CHOWAN RIVER BASINWIDE WATER QUALITY PLAN

July 2002

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This document was approved and endorsed by the NC Environmental Management Commission on July 11, 2002 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the Chowan River basin. This plan is the first five-year update to the Chowan River Basinwide Water Quality Management Plan approved by the NC Environmental Management Commission in September 1997.

No state funds were used to print this public document. This publication was funded through the Clean Water Act's Section 319 Program and the Nonpoint Source Program Section 6217.

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North Carolina's Basinwide Approach to Water Quality Management

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the seventeen major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by the DWQ, their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholders in the state. The first basinwide plan for the Chowan River basin was completed in 1997.

This draft document is the first five-year update of the *Chowan River Basinwide Water Quality Plan*. The format of this plan was revised in response to comments received during the first planning cycle. DWQ replaced much of the general information in the first plan with more detailed information specific to the Chowan River basin. A greater emphasis was placed on identifying causes and sources of pollution for individual streams in order to facilitate local restoration efforts.

DWQ considered comments from two public workshops held in the basin and subsequent discussions with local resource agency staff and citizens during draft plan development. This input will help guide continuing DWQ activities in the basin.

Goals of the Basinwide Approach

The goals of DWQ's basinwide program are to:

- identify water quality problems and restore full use to impaired waters;
- identify and protect high value resource waters;
- protect unimpaired waters while allowing for reasonable economic growth;
- develop appropriate management strategies to protect and restore water quality;
- assure equitable distribution of waste assimilative capacity for dischargers; and
- improve public awareness and involvement in the management of the state's surface waters.

Chowan River Basin Overview

The Chowan River basin is located in the northeastern coastal plain of North Carolina and southeastern Virginia. The North Carolina portion includes all or part of Northampton, Hertford, Gates, Bertie and Chowan counties. The Chowan River is formed at the border of Virginia and North Carolina by the confluence of the Nottoway and Blackwater Rivers, and its streams flow southeastward towards the Albemarle Sound.

The majority of the river's watershed (approximately 75 percent) lies within the Virginia border. This Virginia portion of the basin is managed as the Chowan River and Dismal Swamp basin.

This Virginia portion covers 4,061 square miles of the Chowan River and Chowan River basin's headwaters (Virginia, 2000).

The Chowan River basin in North Carolina is composed of two major drainages: Chowan River and Meherrin River. There is very little information available regarding water quality in the basin. However, the data available indicate that water quality is generally good. All of the waters in the basin are designated as Nutrient Sensitive Waters.

Population of the basin, based on 1990 census data, was estimated to be 62,474. The 2000 population was estimated to be 61,034. This change in population over the ten-year period resulted in a 2.3 percent decrease in population. The overall population density of the basin is 48 persons per square mile compared to an estimated statewide average of 139 persons per square mile.

The Chowan River basin is part of the Albemarle-Pamlico Estuarine system, the second largest estuarine system in the United States. In 1987, this estuarine system became part of the Environmental Protection Agency National Estuary Program and was the subject of a major study known as the Albemarle-Pamlico Estuarine Study.

Forest and agriculture dominate the Chowan River basin. Over half of the land in the basin is forested with another 32.6 percent devoted to cultivated crops. Important natural resources in the basin include wetlands, anadromous fish spawning areas and Merchant's Millpond State Park. Most of the water used in the basin comes from groundwater sources.

Assessment of Water Quality in the Chowan River Basin

Surface waters are classified according to their best intended uses. Determining how well a water supports its designated uses (use support status) is an important method of interpreting water quality data and assessing water quality. Waters are rated fully supporting (FS), partially supporting (PS) or not supporting (NS). The terms refer to whether the classified uses of the water (i.e., aquatic life protection, recreation and water supply) are being met. For example, waters classified for aquatic life protection and secondary recreation (Class C for freshwater and SC for saltwater) are rated FS if data used to determine use support did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR).

Beginning in 2000 with the Roanoke River basin, an approach to assess ecosystem health and human health risk is being initiated via the development of use support ratings for each of six use support categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. Each of these categories relates to the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the multiple use categories. For many waters, a use category will not be applicable (NA) to the best use classification of that water (e.g., drinking water supply is not the best use of a Class C water). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water.

Aquatic Life/Secondary Recreation

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (802.6 miles) in the Chowan River basin. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table 1.

Approximately 36 percent of stream miles (288.2) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. Impaired waters account for 2.8 percent of the total stream miles and 7.8 percent of monitored stream miles.

Table 1 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Chowan River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**107.2**	**13.3%**		**107.2**	**37.2%**
Impaired	**22.5**	**2.8%**		**22.5**	**7.8%**
Partially Supporting	*22.5*	*2.8%*		*22.5*	*7.8%*
Not Supporting	*0*	*0%*		*0*	*0%*
Not Rated	**672.9**	**84.0%**		**158.5**	**55.0%**
Total	**802.6**			**288.2**	

* = Percent based on total of all waters, both monitored and evaluated. ** = Percent based on total of all monitored waters.

Fish Consumption

Like the aquatic life/secondary recreation use support category, the fish consumption use support category is also applied to all waters in the state. Approximately five percent of stream miles in the Chowan River basin were monitored for the fish consumption use support category during this basinwide cycle. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there is a regional advisory limiting consumption of shark, swordfish, king mackerel, tilefish as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack), due to elevated methylmercury levels. Because of this advisory, all waters south and east of Interstate 85 are considered partially supporting the fish consumption use on an evaluated basis. Only 39.8 miles of the basin were monitored during the 1995-2000 basinwide planning cycle. A basinwide summary of current fish consumption use support ratings is presented in Table 2.

Table 2 Fish Consumption Use Support Summary Information for Waters in the Chowan River Basin (2000)

Fish Consumption Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**0.0**			**0.0**	**0%**
Impaired	**802.6**	**100%**		**39.8**	**100%**
Partially Supporting	**802.6**	*100%*		*39.8 miles*	*100%*
Not Supporting	*0*			*0*	*0*
Not Rated	**0.0**			**0.0**	**0**
TOTAL	**802.6**			**39.8**	

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Primary Recreation

There are 105.4 miles currently classified for primary recreation in the Chowan River basin. A basinwide summary of current primary recreation use support ratings is presented in Table 3.

Table 3 Primary Recreation Use Support Summary Information for Waters in the Chowan River Basin (2000)

Primary Recreation Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**73.4**	**69.6**		**73.4**	**100.0%**
Impaired	**0**	**0**		**0**	**0**
Partially Supporting	*0*	*0*		*0*	*0*
Not Supporting	*0*	*0*		*0*	*0*
Not Rated	**32.0**	**30.4%**		**0**	**0%**
TOTAL	**105.4**	**---**		**73.4**	**-----**

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Use Support Summary

There are 22.5 impaired stream miles in the aquatic life/secondary recreation use support category and no impaired waters in the primary recreation use support category. All waters are considered impaired for the fish consumption use support category due to a regional fish consumption advisory for shark, swordfish, king mackerel, tilefish as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack), although only one stream was monitored to

assess this category. There were no waters impaired in the primary recreation use support category. The water supply use support category was not assessed in this basin because there are no surface water drinking water supplies. Descriptions of impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each waterbody are discussed in detail in the appropriate subbasin chapter.

Section A

General Basinwide Information

Chapter 1 -
Introduction to Basinwide Water Quality Planning

1.1 What is Basinwide Water Quality Planning?

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the seventeen major river basins in the state, as shown in Figure A-1 and Table A-1. Preparation of an individual basinwide water quality plan is a five-year process, which is broken down into three major phases as presented in Table A-2. While these plans are prepared by the Division of Water Quality, their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholder groups in the state. The first cycle of plans was completed in 1998, but each plan is updated at five-year intervals.

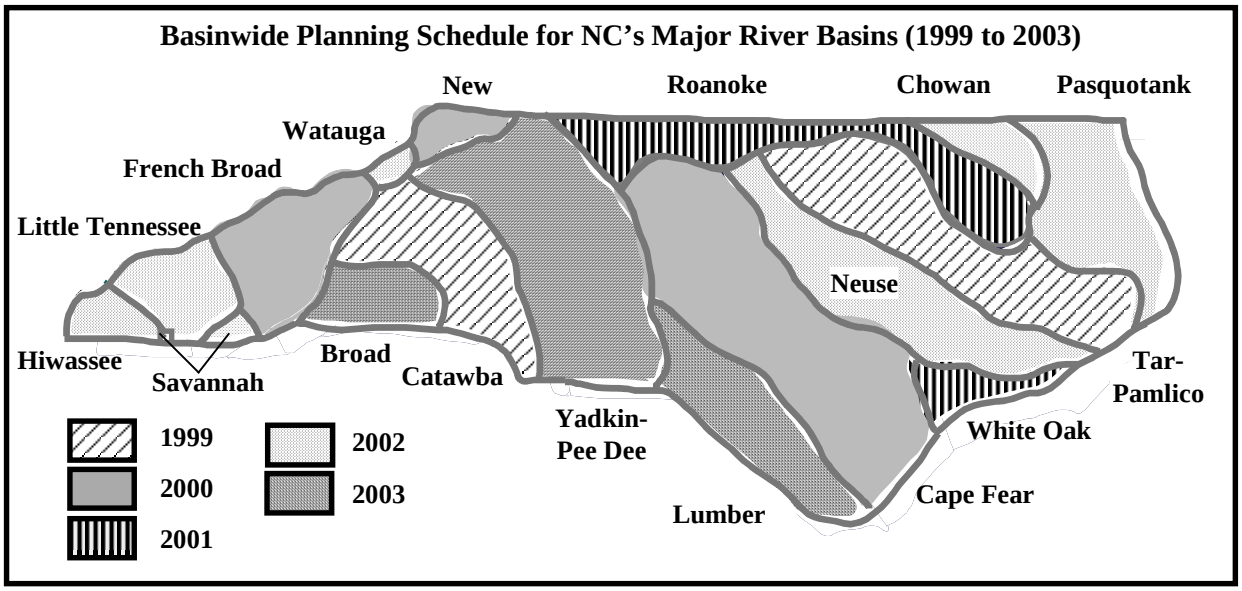

Figure A-1 Basinwide Planning Schedule (1999 to 2003)

1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide planning are to:

- identify water quality problems and restore full use to impaired waters;
- identify and protect high value resource waters;
- protect unimpaired waters while allowing for reasonable economic growth;
- develop appropriate management strategies to protect and restore water quality;
- assure equitable distribution of waste assimilative capacity for dischargers; and
- improve public awareness and involvement in the management of the state's surface waters.

Table A-1 Schedule for Second Cycle of Basinwide Planning (1998 to 2003)

Basin	DWQ Biological Data Collection	River Basin Public Workshops	Public Mtgs. and Draft Out For Review	Final Plan Receives EMC Approval	Begin NPDES Permit Issuance
Neuse	Summer 2000	6/2001	5/2002	7/2002	1/2003
Lumber	Summer 2001	12/2002	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 97	6/1998	4/1999	7/1999	1/2000
Catawba	Summer 97	2/1999	10/1999	12/1999	3/2000
French Broad	Summer 97	5/1999	2/2000	5/2000	8/2000
New	Summer 98	6/1999	4/2000	7/2000	11/2000
Cape Fear	Summer 98	7/1999	4/2000	7/2000	12/2000
Roanoke	Summer 99	4/2000	2/2001	7/2001	1/2002
White Oak	Summer 99	10/2000	7/2001	9/2001	6/2002
Savannah	Summer 99	10/2000	12/2001	3/2002	8/2002
Watauga	Summer 99	10/2000	12/2001	2/2002	9/2002
Little Tennessee	Summer 99	3/2001	12/2001	4/2002	10/2002
Hiwassee	Summer 99	10/2000	12/2001	3/2002	8/2002
Chowan	**Summer 2000**	**3/2001**	**5/2002**	**7/2002**	**11/2002**
Pasquotank	Summer 2000	3/2001	5/2002	7/2002	12/2002
Broad	Summer 2000	11/2001	11/2002	2/2003	7/2003
Yadkin Pee-Dee	Summer 2001	4/2002	12/2002	3/2003	9/2003

Note: A basinwide plan was completed for all 17 basins during the first cycle (1993 to 1998).

