5	0	1	4	1	1	53
Total Permitted Flow (MGD)	5.0	66.0	0.0	0.8	26.0	8.0	2.9	17.7	9.5	1.6	5.0	4.0	4.2	1.6	39.0	1.5	28.1	0.0	1.7	0.0	1.0	2.0	0.5	0.1	226.3
Non-Municipal Facilities	12	29	8	6	7	7	10	25	12	4	6	3	4	9	3	6	49	3	2	2	2	10	5	3	227
Total Permitted Flow (MGD)	0.4	3.9	0.1	0.0	0.3	0.3	11.0	10.3	0.3	0.0	1.0	0.0	4.8	1.5	0.9	12.5	64.9	0.1	3.0	0.0	0.4	8.6	2.0	0.0	126.3

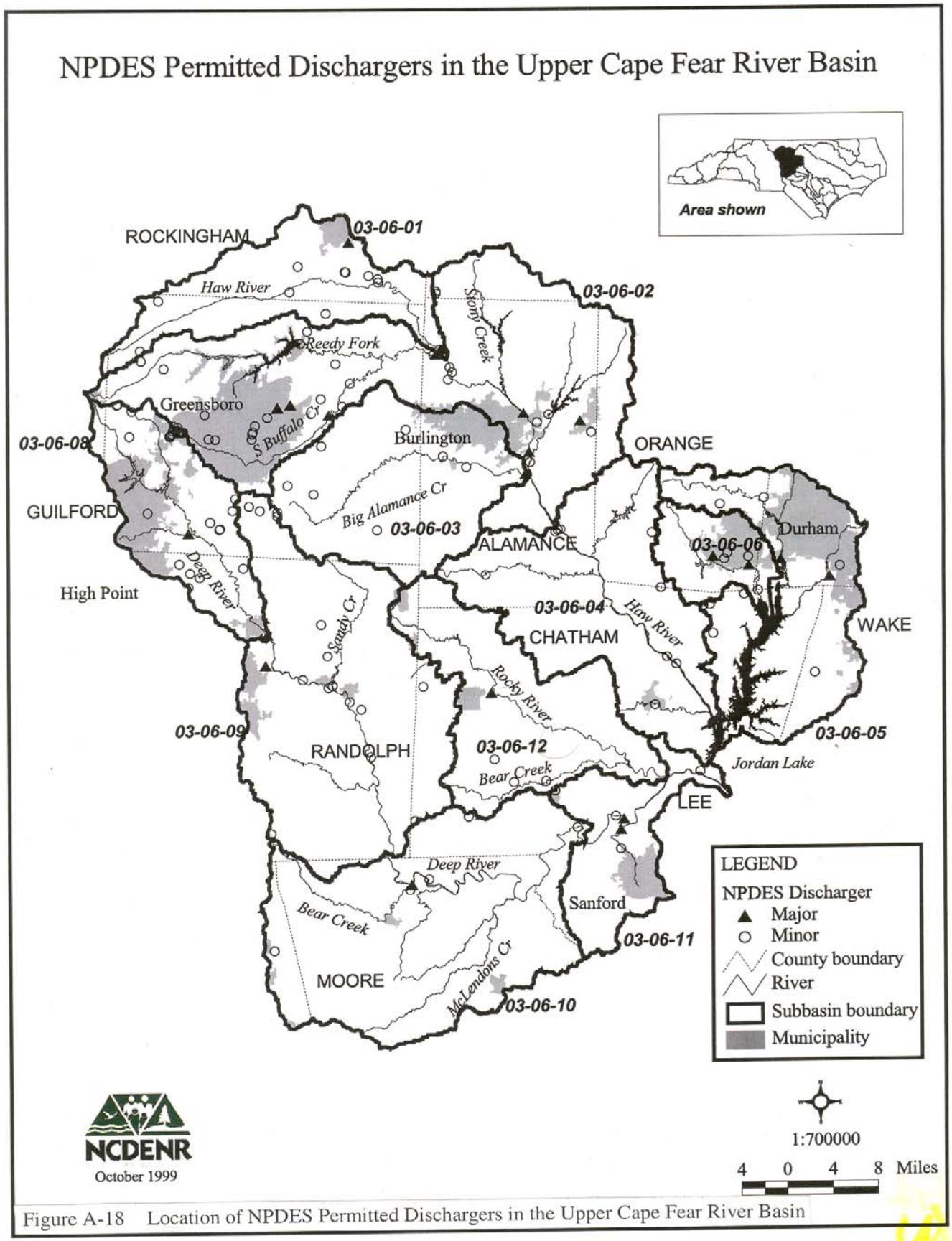


Figure A-18 Location of NPDES Permitted Dischargers in the Upper Cape Fear River Basin