Table A-2 Five-Year Process for Development of an Individual Basinwide Plan

Years 1 - 2 **Water Quality Data Collection and Identification of Goals and Issues**	• Identify sampling needs • Conduct biological monitoring activities • Conduct special studies and other water quality sampling activities • Coordinate with local stakeholders and other agencies to continue to implement goals within current basinwide plan
Years 2 - 3 **Data Analysis and Public Workshops**	• Gather and analyze data from sampling activities • Develop use support ratings • Conduct special studies and other water quality sampling activities • Conduct public workshops to establish goals and objectives and identify and prioritize issues for the next basin cycle • Develop preliminary pollution control strategies • Coordinate with local stakeholders and other agencies
Years 3 - 5 **Preparation of Draft Basinwide Plan, Public Review, Approval of Plan, Issue NPDES Permits and Begin Implementation of Plan**	• Develop draft basinwide plan based on water quality data, use support ratings, and recommended pollution control strategies • Circulate draft basinwide plan for review and present draft plan at public meetings • Revise plan after public review period • Submit plan to Environmental Management Commission for approval • Issue NPDES permits • Coordinate with other agencies and local interest groups to prioritize implementation actions • Conduct special studies and other water quality sampling activities

1.3 Major Components of the Basinwide Plan

The second round of basinwide plans uses a different format from the earlier basinwide plans. Each plan is subdivided into three major sections. The intent of the format change is to make the plans easier to read and understand, but still comprehensive in content.

Section A: Basinwide Information

- Introduces the basinwide planning approach used by the state.
- Provides an overview of the river basin including: hydrology, land use, local government jurisdictions, population and growth trends, natural resources, wastewater discharges, animal operations and water usage.
- Presents general water quality information including summaries of water quality monitoring programs and use support ratings in the basin.

Section B: Subbasin Information

- Summarizes recommendations from first basin plan, achievements made, what wasn't achieved and why, current priority issues and concerns, and goals and recommendations for the next five years by subbasin.

Section C: Current and Future Initiatives

- Presents current and future water quality initiatives by federal, state and local agencies, and corporate, citizen and academic efforts.
- Describes DWQ goals and initiatives beyond the five-year planning cycle for the basin.

1.4 Benefits of Basinwide Water Quality Planning

Several benefits of basinwide planning and management to water quality include:

- *Improved efficiency*. The state's efforts and resources are focused on one river basin at a time.
- *Increased effectiveness*. The basinwide approach is in agreement with basic ecological principles.
- *Better consistency and equitability*. By clearly defining the program's long-term goals and objectives, basinwide plans encourage *consistent* decision-making on permits and water quality improvement strategies.
- *Increased public participation in the state's water quality protection programs*. The basinwide plans are an educational tool for increasing public involvement and awareness about water quality issues.
- *Increased integration of point and nonpoint source pollution assessment and controls*. Once waste loadings from both point and nonpoint sources are established, management strategies can be developed to ensure compliance with water quality standards.

1.5 How to Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for local citizens and other stakeholders to participate in the planning process. DWQ offers three opportunities for the public to participate in the process:

- Public Workshops: Held prior to writing the basinwide plans. DWQ staff present information about basinwide planning and the water quality of the basin. Participants then break into smaller groups where they can ask questions, share their concerns, and discuss potential solutions to water quality issues in the basin.
- Public Meetings: Held after the draft basinwide plan has been approved by the Water Quality Committee of the Environmental Management Commission. DWQ staff present more detailed information about the draft basinwide plan and its major recommendations. Then, the public is invited to comment and ask questions.
- Public Comment Period: Held after the draft plan has been approved by the Water Quality Committee of the Environmental Management Commission. The comment period is at least thirty days in length from the date of the first public meeting.

Citizens seeking involvement in efforts to restore and protect water quality can call the DWQ Planning Branch at (919) 733-5083 and ask to speak to the basin planner for your river basin.

1.6 Other References

There are several reference documents and websites that provide additional information about basinwide planning and the basin's water quality:

- *Chowan River Basinwide Assessment Report*. January 2002. This technical report presents the physical, chemical and biological data in the Chowan River basin. 120 pp.
- *Chowan River Basinwide Water Quality Management Plan*. September 1997. This first basinwide plan for the Chowan River basin presents water quality data, information and recommended management strategies for the first five-year cycle.
- *A Citizen's Guide to Water Quality Management in North Carolina*. August 2000. This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. 156 pp.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Chowan River Basin*. August 1998. DWQ NC Wetlands Restoration Program. Raleigh, NC.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description*. Creager, C.S. and J.P. Baker. 1991. DWQ Water Quality Section. Raleigh, NC.
- NC Division of Water Quality Basinwide Planning Website http://h2o.enr.state.nc.us. Click on Water Quality Section and then, under Programs, click on Basinwide Planning Program.
- NC Division of Water Quality Environmental Sciences Branch Website http://esb.ehnr.state.nc.us/BAU.html.

Anyone interested in receiving these documents can contact the DWQ Planning Branch at (919) 733-5083 or by internet http://h2o.enr.state.nc.us/basinwide/.

1.7 Division of Water Quality Functions and Locations

The major activities coordinated by DWQ through basinwide planning are listed in Figure A-2. Information on the location, address and phone numbers for each Branch and Regional Office are also shown in Figure A-2 and Figure A-3. Additional information can be found on the Division of Water Quality website at http://h2o.enr.state.nc.us/.

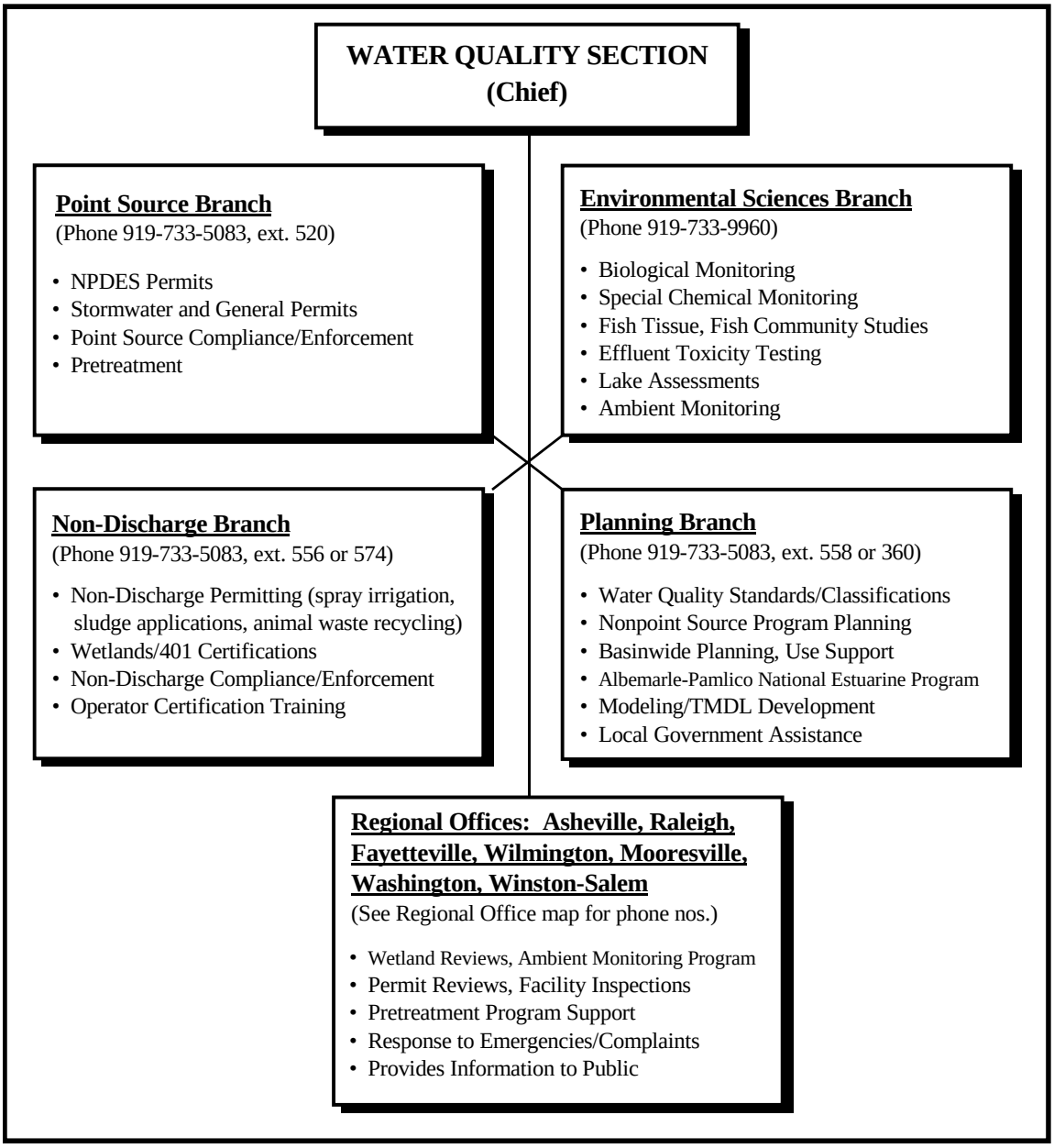

Figure A-2 Water Quality Section Organization Structure

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Figure A-3 Division of Water Quality Regional Offices

Chapter 2 -
Basin Overview

2.1 General Overview

The Chowan River basin is located in the northeastern coastal plain of North Carolina and southeastern Virginia. The North Carolina portion includes all or part of Northampton, Hertford, Gates, Bertie and Chowan counties (Figure A-4). The Chowan River is formed at the border of Virginia and North Carolina by the confluence of the Nottoway and Blackwater Rivers, and its streams flow southeastward towards the Albemarle Sound.

Chowan River Basin Statistics

Total Area: 1,378 mi^2
Stream Miles: 802.6
Estuary Acres: 16,970.7
No. of Counties: 5
No. of Municipalities: 19
No. of Subbasins: 4
Population (2000): 61,034 *
Estimated Pop. (2020): 64,495 *
% Increase (2000-2020): 5.7%
Pop. Density (1990): 48 persons / sq. mi.

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

The majority of the river's watershed (approximately 75 percent) lies within the Virginia borders (Figure A-5). This Virginia portion of the basin is managed as the Chowan River and Dismal Swamp basin. This Virginia portion covers 4,061 square miles of the Chowan River and Chowan River basin's headwaters. The Virginia basin is bordered by the James River basin and the small coastal river basins to the east, the Roanoke River basin to the west, and the Virginia/North Carolina state line to the south. The basin is approximately 145 miles in length and varies from 10 to 50 miles in width. The Chowan River and Dismal Swamp basin is mostly rural with approximately 64 percent of its land covered by forest, 28 percent cropland and pasture, and about 6 percent urban areas (Hill, 2000).

The Chowan River basin in North Carolina is composed of two major drainages: Chowan River and Meherrin River. There is only meager information available regarding water quality in the basin. However, the data available indicate that water quality is generally good. Many streams have been classified as High Quality Waters, and all of the waters in the basin are designated as Nutrient Sensitive Waters.

Population of the basin, based on 2000 census data, was estimated to be 61,034. Population among the municipalities ranges from 78 in Como to 5,394 in Edenton. The overall population density of the basin is 48 persons per square mile compared to an estimated statewide average of 139 persons per square mile.

The Chowan River basin is part of the Albemarle-Pamlico Estuarine system, the second largest estuarine system in the United States. In 1987, this estuarine system became part of the National Estuary Program and was the subject of a major study known as the Albemarle-Pamlico Estuarine Study (APES) (refer to Section C, Chapter 2).