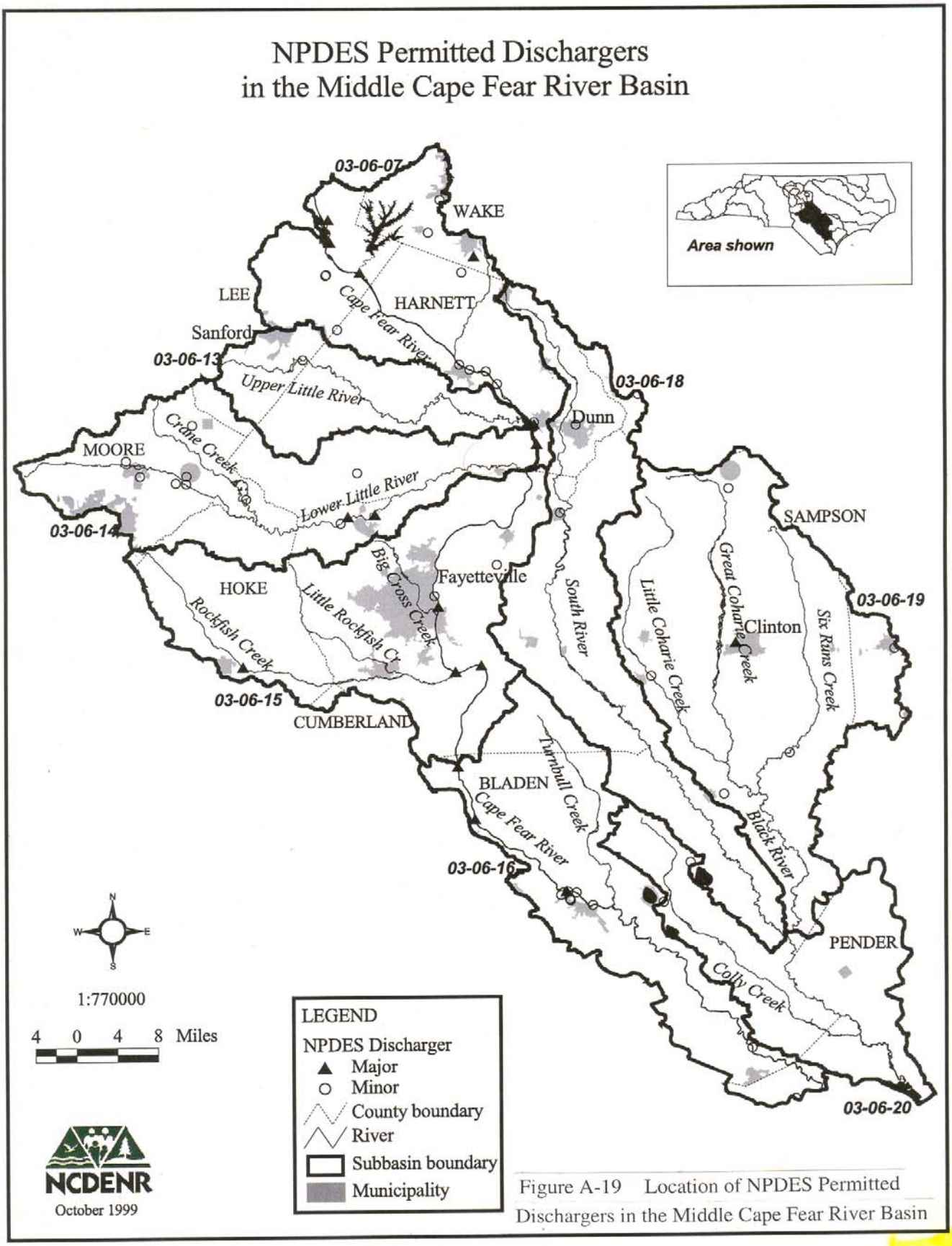
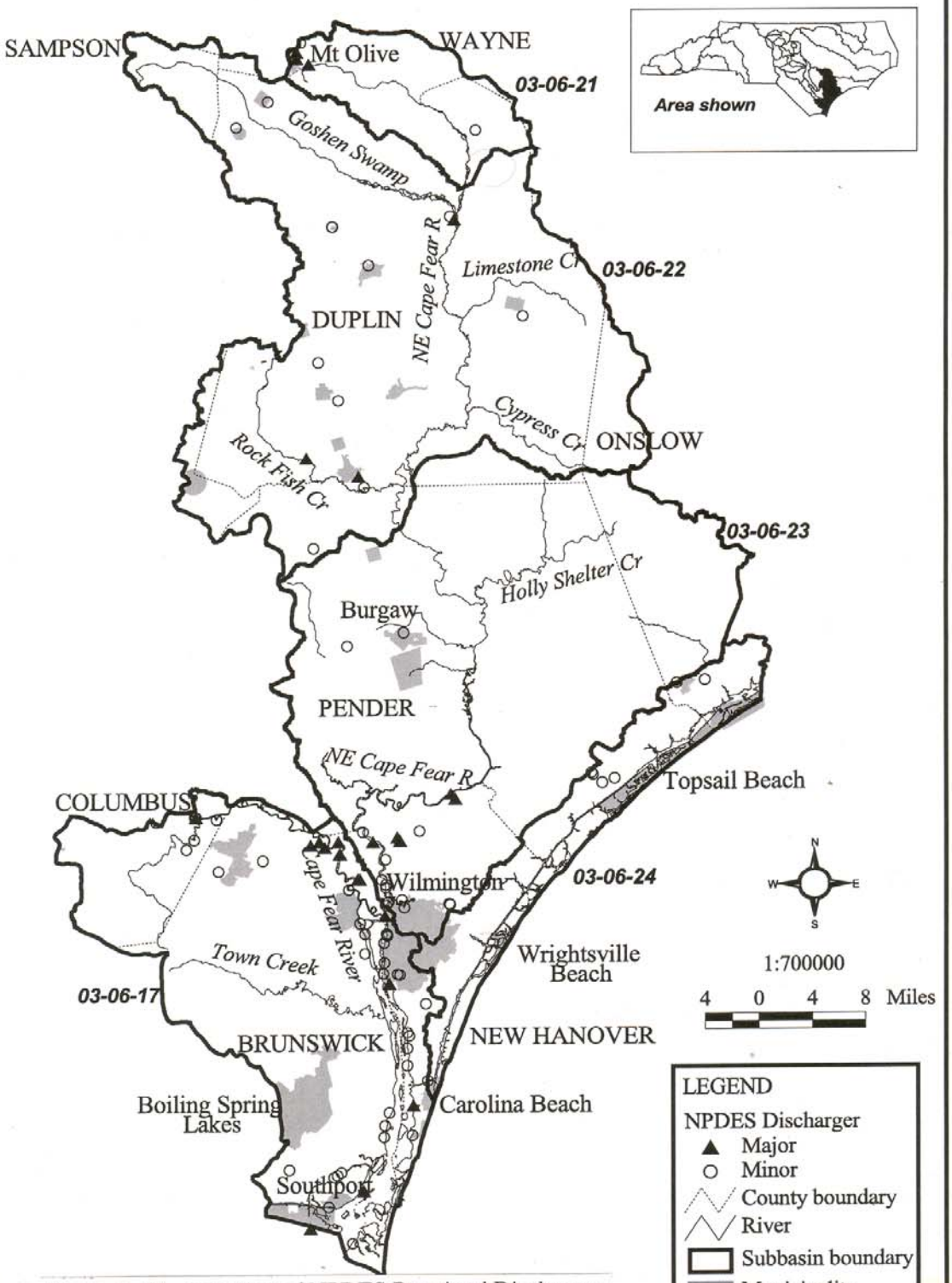


Figure A-19 Location of NPDES Permitted Dischargers in the Middle Cape Fear River Basin

NPDES Permitted Dischargers in the Lower Cape Fear River Basin



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October 1999

Figure A-20 Location of NPDES Permitted Dischargers in the Lower Cape Fear River Basin

EPA Stormwater Rules

Phase I – December 1990

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

Phase II – November 1999

- Requires a NPDES permit for municipal storm sewer systems serving populations under 100,000 that are located in urbanized areas.
- Provides incentives to industrial facilities covered under Phase I for protecting operations from stormwater exposure.
- Requires a NPDES stormwater permit for construction sites that are 1-5 acres.

Permits are granted in the form of general stormwater permits (covering a wide variety of activities) or individual stormwater permits. Excluding construction general permits, there are 623 general stormwater permits and 48 individual stormwater permits issued within the river basin. Individual permit holders are presented in Table A-13.

The municipalities covered by the NPDES stormwater regulations are called Municipal Separate Storm Sewer Systems (MS4s). Phase I covers large and medium MS4s (population of 100,000 or more). There are six permitted Phase I MS4s in North Carolina. The cities of Greensboro, Durham and Fayetteville (which also includes Cumberland County) are the only Phase I MS4s in the Cape Fear River Basin.

On October 29, 1999, a second phase of the NPDES stormwater program was signed into law. Phase II lowers the construction activity threshold to 1 or more acres of land disturbance and allows a permitting exemption for industrial facilities that do not have significant materials or activities exposed to stormwater.

Phase II also pulls many small local governments into the NPDES stormwater program. The federal regulations require that small MS4s with a population of 50,000 or more and a density of 1,000 people per square mile be covered under a NPDES stormwater permit. This includes small municipalities that, when clustered together, are considered an urbanized area that collectively meets the 50,000/1,000 criteria. In addition, DWQ is required to develop designation criteria that pull in other small MS4s. The designation criteria must include, at a minimum, all MS4s with a population of 10,000 or more and a density of 1,000 people per square mile. At a minimum, the local governments listed in Table A-14 will be covered under Phase II of the NPDES stormwater program. It is highly likely that additional local governments will be required to seek a permit through designation. Phase II MS4 permit applications must be submitted to DWQ by March 1, 2003.

Table A-13 Summary of Individual NPDES Stormwater Permits in the Cape Fear River Basin

Permit #	Facility Name	Receiving Stream	Subbasin	County
NCS000030	Air Products and Chemicals, Inc.	UT Little Troublesome Creek	03-06-01	Rockingham
NCS000085	Safety-Kleen (TS)	UT Troublesome Creek	03-06-01	Rockingham
NCS000010	Stockhausen, Inc.	Mile Run Creek	03-06-02	Guilford
NCS000048	Chemol Co., Inc.	Mile Run Creek	03-06-02	Guilford
NCS000077	Dow Corning Corporation	UT South Buffalo Creek	03-06-02	Guilford
NCS000107	Unitex Chemical Corporation	South Buffalo Creek	03-06-02	Guilford
NCS000119	Unichem, Inc.	Haw River	03-06-02	Alamance
NCS000155	GKN Automotive Components, Inc.	Buffalo Creek	03-06-02	Lee
NCS000206	Duke Power Fairfax Ops Center	UT South Buffalo Creek	03-06-02	Guilford
NCS000253	Southern Foundries Corporation	North Buffalo Creek	03-06-02	Guilford
NCS000308	Air Products & Chemicals, Inc.	UT Little Buffalo Creek	03-06-02	Guilford
NCS000353	H B Fuller Company - Guilford Co.	UT South Buffalo Creek	03-06-02	Guilford
NCS000090	Burlington Chemical Company	Gum Creek	03-06-03	Alamance
NCS000017	Glaxo Wellcome, Inc. - Durham Co.	UT Northeast Creek	03-06-05	Durham
NCS000046	National Specialty Gases	UT Northeast Creek	03-06-05	Durham
NCS000050	SCM Metal Products, Inc.	UT Northeast Creek & Stirrup Iron Creek	03-06-05	Durham
NCS000084	South Atlantic Services, Inc.	Fishing Creek	03-06-05	New Hanover
NCS000201	Univ. of North Carolina - Chapel Hill	UT Bolin Creek	03-06-06	Orange
NCS000087	PAC-FAB, Inc.	Little Buffalo Creek	03-06-07	Lee
NCS000100	Allied Signal, Inc.	Shaddox Creek & Haw River	03-06-07	Chatham
NCS000150	Neste Resins Corporation	Haw River	03-06-07	Chatham
NCS000151	Weyerhaeuser Company	Shaddox Creek	03-06-07	Chatham
NCS000078	Novartis Crop Protection, Inc.	East Fork Long Branch Creek	03-06-08	Guilford
NCS000092	Marsh Furniture Company	UT Richland Creek	03-06-08	Guilford
NCS000280	Lester Group, Inc. - Fortress Wood Prod.	UT Bull Run Creek	03-06-08	Guilford
NCS000319	Marlowe-Van Loan Corporation	Richland Creek	03-06-08	Guilford
NCS000242	Ultracraft Company	UT Sandy Creek	03-06-09	Randolph
NCS000023	Pioneer Southern, Inc.	Rita Branch	03-06-10	Montgomery
NCS000123	Perdue Farms, Inc.	Bear Creek & Buck Creek	03-06-10	Moore
NCS000122	General Timber, Inc.	George's Creek	03-06-11	Chatham
NCS000056	ICI Americas, Inc.	Cape Fear River	03-06-15	Cumberland
NCS000088	Borden Packaging & Industrial Products	Cape Fear River	03-06-15	Cumberland
NCS000147	Fiber Industries	UT Cape Fear River	03-06-15	Cumberland
NCS000187	Black & Decker (US), Inc.	UT Lake Lynn	03-06-15	Cumberland
NCS000076	Corning, Inc.	Spring Branch	03-06-17	New Hanover
NCS000101	Federal Paper Board Co. - Riegelwood	Cape Fear River	03-06-17	Columbus
NCS000156	Wright Corporation	Mill Creek & Livingston Creek	03-06-17	Columbus
NCS000174	NC State Ports Authority - Wilmington	Cape Fear River	03-06-17	New Hanover
NCS000208	Military Ocean Terminal - Sunny Point	Cape Fear River	03-06-17	Brunswick
NCS000244	American Distillation Co.	Cape Fear River	03-06-17	Brunswick
NCS000258	National Starch & Chemical Co .- Leland	Alligator Branch	03-06-17	Brunswick
NCS000344	American Crane Corp - New Hanover	UT Barnards Creek	03-06-17	New Hanover
NCS000309	Schindler Elevator Corporation	Old Williams Mill Branch	03-06-19	Sampson
NCS0000003	Occidental Chemical Company	Northeast Cape Fear River	03-06-23	New Hanover
NCS000022	GE Wilmington	Prince George Creek	03-06-23	New Hanover
NCS000118	Arteva Specialties, Sarl	Northeast Cape Fear River	03-06-23	New Hanover
NCS000214	Royster Clark, Inc.	Northeast Cape Fear River	03-06-23	New Hanover
NCS000222	General Wood Preserving Co., Inc.	UT Sturgeon Creek	03-06-23	Brunswick

Table A-14 Cities and Counties Included in State Stormwater Program

Phase I Cities			
Durham	Fayetteville	Greensboro	
Phase II Cities			
Apex	Cary	High Point	Reidsville
Archdale	Chapel Hill	Hope Mills	Sanford
Asheboro	Elon College	Jamestown	Spring Lake
Belville	Gibsonville	Kernersville	Wilmington
Burlington	Graham	Leland	Wrightsville Beach
Carrboro	Haw River	Mebane	
Phase II Counties			
Alamance	Forsyth	New Hanover	Randolph
Brunswick	Guilford	Onslow	Wake
Durham	Harnett	Orange	Wayne

2.8 Animal Operations

Table A-15 summarizes, by subbasin, the number of registered livestock operations, total animals and total steady state live weight as of September 1998. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin. Figures A-21, A-22 and A-23 show the general location of the registered operations in the basin.

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 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.

The NC Department of Agriculture provided information on animal capacity by subbasin (Table A-16).

Key Animal Operation Legislation (1995-1999)

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. DENR 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 DENR to develop an inventory of inactive lagoons, and 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.

Table A-15 Registered Animal Operations in the Cape Fear River Basin (as of 9/98)

Subbasin	Swine			Cattle		
	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight
03-06-01	1	2,850	493,620	5	2,599	2,598,200
03-06-02	1	1,000	130,500	6	2,010	2,154,000
03-06-03	3	9,660	776,580	2	400	560,000
03-06-04	3	23,544	2,432,520	17	2,505	2,507,000
03-06-05	0	0	0	0	0	0
03-06-06	0	0	0	1	125	175,000
03-06-07	2	5,616	866,112	0	0	0
03-06-08	0	0	0	5	2,325	3,255,000
03-06-09	13	43,435	6,222,528	3	625	875,000
03-06-10	2	12,253	924,090	1	200	280,000
03-06-11	0	0	0	0	0	0
03-06-12	1	400	52,200	2	250	350,000
03-06-13	6	27,815	3,251,025	0	0	0
03-06-14	5	32,152	4,157,160	1	700	980,000
03-06-15	13	55,550	6,753,860	0	0	0
03-06-16	42	254,353	32,063,197	0	0	0
03-06-17	7	45,216	6,381,110	0	0	0
03-06-18	82	450,398	57,856,987	0	0	0
03-06-19	306	1,538,402	182,351,532	0	0	0
03-06-20	12	88,672	10,888,120	0	0	0
03-06-21	69	240,648	27,261,539	0	0	0
03-06-22	404	787,900	217,781,138	0	0	0
03-06-23	46	204,757	25,636,095	0	0	0
03-06-24	1	1,800	243,000	0	0	0
Totals	1,019	3,826,421	586,522,913	43	11,739	13,734,200