Figure A-4 General Map of the Chowan River Basin

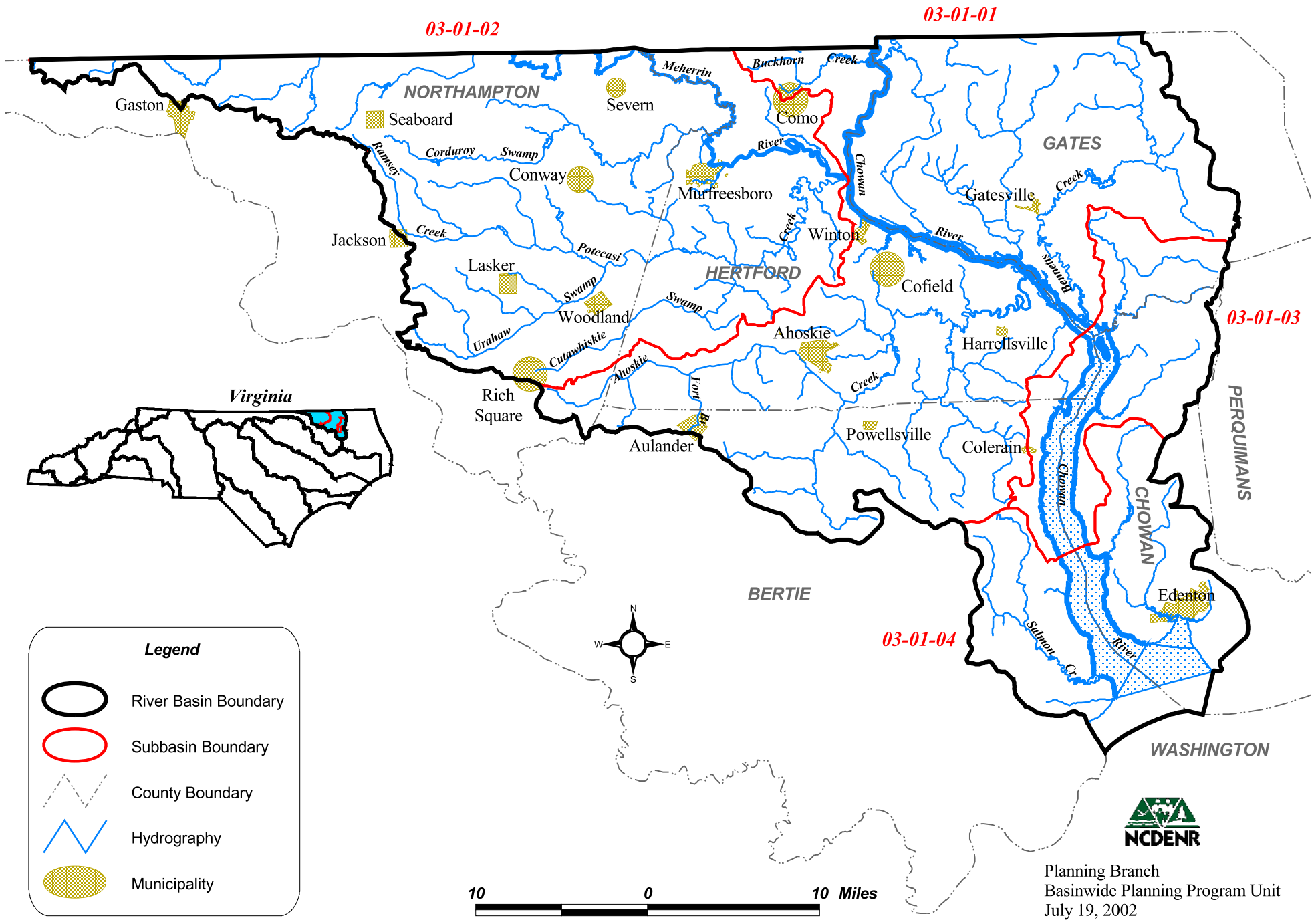
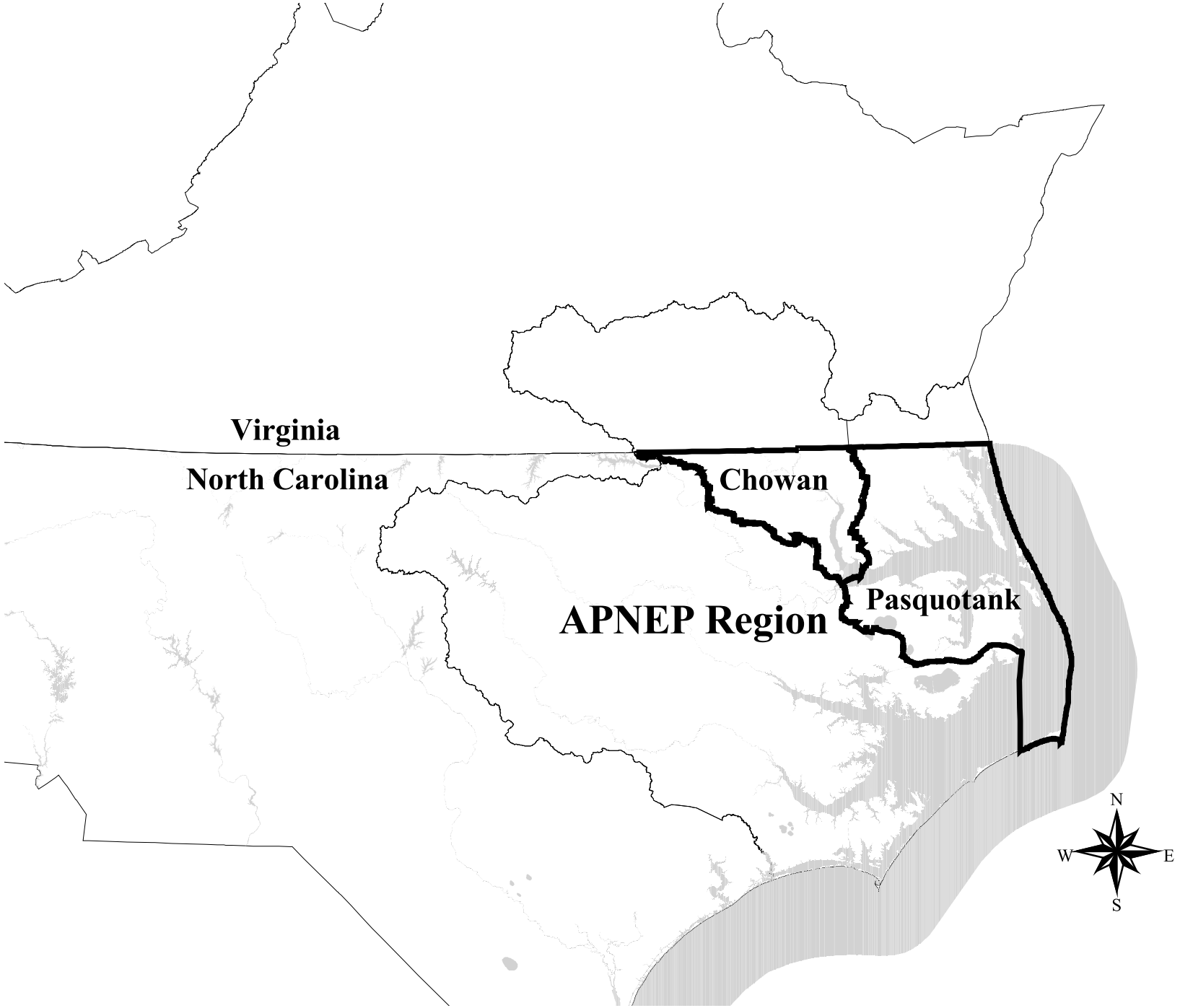


Figure A-5 Virginia Portion of Chowan and Pasquotank River Basins



Forest and agriculture dominate the NC portion of the Chowan River basin. Over half of the land in the basin is forested (54.9 percent) with another 33.8 percent devoted to agriculture. Important natural resources in the basin include wetlands, anadromous fish spawning areas and Merchant's Millpond State Park. Most of the water used in the basin comes from groundwater sources.

2.2 Local Governments and Planning Jurisdictions in the Basin

The basin encompasses all or part of the following five counties and 19 municipalities. Table A-3 provides a listing of these municipalities, along with the appropriate regional planning jurisdiction (Council of Governments). Four municipalities are located in more than one major river basin.

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

County	Council of Government Region	Municipalities
Bertie	Region Q Council of Governments	Aulander ♦ Colerain Powellsville
Chowan	Region R Council of Governments	Edenton
Gates	Region R Council of Governments	Gatesville
Hertford	Region Q Council of Governments	Ahoskie Cofield Como Harrellsville Murfreesboro Winton
Northampton	Region L Council of Governments	Conway Gaston ♦ Jackson ♦ Lasker Rich Square ♦ Seaboard Severn Woodland

♦ Located in more than one river basin

Note: Counties adjacent to and sharing a border with a river basin are not included as part of that basin if only a trace amount of the county (<2%) is located in that basin, unless a municipality is located in that county.

Region	Name	Location
L	Upper Coastal Plain Council of Governments	Rocky Mount
Q	Mid East Commission	Washington
R	Albemarle Commission	Hertford

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey and the Natural Resources Conservation Service (NRCS), use a system of defining watersheds that is different from that used by the Division of Water Quality (DWQ) and many other state agencies in North Carolina. Under the federal system, the North Carolina portion of the Chowan River basin (approximately 25 percent of the entire river's watershed) is made up of two hydrologic areas referred to as a hydrologic unit. DWQ has a two-tiered system in which the state is divided into

17 major river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Chowan River basin is subdivided by DWQ into four subbasins that correspond with the watersheds of the Chowan River and the Meherrin River (shown on Figure A-4). Maps of each subbasin are included in Section B of this plan.

Table A-4 Hydrologic Subdivisions in the Chowan River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ 6-digit Subbasin Codes
Chowan River	03010203	
Upper Chowan River and Ahoskie Creek		03-01-01
Middle Chowan River and tributaries		03-01-03
Lower Chowan River and tributaries		03-01-04
Meherrin River and tributaries	03010204	03-01-02

Hydrologic Features

In the North Carolina portion of the basin, 802.6 miles of freshwater streams drain 1,378 square miles of wooded swamps and agricultural terrain. The average drainage area per stream mile is 1.75 square miles.

Located in the Inner Coastal Plain, the Chowan River basin is bounded easterly by the Suffolk Scarp. The scarp is an ancient shoreline crossing the Coastal Plain, formed when glaciers melted and sea level rose. Passersby can see the shoreline remnants by the steep cliffs on the western shore of the river.

The basin lies in the 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 on the Coastal Plain. 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.

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 National Resources Inventory (NRI) is a statistically based longitudinal survey that has been designed and implemented to assess conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. The NRI provides results that are nationally and temporally consistent for four points in time – 1982, 1987, 1992 and 1997.

In general, NRI protocols and definitions remain fixed for each inventory year. However, part of the inventory process is that the previously recorded data are carefully reviewed as determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary Report: 1997 National Resources Inventory*, provides guidance for use and interpretation of current NRI data:

> *"The 1997 NRI database has been designed for use in detecting significant changes in resource conditions relative to the years 1982, 1987, 1992 and 1997. All comparisons for two points in time should be made using the new 1997 NRI database. Comparisons made using data published for the 1982, 1987 and 1992 NRI may provide erroneous results, because of changes in statistical estimation protocols, and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected."*

Table A-5 summarizes acreage and percentage of land cover from the 1997 NRI for the North Carolina portion of the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover. Land cover in the basin, as presented in Table A-5, is dominated by forestland that covers approximately 54.9 percent of the land area. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 33.8 percent. Only 2.8 percent of the land area is developed. A description of land cover types, including the "Other" category, to which 8.6 percent of land in the basin is assigned, can be found in Table A-6.

Table A-5 Land Cover in the Chowan River Basin by Major Watersheds -1982 vs. 1997 (Source: USDA-NRCS, NRI, updated June 2001)

	MAJOR WATERSHED AREAS *								
	Chowan River Watershed		Meherrin River Watershed		1997 TOTALS		1982 TOTALS		% change
LAND COVER	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	since 1982
Cult. Crop	142.4	30.3	119.6	35.8	262.0	32.6	264.1	32.8	-0.8
Uncult. Crop	1.5	0.3	0.0	0.0	1.5	0.2	0.0	0.0	150.0
Pasture	3.1	0.7	4.9	1.5	8.0	1.0	10.5	1.3	-23.8
Forest	266.7	56.7	174.8	52.3	441.5	54.9	445.9	55.4	-1.0
Urban & Built-Up	11.2	2.4	11.5	3.4	22.7	2.8	14.0	1.7	62.1
Federal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	45.7	9.7	23.2	6.9	68.9	8.6	70.3	8.7	-2.0
Totals	470.6	100.0	334.0	100.0	804.6	100.0	804.8	100.0	
% of Total Basin		58.5		41.5		100.0			
SUBBASINS	03-01-01 03-01-03 03-01-04 **		03-01-02						
8-Digit Hydraulic Units	03010203		03010204						

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

** A small portion of subbasin 03-01-04 is contained in hydrologic unit 03010205.
It is not currently feasible to estimate the land use in that portion to include the Chowan land cover estimates.
The hydrologic unit 03010205 is discussed in the Pasquotank River Basin Water Quality Plan.

Table A-6 Description of Land Cover Types (Source: USDA-NRCS, NRI, updated June 2001)

Land Cover Type	Land Cover Description
Cultivated Cropland	Harvestable crops including row crops, small grain and hay crops, nursery and orchard crops, and other specialty crops.
Uncultivated Cropland	Summer fallow or other cropland not planted.
Pastureland	Forage plants for livestock grazing, including land that has a vegetative cover of grasses, legumes and /or forbs, regardless of whether or not it is being grazed by livestock.
Forestland	At least 10 percent stocked (a canopy cover of leaves and branches of 25 percent or greater) by single-stemmed trees of any size, which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover. The minimum area for classification of forestland is 1 acre; must be at least 1,000 feet wide.
Urban and Built-up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	*Rural Transportation*: Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes). *Small Water Areas*: Waterbodies less than 40 acres in size and streams less than one-half mile wide. *Census Water*: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width. *Minor Land*: Lands not in one of the other categories.

Comparisons of land cover between 1982 and 1997 (Figure A-6) show a decrease in cultivated cropland, pasture and forestland uses while at the same time substantial increases in the urban/built-up and uncultivated cropland land uses. Usage that includes rural transportation routes and minor lands that are not categorized as "Urban/Built-Up" have increased over the 10-year period.

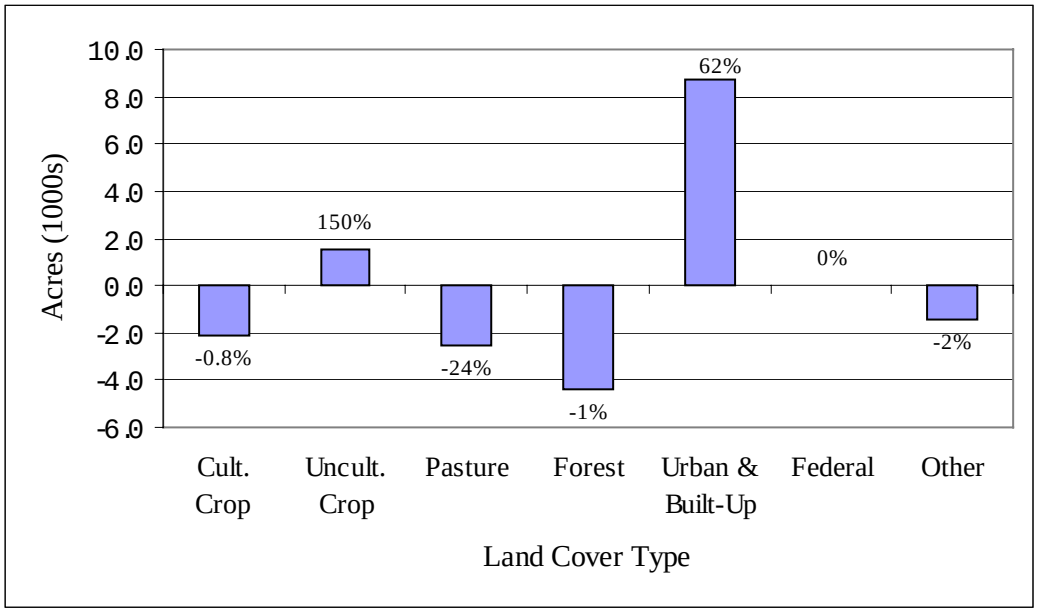


Figure A-6 Land Cover Changes from 1982 to 1997 for the Chowan River Basin (Source: USDA-NRCS, NRI, updated June 2001)

The most recent land cover information for the Chowan 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. The 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-7. 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-7 Description of Major CGIA Land Cover Categories

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

Unfortunately, due to differences in the system of categorizing various land cover classes, it is not possible to establish trends in land cover changes by comparing this data set to previously

attained land cover data. However, it is anticipated that comparisons will be possible with future satellite data since a strong consensus-based effort was made to develop the classification system that was used with the 1996 data. Satellite imagery from a 1998 fly-over is available; however, it is not in a format conducive for analysis. DWQ is collaborating with CGIA to make this data available for future analysis in the next basin plan update.

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

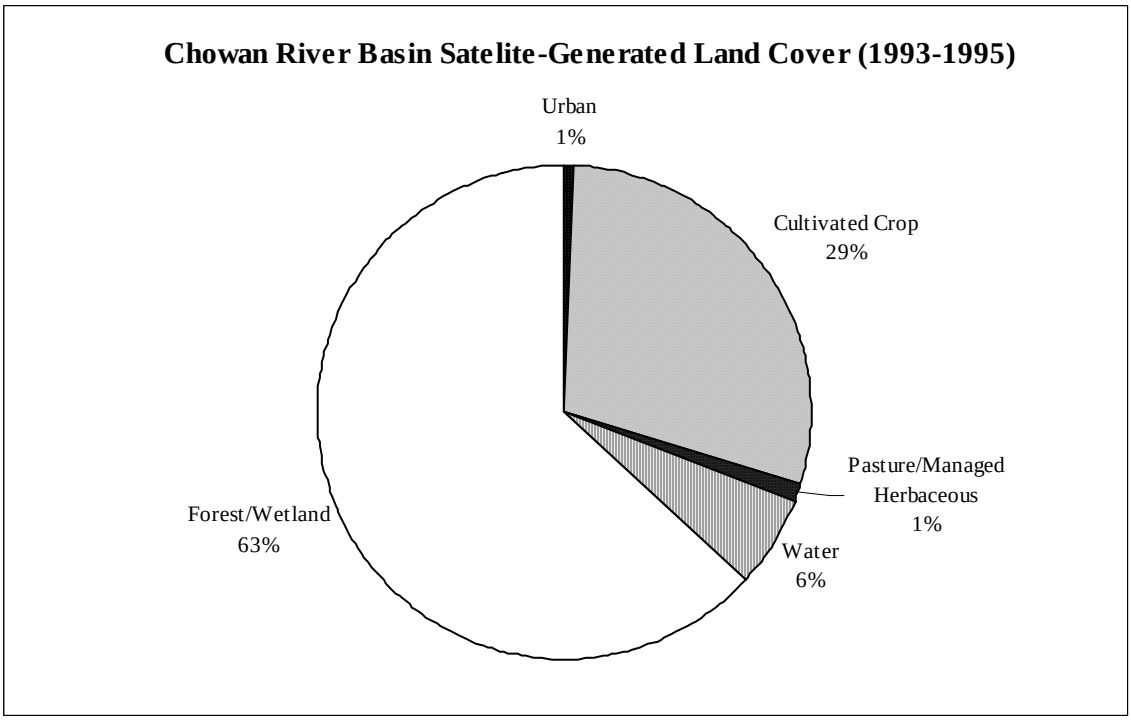


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Chowan River Basin

2.5 Population and Growth Trends

Population

The Chowan River basin has an estimated population of 62,474 based on 1990 census data. Table A-8 presents census data for 1970, 1980 and 1990 for each of the subbasins. It also includes population densities (persons/square mile) based on the *land area* (excludes open water) for each subbasin. Most of the basin's population is located in the upper Chowan River, Wiccacon River and Ahoskie Creek watershed (subbasin 03-01-01), followed closely by the Meherrin River and Potecasi Creek watershed (subbasin 03-01-02). Combined, these subbasins contain approximately 76 percent of the total basin population, and the subbasins have population densities comparable to the basinwide average of 48 persons/square mile. The

Rockyhock Creek to Albemarle Sound watershed (subbasin 03-01-04) has the largest population density out of all the subbasins.

Table A-8 Chowan River Subbasin Population, Densities (1970, 1980 and 1990) and Land Area Summaries

	POPULATION [1] (Number of Persons)			POPULATION DENSITY [2] (Persons/Square Mile)			LAND AND WATER AREAS [3]			
							Total Land and Water Area		Water Area	Land Area
SUBBASIN	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
03-01-01	25,469	26,191	24,884	45	46	44	371,398	579	10	569
03-01-02	24,723	23,168	22,713	50	47	46	317,270	494	3	491
03-01-03	3,659	4,028	4,731	37	40	47	79,102	123	23	100
03-01-04	9,428	10,249	10,146	62	67	67	114,159	177	45	152
TOTALS	**63,279**	**63,636**	**62,474**	**48**	**49**	**48**	**881,929**	**1,373**	**81**	**1,312**

[1] Population estimated based on US Census data and percentage of census block that falls within the subbasin.
[2] Population density based on land area only. Large wetlands (swamps) not included in area used to calculate density.
[3] Information generated by the NC Center for Geographic Information Analysis.

In using these data, it should be noted that 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 that separate 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 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

Table A-9 presents population data for municipalities that are located wholly or partially within the basin. The table indicates that Winton is currently the fastest growing municipality in the basin with an increase in population of 20 percent from 1990 to 2000. Population in Edenton, Jackson, Severn and Woodland increased over the same 10-year period. However, the majority of municipalities in the basin experienced a net decrease in their populations. Municipalities with at least a 20 percent decrease in population included Aulander, Como, Lasker and Murfreesboro. This information was obtained from the Office of State Planning (April and May 2001).

Table A-9 Population and Percent Change for Municipalities Located Wholly or Partly in the Chowan River Basin

Municipality	County	Apr-80	Apr-90	April-2000	% Change (1980-90)	% Change (1990-2000)
Ahoskie	Hertford	4,887	4,535	4,523	-7.2	-0.3
Aulander *	Bertie	1,214	1,209	888	-0.4	-26.6
Cofield	Hertford	465	407	347	-12.5	-14.7
Colerain	Bertie	284	241	221	-15.1	-8.3
Como	Hertford	89	102	78	14.6	-23.5
Conway	Northampton	678	759	734	11.9	-3.3
Edenton	Chowan	5,357	5,268	5,394	-1.7	2.4
Gaston *	Northampton	883	1,003	973	13.6	-3.0
Gatesville	Gates	363	308	281	-15.2	-8.8
Harrellsville	Hertford	151	106	102	-29.8	-3.8
Jackson *	Northampton	720	592	695	-17.8	17.4
Lasker	Northampton	96	139	103	44.8	-25.9
Murfreesboro	Hertford	3,007	2,580	2,045	-14.2	-20.7
Powellsville	Bertie	320	279	259	-12.8	-7.2
Rich Square *	Northampton	1,057	1,058	931	0.1	-12.0
Seaboard	Northampton	687	791	695	15.1	-12.1
Severn	Northampton	309	260	263	-15.9	1.2
Winton	Hertford	825	796	956	-3.5	20.1
Woodland	Northampton	861	760	833	-11.7	9.6

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

Table A-10 shows the projected population and percent change in growth between 1990 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 Chowan River basin. Even though 100 percent of Hertford, 80 percent of Gates, 67 percent of Chowan and 65 percent of Northampton counties are contained within the basin, only 30 percent of Bertie County is encompassed.

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

County	% County in Basin *	1990	2000	Estimated Population 2020	Estimated Pop Change 1990-2000	Estimated Pop Change 2000-2020
Bertie	30	20,388	19,773	18,347	-615	-1,426
Chowan	67	13,506	14,526	16,026	1,020	1,500
Gates	80	9,305	10,516	12,869	1,211	2,353
Hertford	100	22,317	22,601	22,679	284	78
Northampton	65	21,004	22,086	23,507	1,082	1,421
Total		**86,520**	**89,502**	**93,428**	**2,982**	**3,926**

* Source: North Carolina Center for Geographic Information and Analysis

Note: The numbers reported reflect county population; however, the county is not entirely contained within the basin. The intent is to demonstrate growth for counties located wholly or partially within the basin.

For more information on past, current and projected population estimates, contact the Office of State Planning at (919) 733-4131 or visit their website at http://www.ospl.state.nc.us/demog/.

2.6 Natural Resources

2.6.1 Public Lands in the Chowan River Basin

Figure A-8 shows a diversity of public lands and significant natural heritage areas in the Chowan River basin. One of the most frequently visited areas includes Merchants Millpond State Park, about 3,300 acres situated east of the Chowan mainstem. Several significant natural heritage areas in the form of game lands are also adjacent to the Chowan mainstem throughout the basin. A small percentage (1.2 percent) of the Chowan River basin is publicly-owned conservation land. The Chowan Swamp State Natural Area, administered by the Division of Parks and Recreation, protects more than 6000 acres. Wildlife Resources Commission has two small game lands within the basin, the Chowan Game Lands and the Chowan Swamp Game Lands.

2.6.2 Ecological Significance of the Chowan River Basin

The Chowan River is known for some of the best fishing in the state, with largemouth bass, bluegill, chain pickerel, black crappie, perch and herring being some of the most sought after species. However, the Chowan River is noteworthy for more than good fishing. Approximately one hundred miles of the Chowan River are considered to be a significant aquatic habitat by the North Carolina Natural Heritage Program. The Chowan River has received this designation because of the diversity of its freshwater mussel populations, many of which are rare and vulnerable.