Figure A-21 Registered Animal Operations in the Upper Cape Fear River Basin

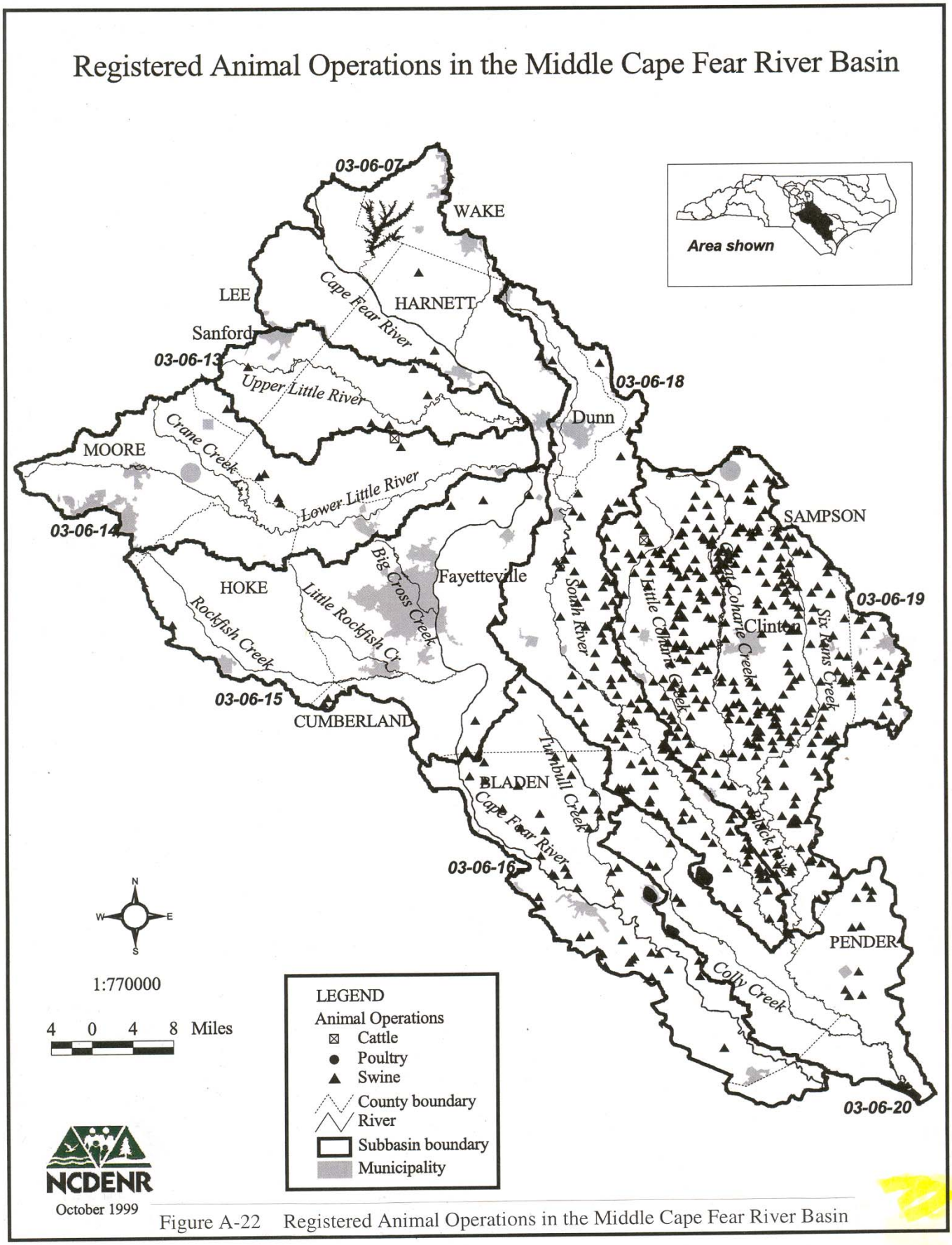
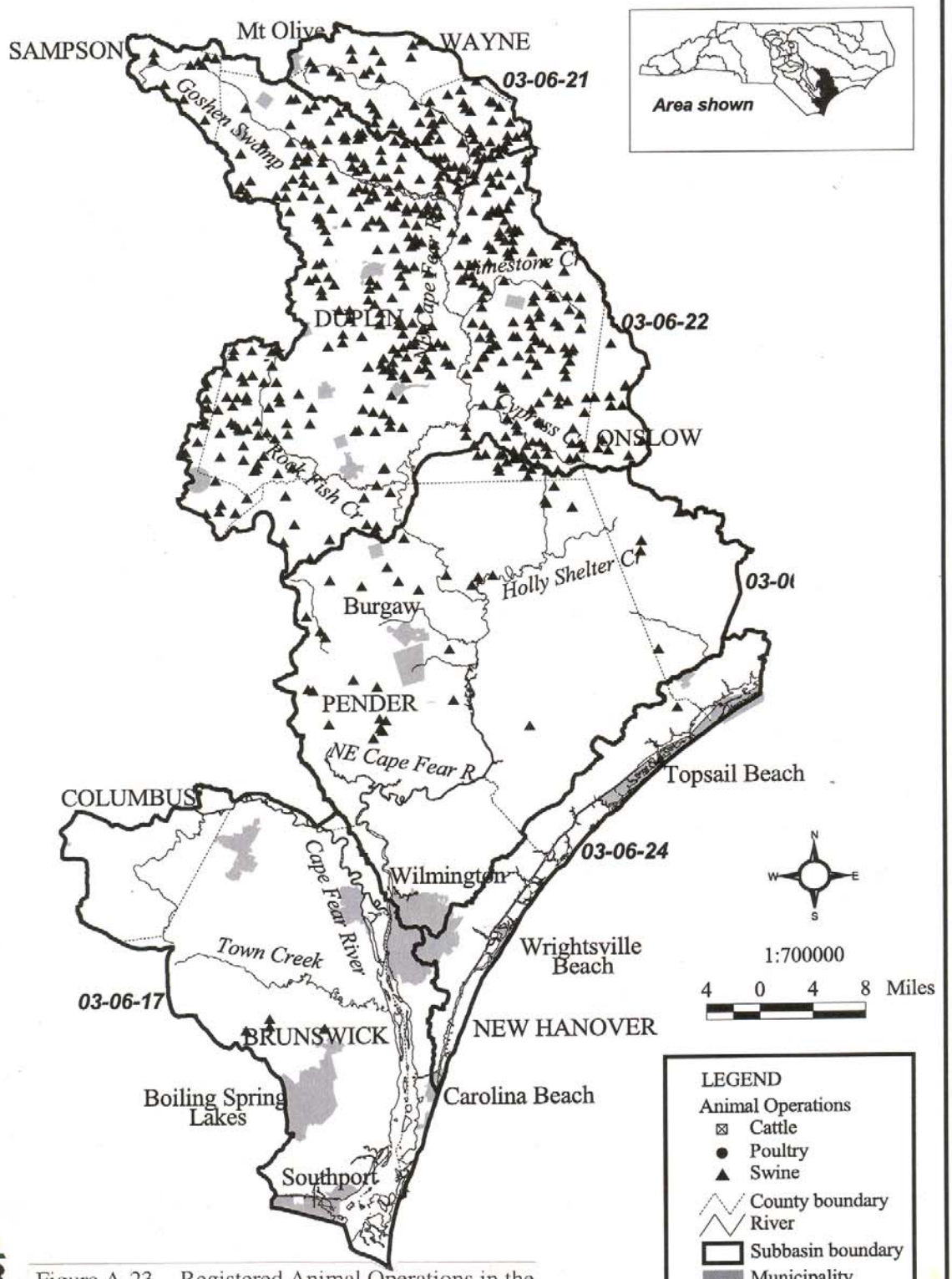