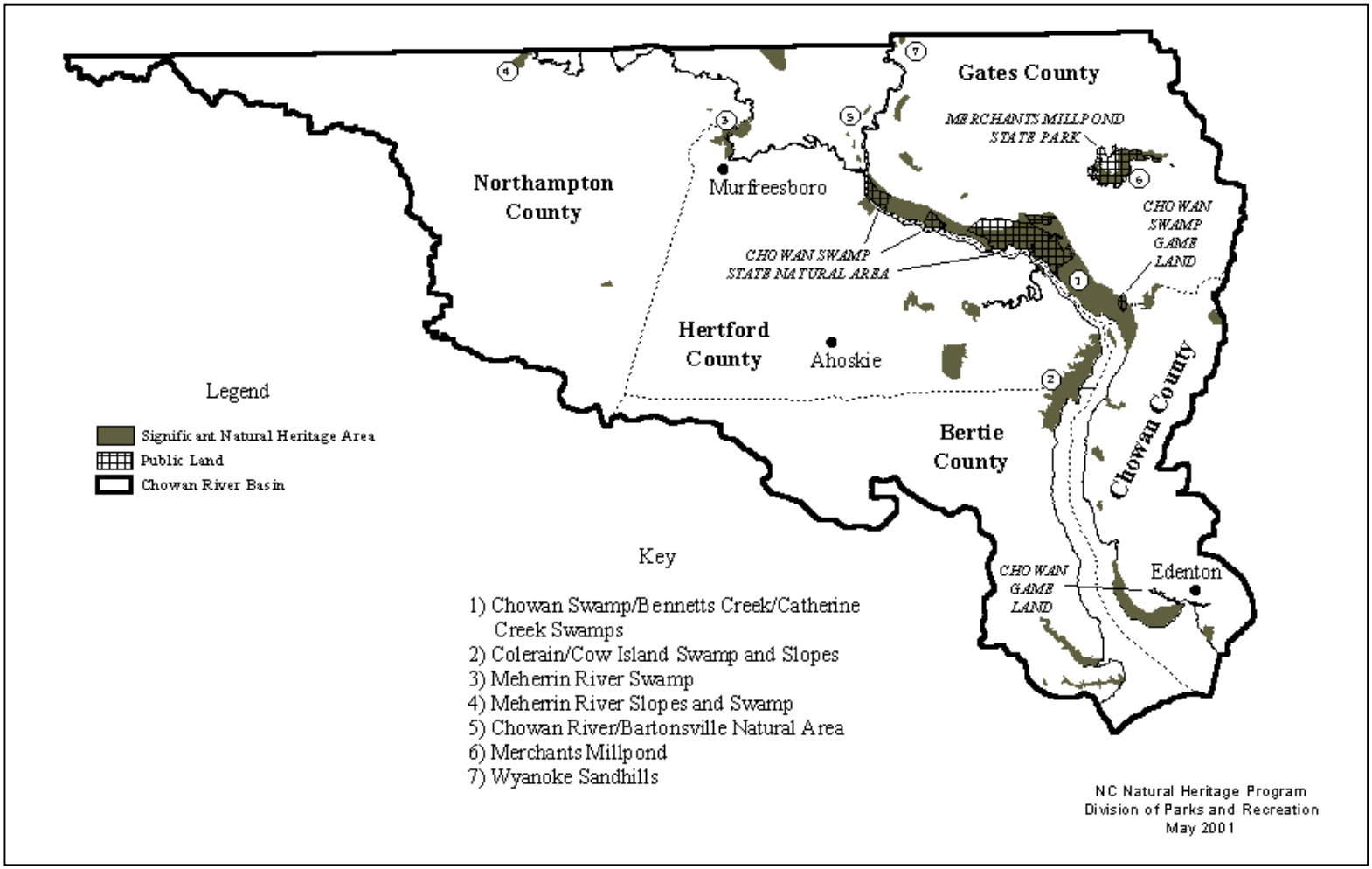


Figure A-8 Public Lands and Significant Natural Heritage Areas in the Chowan River Basin

The Natural Heritage Program inventories areas for natural diversity and catalogs rare plant and animal species and natural communities. As previously mentioned, the Chowan River is, for much of its length, considered to be a significant aquatic habitat. There are a number of other significant natural areas in the Chowan River basin, a few of which are described below. Inclusion on the list does not imply that protection or public access exists. More complete information on natural areas may be obtained from the Natural Heritage Program at (919) 715-8703 or by visiting http://ils.unc.edu/parkproject/nhp/index.html.

Tidal Cypress-Gum Swamp

Perhaps the most important wetland community in the Chowan River basin is Tidal Cypress-Gum Swamp, which is found along much of the shoreline of the Chowan River. Tidal swamps are flooded on a tidal cycle rather than seasonally, as is characteristic of many floodplain communities. The Chowan Swamp/Bennetts Creek/Catherine Creek Swamps Natural Area contains some of the largest areas of Tidal Cypress-Gum Swamp in the state. The natural area consists of approximately 16,000 acres along the northern floodplain of the Chowan River. The Colerain/Cow Island Swamp and Slopes Natural Area is similar to the Chowan Swamp, in that it lies in the floodplain of the Chowan River and features Tidal Cypress-Gum Swamp along the shoreline, as well as other wetland communities farther from the river. This natural area is located downstream from the Chowan Swamp, on the western shore of the river in Hertford and Bertie counties.

Old-Growth Swamp Forest and Upland Loblolly Pine

The Chowan River/Bartonsville Natural Area is a state-significant site located along the western margin of the Chowan River floodplain just north of the confluence with the Meherrin River. The natural area includes representative examples of mature, old growth swamp forest (with cypress and gum) and upland loblolly pine plant communities. Old growth examples of these communities are rare on the coastal plain, and within the natural area one can find the former National Champion loblolly as well as significant wildlife habitat. A portion of the site was protected by a 1965 agreement with the Society of American Foresters.

2.6.3 Significant Natural Heritage Areas

There are six natural areas identified as significant along the Meherrin River. Those important to water quality include the Meherrin River Swamp in Hertford County and the Meherrin River Slopes and Swamp in Northampton County. Refer again to Figure A-8 for general location of the areas discussed below.

Merchants Millpond

Merchants Millpond was constructed in 1811 as a source of waterpower, but has not been used as such for a long time. Now Merchant's Millpond State Park, the shallow pond supports an excellent Piedmont/Coastal Plain Semipermanent Impoundment community, believed to resemble those in the large, mature beaver ponds that were eliminated from the state when beavers became extinct. The pond has an open canopy of stunted cypress and tupelo trees and supports a diverse assemblage of aquatic herbs including several rare species. Upstream of the

pond, in Lassiter Swamp, is an excellent quality blackwater Cypress-Gum Swamp, including an area of virgin water tupelo. The state champion water tupelo can be found in this area. The diversity of habitat supports a tremendous variety of animal life. Over 190 species of birds have been recorded in the park. Diverse populations of reptiles and amphibians and numerous mammals such as beaver, mink and river otter are also found here.

Wyanoke Sandhills

The Wyanoke Sandhills Natural Area is the northernmost longleaf pine community in the state. The site also contains good examples of other uncommon natural communities, including wetlands, and a significant historical site containing Civil War earthworks.

2.6.4 Rare and Threatened Aquatic Species in the Chowan River Basin

Several protected species live in the Chowan River basin, including fish, aquatic insects, mollusks, crustaceans and plants. The following information on rare aquatic and wetland-dwelling species (Table A-11) was obtained from the NC Natural Heritage Program, Division of Parks and Recreation.

Table A-11 Rare and Threatened Aquatic Species in the Chowan River Basin (as of June 2001)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
fish	Shortnose Sturgeon	*Acipenser brevirostrum*	E	E
aquatic insect	a caddisfly	*Ceraclea tarsipunctata*	SR	--
mollusk	Triangle Floater	*Alasmidonta undulata*	T	--
mollusk	Alewife Floater	*Anodonta implicata*	SC*	--
mollusk	Eastern Lampmussel	*Lampsilis radiata radiata*	SC*	--
mollusk	Tidewater Mucket	*Leptodea ochracea*	SC*	--
mollusk	Eastern Pondmussel	*Ligumia nasuta*	SC*	--
crustacean	Chowanoke Crayfish	*Orconectes virginiensis*	SR	FSC
Plant	Water Purslane	*Didiplis diandra*	SR	--
plant	Water Violet	*Hottonia inflata*	C	--
plant	a water-hyssop	*Bacopa innominata*	C	--
plant	Conferva Pondweed	*Potamogeton confervoides*	C	FSC
plant	Pale Mannagrass	*Torreyochloa pallida*	SR	--

* Effective July 1, 2002, these species will be listed as State Threatened.

Rare Species Listing Criteria

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

Five of the rare aquatic animals – the Triangle Floater, Alewife Floater, Eastern Lampmussel, Tidewater Mucket and Eastern Pondmussel – are species of freshwater mussels. Freshwater mussels have an interesting life cycle, with many of them dependent on specific fish to act as hosts for their larvae. Freshwater mussels have surprisingly long life spans – with thicker-shelled river species living 20-40 years. Freshwater mussels are imperiled nationwide, due to degraded physical habitats (e.g., sedimentation) and reduced water quality, as well as declining populations in certain fish species that act as hosts.

The Triangle Floater formerly inhabited virtually every North Carolina river system that drained to the Atlantic. However, the populations of this small mussel are declining, and it is not found in many of the locales where it was once collected. The Triangle Floater prefers slow-moving streams rather than rapids or riffles.

The Alewife Floater is usually found in more northern areas, ranging from Nova Scotia to the Potomac River in Virginia and Maryland. However, North Carolina contains a population as well. The Alewife Floater gets its name from its association with its main host fish, the alewife. The larvae attach to the fish's gills for the period of development when the larvae are most vulnerable -- up to several years -- then drop to the streambed to live as adults.

The Eastern Lampmussel is usually found in medium to coarse sand habitats. Like the Alewife Floater, the Eastern Lampmussel is generally considered a northern species, with a discontinuous range from the Pee-Dee Drainage basin north to the St. Lawrence Drainage basin. Little is known about its fish hosts.

The Tidewater Mucket is known from only a few locations within North Carolina, including a large population in Lake Waccamaw, populations in the Tar and Roanoke Rivers, and much smaller populations in the Chowan and Meherrin Rivers. Although not truly restricted to tidal portions of rivers, the Tidewater Mucket is never found far from the Atlantic coast. This suggests that, like the Alewife Floater, its dominant or preferred fish host is anadromous, a species that migrates throughout its life cycle from freshwater to saltwater, back to freshwater.

The Eastern Pondmussel reaches its southern range limit in North Carolina. Like the other freshwater mussel species discussed, its population appears to be declining, probably due to poor water quality. In North Carolina, this species is known from the Chowan, Roanoke and Cape Fear River basins. The species has been recently become extinct from the Pamlico River basin.

The Shortnose Sturgeon is a large, anadromous fish that once was common in North Carolina waterways. The shortnose sturgeon may live for up to 30 years and inhabits the lower sections of larger rivers and estuaries along the Atlantic coast. It may spend most of the year in brackish or saltwater and move into freshwater only to spawn. The species has suffered from excessive harvesting and habitat degradation and is now in danger of extinction. The fish has not been recorded from the Chowan River for over one hundred years.

Not much is known about the natural history of the Chowanoke Crayfish. This crustacean reaches the southern end of its range in North Carolina, but the only other place it occurs is Virginia. It lives in sluggish streams flowing through woodlands with sandy or gravelly substrates and is considered one of North Carolina's rarest crayfish.

For more information on the Division of Parks and Recreation's NC Natural Heritage Program, call (919) 715-8702 or visit the website at http://ils.unc.edu/parkproject/nhp/index.html.

2.6.5 Fisheries Resources

The Chowan River is a vital resource for commercial and recreational fishers. Recreationally important gamefish species that reside in the river include largemouth bass, black crappie and many sunfish species. Commercially important species include several anadromous fish species such as blueback herring, alewife, hickory shad, American shad, Atlantic sturgeon and striped bass. Blueback herring and alewife are commonly referred to as 'river herring'.

In an effort to examine the status of the populations in the Chowan River, Figure A-9 provides landing statistics. Commercial landings measure the number of pounds of fish caught. The value is an indicator of the direct income generated from the landings. The North Carolina Division of Marine Fisheries (DMF) also conducts stock status reports of important commercial fisheries in the state. The 2000 report listed river herring in Albemarle Sound as overfished. This was evidenced by a reduced number of age classes in harvest, low juvenile production and a fewer number of repeat spawners. DMF does not currently have a sampling program for the Chowan River specifically. Atlantic Sturgeon is listed as overfished as well due to low landings since 1960 (NCDENR-DMF, 2000). The Albemarle-Roanoke Striped Bass community is listed as viable. American Shad's status is unknown due to a lack of a current sampling program (NCDENR-DMF, 2000).

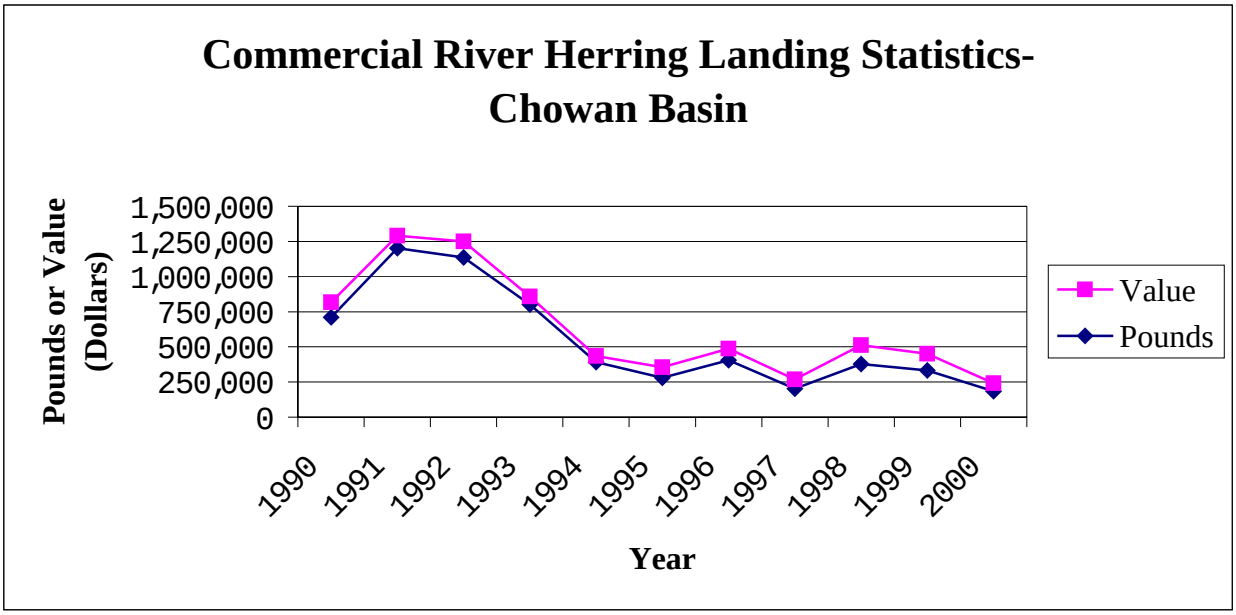


Figure A-9 Chowan River Basin Commercial Landing Statistics

2.7 Permitted Wastewater and Stormwater Discharge Facilities

Discharges that enter surface waters through a pipe, ditch or other well-defined point are broadly referred to as "point sources". Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities that 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. DWQ issues discharge permits under the NPDES program through the Environmental Protection Agency's delegation authority.

The primary pollutants associated with point source discharges are:

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

2.7.1 Wastewater Discharges in the Chowan 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, and washers).

Municipal Facilities: Public facilities that serve a municipality. Can treat waste from homes and industries.

Nonmunicipal: Non-public facilities that provide treatment for domestic, industrial or commercial wastewater. This category includes wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

There are 11 permitted discharges in the Chowan River basin. Table A-12 provides summary information (numbers of facilities and permitted flows) regarding the discharges by types and subbasin. More detailed information regarding the dischargers characterized in the table is provided in Appendix I.

Figure A-10 shows the location of major and minor permitted wastewater discharges within the basin. The number of triangles on the map depicting major discharges does not correspond exactly to the number of major facilities listed in Table A-12, because some major facilities may have more than one discharge location (outfall). Each outfall received its own triangle on the map.

Table A-12 Summary of NPDES Dischargers and Permitted Flows for the Chowan River Basin (as of 3/5/2001)

	Subbasin				
Facility Categories	**03-01-01**	**03-01-02**	**03-01-03**	**03-01-04**	**TOTAL**
Total Facilities	5	0	2	4	11
Total Permitted Flow (MGD)	0.044	0	1.524	0.02	1.588
Major Discharges	0	0	1	0	1
Total Permitted Flow (MGD)	0	0	1.5	0	1.5
Minor Discharges	5	0	1	4	10
Total Permitted Flow (MGD)	0.044	0	0.024	0.02	0.088
100% Domestic Waste	4	0	0	0	4
Total Permitted Flow (MGD)	0.044	0	0	0	0.044
Municipal Facilities	0	0	0	0	0
Total Permitted Flow (MGD)	0	0	0	0	0
Nonmunicipal Facilities	5	0	2	4	11
Total Permitted Flow (MGD)	0.044	0	1.524	0.02	1.588

2.7.2 Stormwater Discharges in the Chowan River Basin

Amendments were made to the Clean Water Act in 1990 and, most recently in 1999, pertaining to permit requirements for stormwater discharges associated with industrial activities and storm sewer systems. DWQ administers these regulations in North Carolina through the state stormwater program. The goal of the DWQ stormwater discharge permitting regulations is to prevent pollution via stormwater runoff by controlling the source(s) of pollutants.

EPA Stormwater Rules

Phase I – December 1990

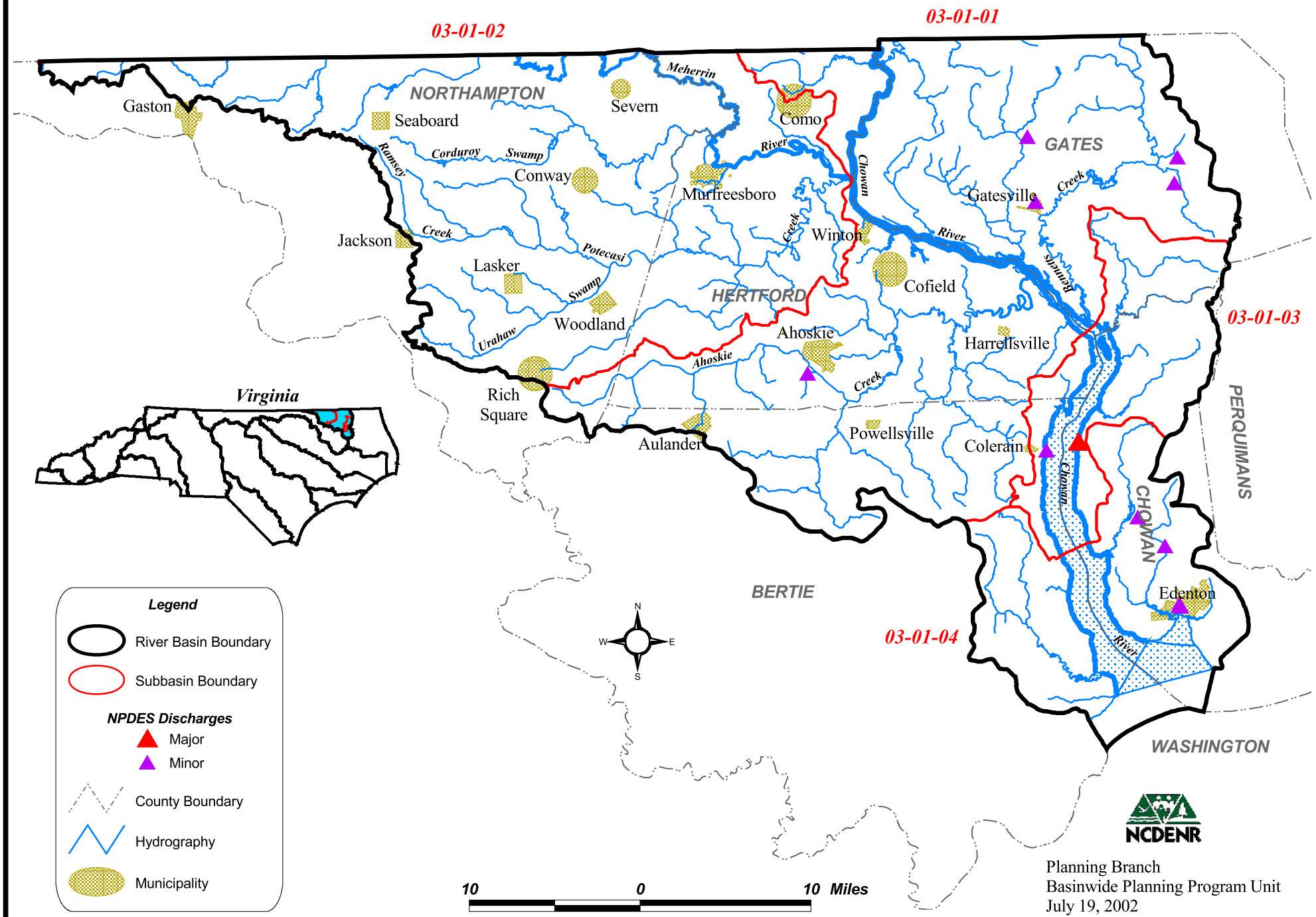
- Requires a NPDES permit for municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more.
- Requires a NPDES stormwater permit for ten categories of industry.
- Requires a NPDES stormwater permit for construction sites that are 5 acres or more.

Phase II – November 1999

- Requires a NPDES permit for some municipal storm sewer systems serving populations under 100,000, located in urbanized areas.
- Provides a "no stormwater exposure" exemption to industrial facilities covered under Phase I.
- Requires a NPDES stormwater permit for construction sites that are 1-5 acres.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. Currently, there are no municipalities in the Chowan River basin large enough to require a stormwater discharge permit. North Carolina is developing further guidelines that may result in additional municipalities designated as Phase II areas.

Figure A-10 NPDES Discharges in the Chowan River Basin



Industrial activities that 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 31 general stormwater permits active within the basin. Four individual stormwater permits are currently held.

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

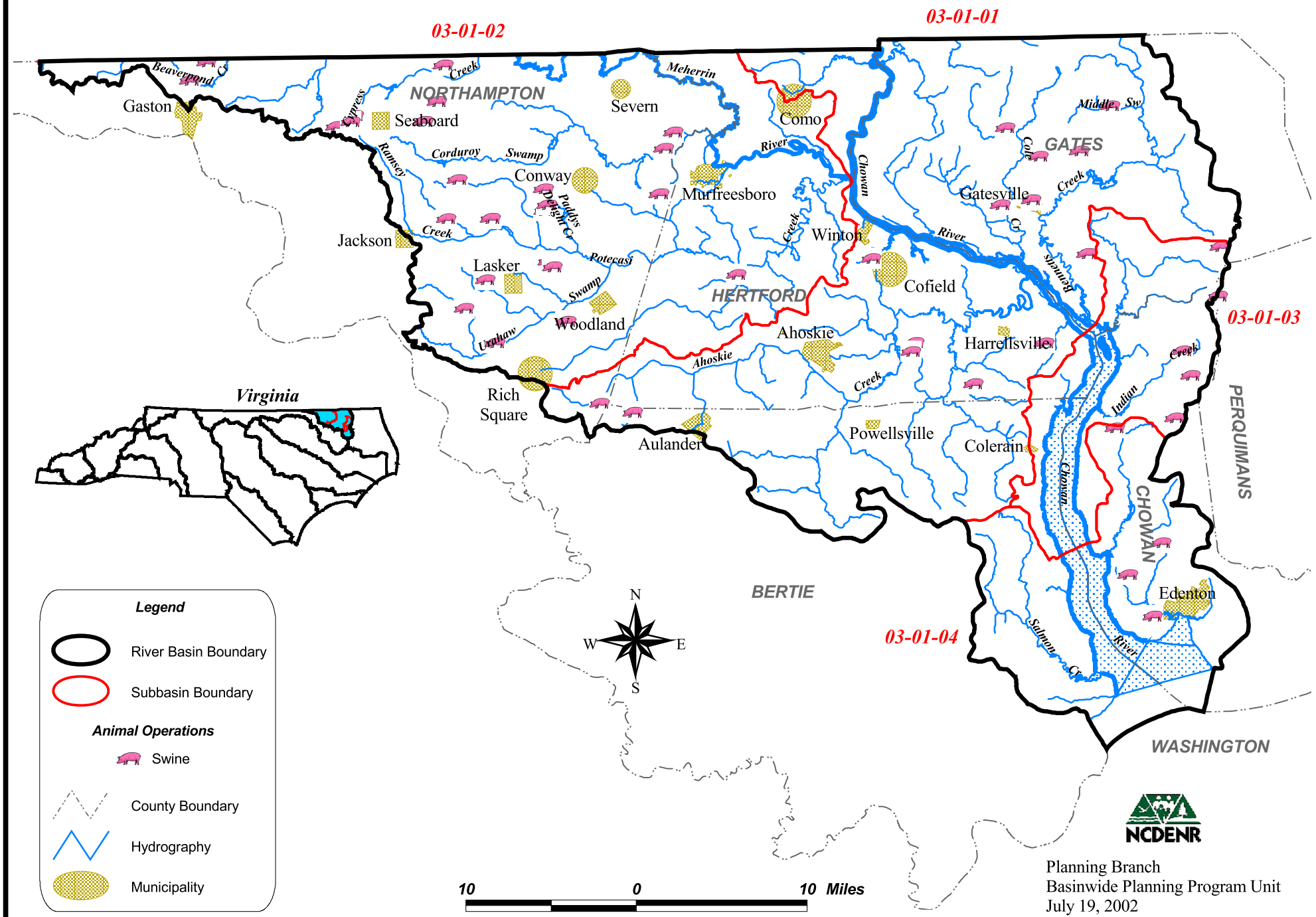
The state stormwater management rules (15A NCAC 2H .1000) regulate development activities in 20 coastal counties and on land statewide that drains to Outstanding Resource Waters (ORW) and/or High Quality Waters (HQW). Under this program, development is permitted as either low density or high density.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