Figure A-22 Registered Animal Operations in the Middle Cape Fear River Basin

Registered Animal Operations in the Lower Cape Fear River Basin



NCDENR
October 1999

Figure A-23 Registered Animal Operations in the Lower Cape Fear River Basin

Table A-16 Estimated Populations of Swine (1998, 1994 and 1990), Dairy (1998 and 1994) and Poultry (1998 and 1994) in the Cape Fear River Basin (NCDA Veterinary Division)

Subbasin	Total Swine Capacity			Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	1990	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
03-06-01	2,884	1,798	1,052	60	1,223	1,629	-25	63,300	100	63,200
03-06-02	1,944	2,342	2,995	-17	2,181	3,656	-40	286,849	86,773	231
03-06-03	2,112	3,357	2,918	-37	1,058	1,353	-22	522,070	482,144	8
03-06-04	3,310	3,354	1,469	-1	5,698	6,153	-7	4,865,029	1,855,294	162
03-06-05	300	209	167	44	640	213	200	10,000	22,000	-55
03-06-06	300	120	167	150	640	641	0	10,000	50	19,900
03-06-07	4,202	4,109	3,256	2	255	1,020	-75	1,857,430	1,653,430	12
03-06-08	118	129	228	-9	2,604	2,677	-3	465,889	415,789	12
03-06-09	37,997	40,443	8,233	-6	2,933	3,113	-6	13,185,379	12,049,038	9
03-06-10	28,585	21,454	18,920	33	405	405	0	9,640,013	9,311,324	4
03-06-11	963	1,042	1,220	-8	0	127	-100	2,219,382	2,080,230	7
03-06-12	3,466	4,524	6,978	-23	1,117	1,483	-25	5,950,459	5,955,399	0
03-06-13	19,353	3,342	1,686	479	0	12	-100	967,800	753,600	28
03-06-14	20,809	8,192	4,437	154	585	589	-1	3,765,400	3,279,900	15
03-06-15	43,395	38,306	24,657	13	0	0	0	486,811	413,911	18
03-06-16	293,021	137,777	38,281	113	0	0	0	125,000	155,000	-19
03-06-17	39,343	20,614	9,231	91	0	0	0	0	0	0
03-06-18	474,316	192,309	98,466	147	0	0	0	1,820,288	1,440,488	26
03-06-19	1,647,410	954,060	353,427	73	1,875	1,875	0	8,582,910	6,092,850	41
03-06-20	95,950	29,170	9,404	229	0	0	0	77,300	47,030	64
03-06-21	275,767	145,138	50,280	90	155	155	0	1,526,230	1,415,500	8
03-06-22	1,804,152	920,839	277,130	96	0	0	0	7,944,900	8,416,850	-6
03-06-23	440,628	229,490	65,424	92	0	0	0	3,251,100	3,052,100	7
03-06-24	1,067	1,051	276	2	0	0	0	2,000	3,000	-33
TOTALS	5,241,392	2,763,169	980,302	90	21,369	25,101	-15	67,625,539	58,981,800	15
% of State Total	54%	51%	39%		22%	19%		32%	32%	

Source : NC Department of Agriculture, Veterinary Division

2.9 Water Use and Minimum Streamflow

2.9.1 Local Water Supply Planning

The North Carolina General Assembly has mandated a local and state water supply planning process under North Carolina General Statute §143-355(l) and (m) to assure that communities have an adequate supply of 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. The current LWSPs are based on 1992 data. Updated plans based on 1997 water supply and water use information were completed in 1999.

In 1992, 130 systems that use water from the Cape Fear River basin provided an average of 208.77 million gallons per day (MGD) to 1.3 million people (Table A-17). Projections of future need show that these systems expect their service populations to increase by 66% to 2.1 million people by 2020. Average daily water use for these systems is expected to increase by 86 percent to 388 MGD by the year 2020. These data only represent systems submitting a LWSP and do not reflect the needs of the public water systems in this basin that are not required to prepare a plan because they are not operated by a unit of local government. The information is self-reported and has not been field verified. However, plans have been reviewed by staff engineers for consistency and reasonableness. More information is available for these and other systems across the state that submitted a Local Water Supply Plan from the Division of Water Resources' website at: www.dwr.ehnr.state.nc.us/home.htm.

2.9.2 Minimum Streamflow

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Hydropower dams that are subject to FERC authority are exempt from Division of Land Resources (DLR) authority. 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. Table A-18 lists hydroelectric projects with minimum releases. The Division of Water Resources (DWR), 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 lists minimum instream flow studies in this basin.

Table A-17 Population and Water Use for Water Systems in the Cape Fear River Basin

County	Population			Average Daily Water Use		
	1992	2000	2020	1992 MGD	2000 MGD	2020 MGD
Alamance	64,394	76,447	94,023	15.334	19.587	24.32
Bladen	11,593	13,935	18,395	1.291	2.352	2.77
Brunswick	83,658	119,138	159,007	11.353	19.005	26.006
Chatham	14,864	17,867	26,156	3.724	5.111	7.277
Columbus	320	350	425	0.474	0.109	0.133
Cumberland	151,684	179,675	249,315	23.191	27.012	43.377
Duplin	16,607	32,104	39,530	5	7	8
Durham	140,000	195,000	279,000	23	30	42
Forsyth	12,276	18,739	46,780	1	2	6
Guilford	271,057	288,565	317,715	43	52	75
Harnett	46,223	65,390	107,142	7	12	18
Hoke	5,755	15,735	18,567	2	3	5
Johnston	2,880	3,300	4,630	1	1	1
Lee	20,515	23,531	26,643	5	6	7
Montgomery	6,443	6,927	7,929	3	4	7
Moore	24,073	31,015	27,680	4	8	10
New Hanover	71,449	101,525	111,596	20	48	36
Orange	68,900	81,900	115,300	8	10	14
Onslow	99,329	111,705	153,475	8.567	9.962	14.175
Pender	11,203	14,051	15,362	1	1	1
Randolph	36,169	41,252	52,782	7	12	19
Rockingham	14,011	14,825	15,400	3	5	5
Sampson	14,205	17,818	19,878	2.344	3.078	3.745
Wake	58,487	92,353	166,178	7	9	20
Wayne	25,579	37,311	39,772	2	4	4
TOTALS	1,271,674	1,600,458	2,112,680	208.278	300.216	399.803

Table A-18 Minimum Streamflow Projects in the Cape Fear River Basin

HYDROELECTRIC DAMS				
Hydropower Dam	**Regulatory Authority**	**Bypass Reach (ft)**	**Drainage Area (sq. mi.)**	**Min. Release (cu.ft/sec)**
Deep River				
Coltrane	unlicensed	320	124	
Worthville	Federal Energy Regulatory Comm (FERC	None	223	None*
Cox Lake	FERC	506	250	42
Cedar Falls	FERC	2112	257	32
Franklin/ Randolph Mills	FERC	480	278	None*
Ramseur	FERC	1430	343	45
Coleridge	FERC	500	391	35
High Falls	FERC	2844	748	108
Carbonton	FERC	None	970	None*
Lockville	FERC	700	1380	70
Haw River				
Altamahaw	unlicensed	800	226	
Glencoe Mills	FERC	1815	495	57
Swepsonville			700	
Saxapahaw	FERC	5200	1020	10
Bynum	FERC	3000	1270	80
B.E. Jordan	FERC		1690	
Rockfish Creek				
Raeford	FERC	None	179	None*
Rocky River				
Rocky River	FERC	None	181	None*

Notes:

* Even though there is no minimum flow, the project must still operate in a run-of-river mode; i.e., instantaneous inflow equals instantaneous outflow. A noncompliant project can alter noticeably the streamflow.

Table A-19 Minimum Instream Flow Studies in the Cape Fear River Basin

WATER SUPPLY IMPOUNDMENTS/WITHDRAWALS		
Dam	**Study Cooperators**	**Purpose of Study**
Big Alamance Creek	DWR	The Town of Burlington's water supply, Lake Mackintosh, has a tiered release with a maximum flow release of 9 cfs at full pool. The recommendation was based on a wetted perimeter study done by DWR.
Back Creek	DWR	DWR requested, following the review of the environmental assessment for the expansion of the Graham-Mebane water treatment plant from 6 to 12 MGD, a tiered release with a maximum low flow release of 5 cfs at full pool from Graham-Mebane Lake. The flow recommendation was based on a wetted perimeter study by DWR.
Bones Creek	DWR and NCWRC	Lake Rim is used by the NC Wildlife Resources Commission as a fish hatchery storage pond. DWR requested a minimum flow as a stipulation for dam repair. The Division assisted the Commission in determining a tiered release of 18 cfs from the impoundment in all months except July, when the release is 10.5 cfs. The releases are based on a hydrologic desktop investigation. A calibrated gage is required to monitor releases.
Branson Creek	NCWRC	A stipulation for repairs to Forest Lake dam in Fayetteville was a minimum flow requirement of 3.4 cfs. The recommendation is based on a NC Wildlife Resources Commission habitat evaluation and a hydrologic desktop investigation.
Little Cross Creek	DWR, NCWRC and DWQ	DWR participated in an aquatic habitat assessment of Little Cross Creek below Glenville Lake (Fayetteville's reserve water source) with the NC Wildlife Resources Commission and DWQ. A minimum flow of 3.6 cfs, based on a hydrologic desktop investigation, was established.
Deep River	DWR	The proposed Randleman reservoir will serve the cities of Greensboro and High Point. The reservoir will have a tiered minimum release ranging from a high of 30 cfs at full pool, 20 cfs when below 60 percent full pool, and 10 cfs when below 30 percent full pool. The minimum flow recommendations are based on a wetted perimeter study. The project will divert up to 30.5 MGD (47.1 cfs) which will reduce the average annual flow. The natural low flows in the lower Deep River will be increased by the minimum release. There will be some interbasin transfer (see Part 2.9.3). Randleman Reservoir will impact hydropower generation in the Deep River. The Coltrane Mill project will be inundated by the impoundment. DWR estimates that hydropower generation will be reduced by 5 to 15 percent depending on the amount of withdrawal from the reservoir, proximity of the generation facility to Randleman, and the minimum flow requirement at each project. The City of High Point's primary sources for water, High Point City Lake and Oak Hollow Reservoir, do not have minimum release requirements. The Dam Safety Law restricts minimum flow requirements for existing reservoirs to 10 percent of the safe yield. This corresponds to 1.3 cfs and 1.9 cfs for High Point City Lake and Oak Hollow Reservoir, respectively.
Mill Creek	NCWRC	Reservoir Park dam in Southern Pines has a minimum flow requirement of 0.5 cfs based upon consultation with the NC Wildlife Resources Commission and a hydrologic desktop investigation.
Nick's Creek	DWR and Town of Carthage	DWR will be cooperating with the Town of Carthage on an instream flow study of Nick's Creek to evaluate a proposal to expand their withdrawal from 0.5 to 1.0 MGD.
Reedy Fork	DWR	Lake Townsend in Greensboro has a minimum flow requirement of 7.1 cfs at full pool as a stipulation for expansion of the water treatment plant from 20 to 30 MGD. The recommended flow is based upon a wetted perimeter study done by DWR.
Rocky River	DWR, Town of Siler City and other agencies	The Town of Siler City has a tiered release at their water withdrawal structure based on an instream flow study performed by DWR. The minimum release from December through May is 3.5 cfs when the town's reservoir is at 40 percent capacity or greater. The town has installed gages to monitor the release. DWR and other resource agencies are now participating in discussions with the town on a proposal to raise the evaluation of the withdrawal pond by 12. 5 feet.

2.9.3 Interbasin Transfer

Water users in North Carolina are required to register their water withdrawals and transfers with the Division of Water Resources if the amount is 100,000 gallons per day or more, according to NCGS §143-215.22H. In addition, transfers of one million gallons per day or more require certification from the Environmental Management Commission, according to NCGS §143-215.22I. Table A-20 lists the parties that have registered withdrawals in the Cape Fear River basin as of January 1, 1999.

The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Subbasins in North Carolina* that was filed in the Office of the Secretary of State on April 16, 1991. Within the Cape Fear basin, six subbasins are delineated: the Haw River, the Deep River, the Cape Fear River, the South River, Northeast Cape Fear River and the New River (Figure A-24). (Note: The New River is not considered part of the Cape Fear River basin under the basinwide management approach which utilizes basin definitions adopted by the Department of Water and Air Resources in 1974. The New River will be addressed as part of the White Oak River Basinwide Water Quality Plan in 2001.)

Figure A-25 shows the approximate location of transfers of 1.0 MGD or greater. Table A-21 lists all potential transfers within the basin. Unless otherwise noted, the transfer amounts are 1992 average daily amounts in million gallons per day (MGD) based on Local Water Supply Plans and registered withdrawal/transfer information. Many of the transfers cannot be quantified due to undocumented consumptive losses (examples: septic, lawn irrigation). Note: Under a provision of Senate Bill 1299 (ratified by the General Assembly on September 23, 1988), all local water systems are now required to report existing and anticipated interbasin transfers as part of the Local Water Supply Planning process. This information will be available for future updates of this management plan and will allow an assessment of cumulative impacts.

Currently, there are two permitted transfers in the Cape Fear basin. The first permit is for Cary/Apex's 16 MGD transfer from the Haw River subbasin to the Neuse River subbasin. Cary and Apex are currently preparing environmental documentation to support an application for increasing the transfer amount. The second permit is for Piedmont Triad Water Authority's 30.5 MGD transfer from the Deep River subbasin to the Haw and Yadkin River subbasins. This permit covers anticipated transfers resulting from the operation of the proposed Randleman dam.

Other large transfers in the Cape Fear basin include Durham (18.0 MGD), Asheboro (4.7 MGD), and High Point (3.5 MGD).