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. Figure A-11 displays locations of animal operations in the Chowan River basin. Within the past five years there have been several additional pieces of legislation enacted that affect animal operations in North Carolina and the Chowan River basin.

Table A-13 summarizes, by subbasin, the number of registered livestock operations, total number of animals, total acres in operation, and total steady state live weight as of March 2001. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

Figure A-11 Registered Animal Operations in the Chowan River Basin



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-13 Registered Animal Operations in the Chowan River Basin (as of 3/16/01)

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
03-01-01	0	0	0	0	0	0	11	71,084	9,769,370
03-01-02	0	0	0	0	0	0	18	113,628	14,435,940
03-01-03	1	600	480,000	0	0	0	3	4,784	645,840
03-01-04	0	0	0	0	0	0	1	5,000	708,500
Totals	1	600	480,000	0	0	0	33	194,496	25,559,650

Since 1997, many facilities have become inactive, and yet may continue to be certified and registered with the state. Some likely causes for the inactivity may include financial difficulties, the state moratorium, or a request by the facility for state buyout to close lagoons. Therefore, Table A-13 may overestimate the number of registered animal operations that still actively raise livestock in the basin.

There were only 34 registered animal operations in the Chowan River basin, containing a total of 33 swine (25,559,650 pounds SSLW) and one cattle operation (480,000 pounds SSLW) as of March 2001. The majority of registered cattle operations are in subbasin 03-01-03 (Chowan River from Catherine Creek to Rockyhock Creek), while registered swine operations are in subbasin 03-01-02 (Meherrin River and Potecasi Creek). As of March 2001, there were no registered poultry 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 Resources 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 the size of the animal, 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-14). The basin contains approximately three percent of the state capacity for poultry and swine, with the highest concentrations located in subbasin 03-01-02 (Meherrin River and Potecasi Creek). Growth in swine capacity has been rapid. Between 1994 and 1998, swine increased 93 percent in subbasin 03-01-02 and 109 percent in subbasin 03-01-01. There has been an 87 percent increase in swine in the basin as a whole.

Table A-14 Estimated Populations of Swine, Dairy and Poultry (1998 and 1994) in the Chowan River Basin

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 (%)
03-01-01	86,656	41,396	109	0	0	0	2,412,275	2,428,400	-1
03-01-02	197,830	102,426	93	0	0	0	2,521,665	2,486,165	1
03-01-03	8,831	8,809	0	0	0	0	586,800	585,100	0
03-01-04	7,631	7,993	-5	0	0	0	646,000	617,000	5
TOTALS	300,948	160,624	87	0	0	0	6,166,740	6,116,665	1
% of State Total	3%	3%	---	0%	0%	---	3%	3%	---

2.9 Water Use

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. LWSPs were submitted by 21 water systems.

There are three countywide systems and one regional water supply system in the area; all of which are dependent on groundwater supply exclusively (Table A-15). Total water supply use in the basin was 5.4 million gallons per day (MGD) by 41,851 people for uses consisting of 67 percent residential use, 26 percent non-residential, and 7 percent unaccounted for use (NCDENR-DWR, 2001). By the year 2020, the state expects to see a 21 percent increase in water demand over the 1997 levels. In addition, one of the systems that submitted a LWSP in 1997 indicated that their peak demands would exceed their water treatment capacity by 2010 (NCDENR-DWR, 2001). An additional 6.6 MGD of water is necessary to ensure that the projected 2010 demands do not exceed 80 percent of the available water in the area. In addition to treatment capacity concerns, water quantity concerns are paramount in the region. Two of the LWSPs submitted indicated that their average daily use exceeds 80 percent of their available supply, and three systems predict that demand levels will exceed 80 percent of their available supply by 2020. DWR recommended that those systems with "Demand as % of Supply" above 80 percent to actively manage demand and pursue additional supplies (NCDENR-DWR, 2001).

Based on 1995 USGS estimates, nonmunicipal users account for 9.44 MGD in the following areas: irrigation (50 percent), livestock (33 percent), domestic (15 percent), industrial (1 percent) and commercial (1 percent) (NCDENR-DWR, 2001).

More information is available for these and other systems across the state that submitted a LWSP from the Division of Water Resources Website at www.dwr.ehnr.state.nc.us/home.htm.

2.9.2 Water Withdrawals and Interbasin Transfers

Prior to 1999, North Carolina General Statute 143-215.22H only required water users to register their water withdrawals and transfers with the Division of Water Resources (DWR) if the amount was one million gallons or more of surface water or groundwater per day. Beginning in 1999, withdrawals and transfers greater than 100,000 gallons per day must be registered with DWR. In addition, transfers of 2 MGD or more require a certification from the Environmental Management Commission, according to 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* and filed in the Office of the Secretary of State.

Table A-15 Water Use and Population for Water Systems in the Chowan River Basin

Population and Water Use for Water Systems in the Chowan River Basin							
		Year-round Service Population		Average Daily Demand (MGD)		Demand as % of Supply	
County	**System**	**1997**	**2010**	**1997**	**2010**	**1997**	**2010**
Bertie	Aulander	1366	1500	0.155	0.163	32	34
	Powellsville	672	634	0.065	0.063	45	44
Chowan	Chowan County	8253	9098	0.93	1.02	49	54
	Edenton	5475	5941	0.8	0.856	77	69
Gates	Gates County	8840	9743	0.812	0.96	54	64
	Gatesville	383	450	0.045	0.0457	100	102
Hertford	Ahoskie	4562	5545	0.712	0.8406	78	92
	Cofield	417	438	0.04	0/0433	29	32
	Hertford County	650	1500	0.194	0.448	18	41
	Murfreesboro	2300	2795	0.353	0.37	16	17
	Winton	822	781	0.185	0.186	16	16
Northampton	Conway	772	583	0.394	0.394	30	30
	Northampton-Jackson	330	375	0.022	0.024	45	6
	Northampton-Miwaukee	2700	2850	0.267	0.301	46	52
	Northampton-North Woodland	374	400	0.02	0.024	13	15
	Northampton-Pendleton	240	250	0.013	0.019	8	11
	Northampton-Rich Square	750	770	0.045	0.06	122	600
	Rich Square	1050	950	0.142	0.093	59	39
	Seaboard	825	975	0.113	0.16	63	48
	Severn	325	400	0.034	0.073	24	11
	Woodland	745	651	0.078	0.05	27	17

All 36 agricultural users are registered for irrigation purposes. In the nonagricultural sector, both are registered for industrial purposes (Table A-16).

Table A-16 Registered Water Withdrawls for 1999 in the North Carolina Portion of the Chowan River Basin

Purpose of Withdrawl	Number of Facilities	Withdrawl Amount (MGD)	Percentage of Total Withdrawl
Agricultural	36	41.436	95.2
Nonagricultural	2	2.1	4.8
Total	38	43.536	----

Though interbasin transfers occur in the state, no surface water transfers are active in the North Carolina portion of this basin (NCDENR-DWR, 2001). However, the Roanoke Rapids Sanitary District sells water to the Northampton-Gaston water system, which results in a minor transfer from the Roanoke River basin to the upper Meherrin River stemming in Virginia. Should there be future interbasin transfers in the state, all local water systems are required to report existing and anticipated transfers as part of the local water supply planning process. This information will be available for future updates of this Basinwide Water Quality Plan.

Chapter 3 -
Summary of Water Quality Information for the Chowan River Basin

3.1 General Sources of Pollution

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. With proper management of wastes and land use activities, these impacts can be minimized. Pollutants that enter waters fall into two general categories: *point sources* and *nonpoint sources*.

Point Sources

Piped discharges from
- Municipal wastewater treatment plants
- Industrial facilities
- Small package treatment plants
- Large urban and industrial stormwater systems

Point sources are typically piped discharges and are controlled through regulatory programs administered by the state. All regulated point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state.

Nonpoint Sources

- Construction activities
- Roads, parking lots and rooftops
- Agriculture
- Failing septic systems and straight pipes
- Timber harvesting
- Hydrological modifications

Nonpoint sources are from a broad range of land use activities. Nonpoint source pollutants are typically carried to waters by rainfall, runoff or snowmelt. Sediment and nutrients are most often associated with nonpoint source pollution. Other pollutants associated with nonpoint source pollution include fecal coliform bacteria, oil and grease, pesticides and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

Unlike point sources of pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given these characteristics, it is difficult and resource intensive to quantify nonpoint contributions to water quality degradation in a given watershed. While nonpoint source pollution control often relies on voluntary actions, the federal and state governments have many incentive programs designed to reduce nonpoint source pollution.

Every person living in or visiting a watershed contributes to impacts on water quality. Therefore, each individual should be aware of these contributions and take actions to reduce them.

Cumulative Effects

While any one activity may not have a dramatic effect on water quality, the cumulative effect of land use activities in a watershed can have a severe and long-lasting impact.

3.2 Description of Surface Water Classifications and Standards

3.2.1 Program Overview

North Carolina's Water Quality Standards program adopted classifications and water quality standards for all the state's river basins by 1963. The program remains consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters, and the protection of unique and special pristine waters with outstanding resource values.

3.2.2 Surface Water Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water (Table A-17). In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. For example, a stream might have a C Sw classification, where C is the primary classification followed by the Sw (Swamp) supplemental classification. A full description of the state's primary and supplemental classifications is available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*. Information on this subject is also available at DWQ's website at http://h2o.enr.state.nc.us/wqhome.html.

Table A-17 Primary and Supplemental Surface Water Classifications

PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS*	
Class	**Best Uses**
C and SC	Aquatic life propagation/protection and secondary recreation.
B and SB	Primary recreation and Class C uses.
SA	Waters classified for commercial shellfish harvesting.
WS	*Water Supply watershed*. There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.
SUPPLEMENTAL CLASSIFICATIONS	
Class	**Best Uses**
Sw	*Swamp Waters*: Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
HQW	*High Quality Waters*: Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies.
ORW	*Outstanding Resource Waters*: Unique and special surface waters that are not impacted by pollution and have some outstanding resource values.
NSW	*Nutrient Sensitive Waters*: Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.

* Primary classifications beginning with an "S" are assigned to saltwaters.

Statewide Water Quality Standards

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in a waterbody to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are discussed briefly below. The standards for Class C waters establish the basic protection level for all state surface waters. With the exception of swamp waters, all of the other primary and supplemental classifications have more stringent standards than for C, and therefore, require higher levels of protection.

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish, or rare and endangered aquatic species. These waters may be designated as HQW or ORW.

3.2.3 Classifications and Standards in the Chowan River Basin

The waters of the Chowan River basin have a variety of surface water quality classifications applied to them ranging from C, B and NSW. The majority of waters in the basin are C waters, designated to protect for aquatic life and secondary recreation. All waters in the basin are classified as Nutrient Sensitive Waters, and no waters are currently classified as Sw, Water Supply Watersheds, Outstanding Resource Waters nor High Quality Waters. It is possible to pursue reclassification of stream segments. Pending reclassifications are presented below.