Table A-20 Water Withdrawal Registrations in the Cape Fear River Basin

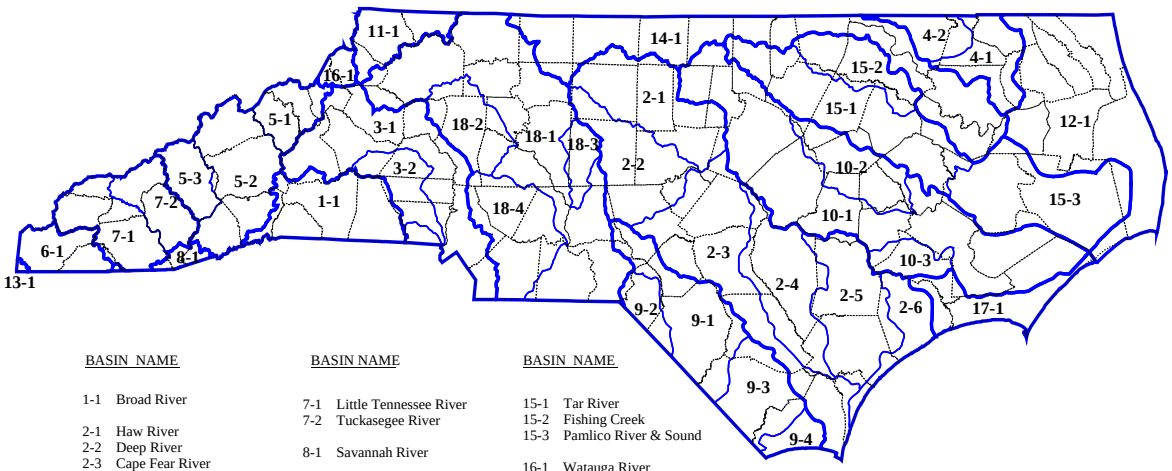
Cape Fear River Basin

Water Withdrawal Registrations pursuant to NCGS 143-215.22H.

Data is self-reported and has not been field verified.

County	Facility #	Capacity MGD	Facility
ALAMANCE	01-003	3.000	CONE MILLS CORPORATION - GRANITE PLANT
ALAMANCE	01-006	229.000	GLENCOE MILLS
CHATHAM	19-002	180.000	CAROLINA POWER & LIGHT COMPANY
CHATHAM	19-007	0.860	WEYERHAEUSER COMPANY
GUILFORD	41-001	5.000	CONE MILLS CORPORATION - WHITE OAK PLANT
GUILFORD	41-002	2.000	CONE MILLS CORPORATION - WHITE OAK PLANT
GUILFORD	41-003	0.000	VULCAN MATERIALS COMPANY
GUILFORD	41-004	0.000	VULCAN MATERIALS COMPANY
GUILFORD	41-008	1.555	JAMESTOWN PARK GOLF COURSE
LEE	53-001	1.440	WAKE STONE CORPORATION - KNIGHTDALE QUARRY
LEE	53-003	1.500	FLOYD BROWNE & ASSOCIATION WTP
LEE	53-004	1.009	GOLDEN POULTRY COMPANY, INC
MOORE	63-002	1.270	SANDY RIDGE FARMS
MOORE	63-003	1.270	SANDY RIDGE FARMS
MOORE	63-004	1.270	SANDY RIDGE FARMS
MOORE	63-012	2.000	TRIPLE H FARMS (SANDHILL TURF)
MOORE	63-013	4.000	SANDHILL TURF, INC
RANDOLPH	76-006	0.000	PIEDMONT TRIAD WATER AUTHORITY
BLADEN	09-003	17.000	E. I. DUPONT DENEMOURS - FAYETTEVILLE
BLADEN	09-004	1.240	COGENTRIX OF NORTH CAROLINA
BLADEN	09-006	2.100	ALAMAC KNITS - WEST POINT STEVENS
BRUNSWICK	10-001	4.000	ARCHER DANIELS MIDLAND COMPANY
BRUNSWICK	10-003	1600.000	CAROLINA POWER & LIGHT COMPANY
BRUNSWICK	10-004	2.000	BALD HEAD ISLAND GOLF CLUB
BRUNSWICK	10-006	0.000	COGENTRIX - BRUNSWICK COUNTY
BRUNSWICK	10-006	4.140	COGENTRIX OF NORTH CAROLINA
BRUNSWICK	10-007	18.000	E. I. DUPONT
COLUMBUS	24-001	50.000	FEDERAL PAPER BOARD COMPANY, INC
CUMBERLAND	26-001	1.500	KIRBY PUGTT
CUMBERLAND	26-002	1.680	MONSANTO AGRICULTURE COMPANY
CUMBERLAND	26-003	11.000	HQ XVIII AIRBORNE CORPS & FORT BRAGG
CUMBERLAND	26-008	5.800	BROOKWOOD COMMUNITY WS
CUMBERLAND	26-009	3.000	BLAKE FARMS, INC
HARNETT	43-001	2.050	NELLO L. TEER COMPANY
HARNETT	43-003	8.000	ERWIN MILLS
MOORE	63-010	1.610	PINEHURST RESORT AND COUNTRY CLUB
NEW HANOVER	65-001	0.000	CAPE INDUSTRIES
NEW HANOVER	65-002	49.000	CAROLINA POWER & LIGHT COMPANY
NEW HANOVER	65-007	3.100	HOECHST CELANESE-WILMINGTON PLANT
WAKE	92-005	28.000	CAROLINA POWER & LIGHT COMPANY
WAKE	92-019	1.400	RONNIE BETTS
SAMPSON	82-017	1.000	DL & B ENTERPRISES, INC
DUPLIN	31-001	1.700	GUILFORD MILLS, INC - GUILFORD EAST SITE
DUPLIN	31-002	3.240	CAROLINA TURKEYS
DUPLIN	31-003	2.090	COGENTRIX OF NORTH CAROLINA
DUPLIN	31-004	2.520	STEVCOKNIT FABRICS COMPANY, INC
DUPLIN	31-005	2.000	BUTTERBALL TURKEY COMPANY
NEW HANOVER	65-003	5.760	OCCIDENTAL CHEMICAL CORPORATION
NEW HANOVER	65-006	4.450	CAPE FEAR INDUSTRIES
NEW HANOVER	65-008	2.110	GENERAL ELECTRIC COMPANY
NEW HANOVER	65-025	15.840	MARTIN MARIETTA
PENDER	71-002	17.760	MARTIN MARIETTA
NEW HANOVER	65-004	2.700	LANDFALL CLUB
NEW HANOVER	65-005	1.500	LANDFALL CLUB
ONSLOW	67-001	5.322	CAMP LEJEUNE MCB
ONSLOW	67-002	8.464	CAMP LEJEUNE MCB
ONSLOW	67-003	4.710	CAMP LEJEUNE MCB
	Total Capacity	**2330.96**	**MGD**

Figure A-24 River Basins Subject to Surface Water Transfers Act



BASIN NAME

1-1 Broad River

2-1 Haw River
2-2 Deep River
2-3 Cape Fear River
2-4 South River
2-5 Northeast Cape Fear River
2-6 New River

3-1 Catawba River
3-2 South Fork Catawba River

4-1 Chowan River
4-2 Meherrin River

5-1 Nolichucky River
5-2 French Broad River
5-3 Pigeon River

6-1 Hiwassee River

BASIN NAME

7-1 Little Tennessee River
7-2 Tuckasegee River

8-1 Savannah River

9-1 Lumber River
9-2 Big Shoe Heel Creek
9-3 Waccamaw River
9-4 Shallotte River

10-1 Neuse River
10-2 Contentnea Creek
10-3 Trent River

11-1 New River

12-1 Albemarle Sound

13-1 Ocoee River

14-1 Roanoke River

BASIN NAME

15-1 Tar River
15-2 Fishing Creek
15-3 Pamlico River & Sound

16-1 Watauga River

17-1 White Oak River

18-1 Yadkin River
18-2 South Yadkin River
18-3 Uwharrie River
18-4 Rocky River

Legend

Major River Basin Boundary

Sub-Basin Boundary

County Boundary

NC-DENR
Division of Water Resources
919-733-4064

Figure A-25 Interbasin Transfers (>1.0 MGD) in the Cape Fear River Basin

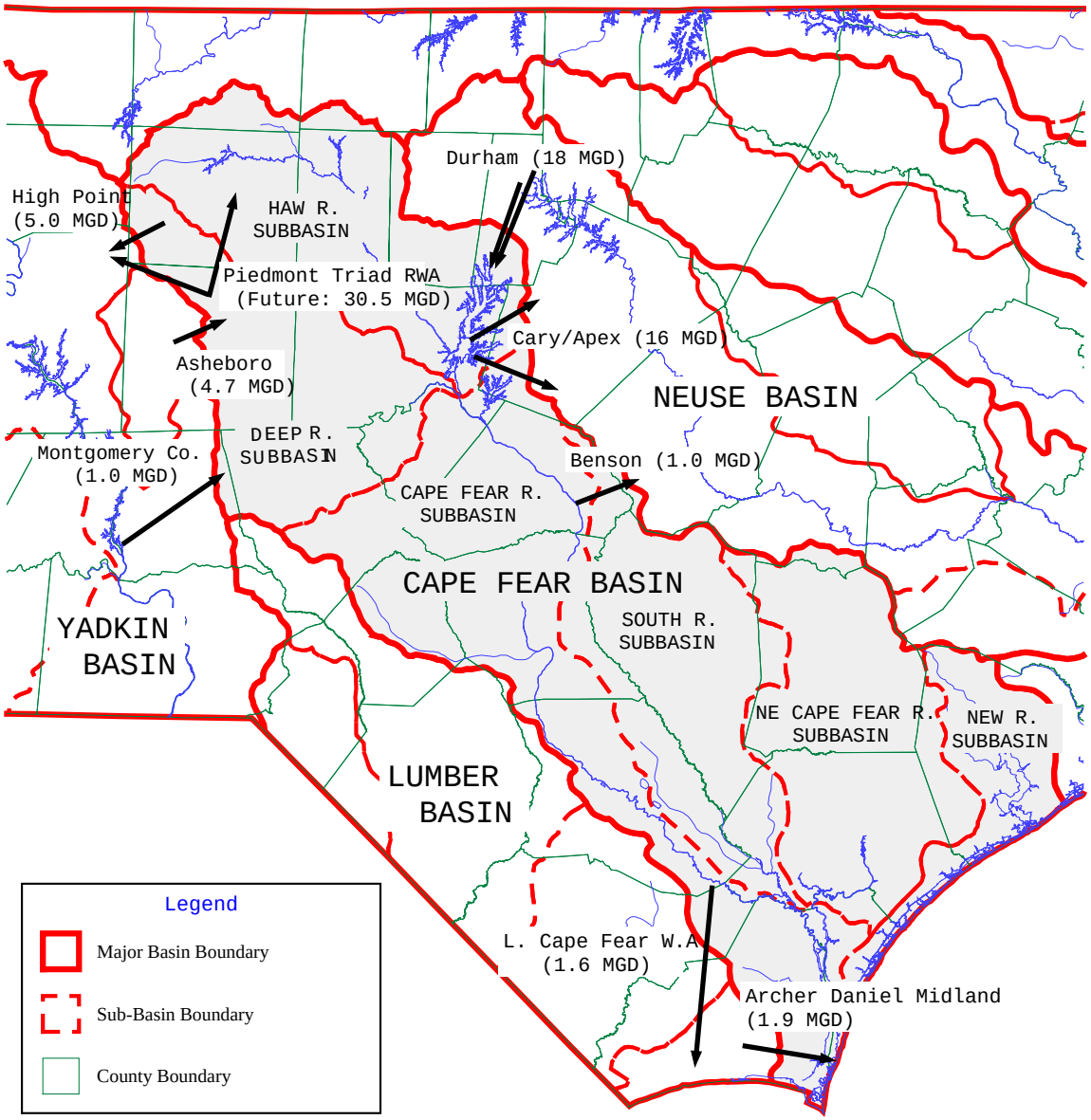


Table A-21 Interbasin Transfers in the Cape Fear River Basin

Source System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD)[1,2,3]
Permitted Transfers				
Cary/Apex	Cary/Apex	Haw	Neuse	16.0[4]
Piedmont Triad WA	Piedmont Triad WA	Deep	Haw, Yadkin	30.5[5]
Other Transfers				
Graham	Orange-Alamance	Haw	Neuse	Emergency
Greensboro	Jamestown	Haw	Deep	0.09
Greensboro	Greensboro	Haw	Deep	Unknown
OWASA	Hillsborough	Haw	Neuse	Emergency
Reidsville	Reidsville	Haw	Roanoke	Unknown
High Point	Greensboro	Deep	Haw	Unknown
High Point	Thomasville	Deep	Yadkin	Emergency
High Point	High Point	Deep	Yadkin	3.5
Lower Cape Fear WSA	Brunswick County	Cape Fear	Shallotte	Unknown
Carthage	Carthage	Cape Fear	Deep	Unknown
Dunn	Benson	Cape Fear	Neuse	1.0
Dunn	Dunn	Cape Fear	South	Unknown
Dunn	Benson	Cape Fear	South	Unknown
Harnett	Fuquay-Varina	Cape Fear	Neuse	Unknown
Harnett	Angier	Cape Fear	South	Unknown
Harnett	Coats	Cape Fear	South	Unknown
Harnett	Dunn	Cape Fear	South	Emergency
Sanford	Chatham County East	Cape Fear	Deep	Unknown
Sanford	Sanford	Cape Fear	Deep	Unknown
Sanford	Lee County - Tramway	Cape Fear	Deep	Emergency
Wilmington	Wilmington	Cape Fear	New	Unknown
General Electric	General Electric	NE Cape Fear	Cape Fear	0.75
Southern Pines	Southern Pines	Lumber	Cape Fear	Unknown
Archer Daniel Midland	Archer Daniel Midland	Shallotte	Cape Fear	1.89
Durham	OWASA	Neuse	Haw	Emergency
Durham	Durham	Neuse	Haw	18.0[6]
Goldsboro	Wayne WD	Neuse	NE Cape Fear	Emergency
Hillsborough	Orange-Alamance WS	Neuse	Haw	Emergency
Orange-Alamance WS	Mebane	Neuse	Haw	Emergency
Orange-Alamance WS	Orange-Alamance WS	Neuse	Haw	Unknown
Raleigh	Holly Springs	Neuse	Cape Fear	0.8
Davidson	Archdale	Yadkin	Deep	Unknown
Davidson	Davidson	Yadkin	Deep	Unknown
Montgomery County	Montgomery County	Yadkin	Deep	1.0
North Wilkesboro	Broadway	Yadkin	Cape Fear	Unknown
Winston Salem	Kernersville	Yadkin	Haw	Unknown
Winston Salem	Winston Salem	Yadkin	Deep	Unknown
Winston Salem	Winston Salem	Yadkin	Haw	Unknown
Asheboro	Randleman	Uwharrie	Deep	Emergency
Asheboro	Asheboro	Uwharrie	Deep	4.7

[1] Transfer amounts are based on average daily water use reported in 1992 Local Water Supply Plans, and the 1993 Water Withdrawal and Transfer Registration Database.

[2] "Unknown" refers to undocumented consumptive use.

[3] "Emergency" refers to emergency connections.

[4] Transfer amount for Cary/Apex are based on its permitted transfer.

[5] Transfer amount for Piedmont Triad Regional Water Authority is based on its permitted transfer, but will not become effective until completion of Randleman dam.

[6] The estimated transfer amount for Durham is based on information in their Jordan Lake allocation application.