Classification and standards for the entire basin can be found in a separate document entitled *Classifications and Water Quality Standards Assigned to the Waters of the Chowan River Basin*. This document may be obtained by calling the Planning Branch of DWQ at (919) 733-5083. It can also be accessed through the DWQ Water Quality Section website at http://h2o.enr.state.nc.us/wqhome.html.

NSW Classification

In 1979, all waters of the Chowan River basin were designated as NSW. The Chowan River basin was the first waterbody in the state to receive the supplemental classification because of water quality problems associated with nutrient enrichment. In response to nuisance algal blooms and fish kills in North Carolina's waters, the North Carolina Environmental Management Commission established the NSW supplemental classification in May of 1979 as a legal basis for controlling the discharge of nutrients, primarily nitrogen and phosphorus, into surface waters. This classification took effect in September 1979 for the Chowan River, thereby, enabling nutrient limits to be included in the NPDES permits of wastewater treatment plants which discharge in the river basin.

Pending Reclassifications in the Chowan River Basin

There are no water segments currently undergoing reclassification in the Chowan River basin. However, several waterbodies in the basin are associated with swamp-like characteristics as

assessed by DWQ biologists (Table A-18). These waterbodies include but are not necessarily limited to:

Table A-18 Proposed Classifications in the Chowan River Basin

Stream Segment	Current Classification	Proposed Classification
Chowan River	B NSW	B NSW Sw
Potecasi Creek	C NSW	C NSW Sw
Ramsey Creek	C NSW	C NSW Sw
Wiccacanee Swamp	C NSW	C NSW Sw
Cole Creek	C NSW	C NSW Sw
Buckland Mill Branch	C NSW	C NSW Sw
Hackley Swamp (Hacklan Branch)	C NSW	C NSW Sw
Jones Swamp	C NSW	C NSW Sw
Stony Creek	C NSW	C NSW Sw
Quioccoson Swamp	C NSW	C NSW Sw
Beaverdam Swamp	C NSW	C NSW Sw
Eason Swamp	C NSW	C NSW Sw
Wildcat Swamp	C NSW	C NSW Sw
Chinkapin Creek	C NSW	C NSW Sw
Cabin Branch	C NSW	C NSW Sw
Bull Branch	C NSW	C NSW Sw
Peele Branch	C NSW	C NSW Sw
Cypress Swamp	C NSW	C NSW Sw
Barbeque Swamp	C NSW	C NSW Sw
Eastmost Swamp	C NSW	C NSW Sw
Kirbys Creek	C NSW	C NSW Sw
Rogers Swamp	C NSW	C NSW Sw
Hunting Branch	C NSW	C NSW Sw
Corduroy Swamp (Taylors Millpond)	C NSW	C NSW Sw
Reedy Branch	C NSW	C NSW Sw
Cutawhiskie Creek	C NSW	C NSW Sw
Chapel Branch	C NSW	C NSW Sw
Urahaw Swamp	C NSW	C NSW Sw
Grant Branch	C NSW	C NSW Sw
Bear Swamp	C NSW	C NSW Sw
Quarter Swamp	C NSW	C NSW Sw
Bennetts Creek and its tributaries	C NSW	C NSW Sw
Trotman Creek and its tributaries	C NSW	C NSW Sw
Cricket Swamp	C NSW	C NSW Sw
Willow Branch	C NSW	C NSW Sw
Dunmoor Branch	C NSW	C NSW Sw
Miller Branch	C NSW	C NSW Sw
Salmon Creek	C NSW	C NSW Sw
Black Walnut Swamp	C NSW	C NSW Sw

Though DWQ scientists did not conduct formal field evaluations, they noted some potential streams for additional intensive field surveys to determine if the segments warrant a Sw supplemental classification. DWQ scientists note that there is a high possibility that all tributaries in subbasin 03-01-01 warrant the supplemental classification due to low flow and low DO during droughts. DWQ scientists indicate that due to high land modification that has occurred over the centuries, it is difficult to identify a natural swamp stream in the area. However, a Water Resources Research Institute study entitled *Effects of Stream Channelization on Bottomland and Swamp Forest Ecosystems* (Maki et al., 1980) studied a reference swamp stream in a forested area, and this research may prove valuable to the reclassification process.

DWQ is currently compiling a list of waterbodies for potential reclassification for the Sw supplemental classification. Public input is requested and valuable during the reclassification procedures.

For more information on the reclassification process or the status of waters in the Chowan River basin currently under reclassification review, contact the DWQ Planning Branch Standards and Classification Unit at (919) 733-5083.

3.3 DWQ Water Quality Monitoring Programs in the Chowan River Basin

DWQ monitoring programs for the Chowan River basin include:

- Benthic Macroinvertebrates (Section 3.3.1)
- Fish Assessments (Section 3.3.2)
- Aquatic Toxicity Monitoring (Section 3.3.3)
- Ambient Monitoring System (Section 3.3.4)

Staff in the Environmental Sciences Branch and Regional Offices of DWQ collect a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the Chowan River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Chowan River basin, available from the Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960. For further information on DWQ's biological sampling methods, refer to Appendix III.

3.3.1 Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthic data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs; and a Biotic Index value, which gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. Bioclassifications fall into five categories ranging from Poor to Excellent.

Extensive evaluation of swamp streams across eastern North Carolina suggests that current coastal plain criteria are not appropriate for assessing the condition of water quality in these special systems. Swamp streams are characterized by slower flow, lower dissolved oxygen, lower pH, and sometimes very complex braided channels and dark-colored water. DWQ is working to refine biological criteria that may be used in the future to assign bioclassifications to these streams. Refer to Chapter 4 of this section for more detailed information.

Overview of Benthic Macroinvertebrate Data

Appendix II lists all the benthic macroinvertebrate collections in the Chowan River basin between 1983 and 2000, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Benthic macroinvertebrates have been collected at 17 sites in the Chowan River basin since 1983; 14 of these sites were sampled during 2000 basinwide surveys or special studies.

For the 2000 collections, the following bioclassifications were found: Excellent – 0 (0%), Good – 2 (12%), Good-Fair – 2 (12%), Fair – 1 (6%), Poor – 0 (0%), and Not Rated – 12 (70%) (Figure A-12). The distribution of water quality ratings is similar for both the 2000 collection and all collections since 1983, suggesting little overall change in water quality within the Chowan River basin.

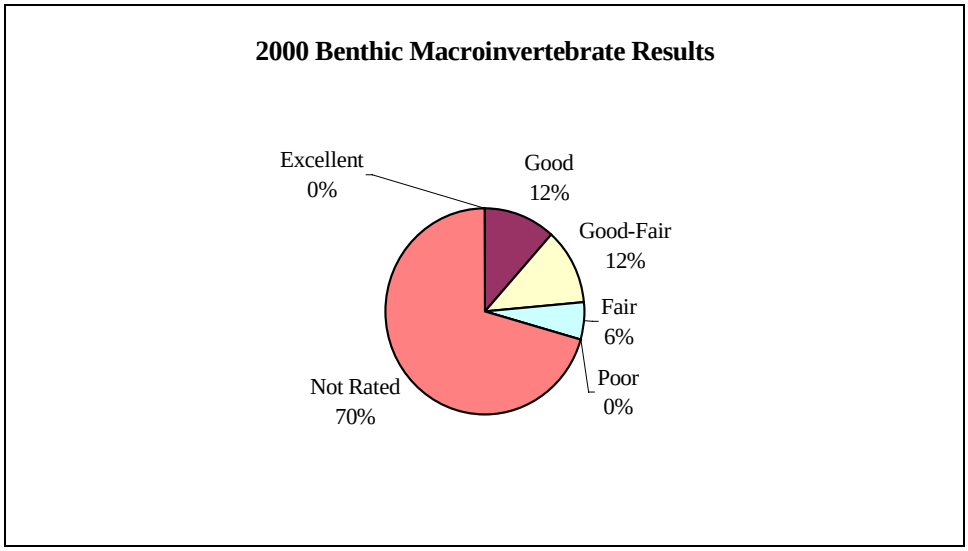


Figure A-12 Bioclassifications for Benthic Macroinvertebrate Sites Sampled by DWQ in 2000

Most of the streams that are not rated are swamp streams or are proposed for reclassification to swamp waters (Sw). Table A-19 lists the most recent ratings since 1983 (by subbasin) for all benthic sites in the Chowan River basin.

Table A-19 Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent sample for each site) in the Chowan River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Total
03-01-01	0	1	1	1	0	5	8
03-01-02	0	1	0	0	0	6	7
03-01-03	0	0	0	0	0	0	0
03-01-04	0	0	1	0	0	1	2
Total (#)	**0**	**2**	**2**	**1**	**0**	**12**	**17**
Total (%)	**0%**	**12%**	**12%**	**6%**	**0%**	**70%**	**---**

Between-year changes in water quality could be evaluated at only four sites in this basin because most streams were sampled for the first time in 2000. Trends in water quality over the past five years were evaluated at several sites in the Chowan River basin, with no sites showing a change in water quality bioclassification (Table A-20). Only the upper Chowan River has had a long-term decline in bioclassification. The changes observed for the upper Chowan River may have been influenced by high flows prior to recent collection.

Reviewing the benthic macroinvertebrate classifications over the long-term (greater than five years), all sampling stations have experienced declines in benthic macroinvertebrate bioclassifications. Though recent water quality impacts are not evident, the data indicate that long-term water quality degradation may have occurred in the river basin.

Table A-20 Summary of Trends Over Time in Benthic Macroinvertebrate Bioclassifications Assigned in the Chowan River Basin

Subbasin	# Trend Sites	5-Year Change			Long-Term (>5 Years) Change		
		None	+	-	None	+	-
03-01-01	2	2	0	0	0	0	2
03-01-02	1	1	0	0	0	0	1
03-01-03	0	0	0	0	0	0	0
03-01-04	1	1	0	0	0	0	1
Total	**4**	**4**	**0**	**0**	**0**	**0**	**4**

3.3.2 Fish Assessments

DWQ uses the North Carolina Index of Biotic Integrity (NCIBI) as a tool for fish assessments. The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Appendix II contains more information regarding the NCIBI and additional fish community sampling data.

The NCIBI is a modification of the Index of Biotic Integrity initially proposed by Karr (1981) and Karr et al. (1986). The NCIBI has been subsequently modified and is continually being refined for applicability to wadeable streams in North Carolina. The IBI method was developed for assessing a stream's biological integrity by examining the structure and health of its fish community. The scores derived from this index are a measure of the ecological health of the water and may not directly correlate to water quality. Currently, the NCIBI is applicable only to coolwater and warmwater streams that are wadeable from one shoreline to the other and for a distance upstream/downstream of 600 feet. Nonwadeable streams and larger rivers that must be sampled with a boat are not currently evaluated with the NCIBI.

However, makeup of the fish community can still be used to point out streams where the community is altered due to degradation of water quality or habitat. NCIBI scores are presented in this report, but NCIBI classes are not listed. In addition, the data were not used for use support evaluations. Use support evaluations are discussed in Part 3.5 of this section.

Overview of Fish Community Assessment Data

In 2000, four sites in subbasins 03-01-01and 03-01-02 were sampled between May and August and evaluated. Ahoskie Creek, Cutawhiskie Swamp and Chinkapin Creek were wadeable sites while Sarem Creek was a nonwadeable, small boat site. Due to the ongoing revision in the NCIBI scoring and rating criteria for the coastal plain ecoregion and the development of evaluation protocols for small boat collecting, no fish community sites in this basin were rated.

In 2000, although not rated, the fish communities at all of the sites appeared to be fairly healthy. The most diverse fish community was found at Chinkapin Creek where a total of 23 species was collected.

Overview of Fish Tissue Sampling Data

Since 1995, DWQ has conducted one fish tissue survey in the Chowan River basin. Fish samples were collected on the Chowan River near Gatesville during August 2000. The survey was conducted to obtain baseline metals data prior to operation of the Nucor steel mill near Tunis (Hertford County). Metals concentrations, except mercury, were non-detectable or at levels below current USEPA, USFDA and North Carolina criteria.

Currently, there are several fish consumption advisories that affect the Chowan River basin. For more information regarding fish consumption advisories, refer to page 56. To view more information about these advisories and to view advisory updates, please visit the NC Department

of Health and Human Services website at http://www.schs.state.nc.us/epi/fish/current.html or call (919) 715-6429.

Chowan River Basin Fish Kills

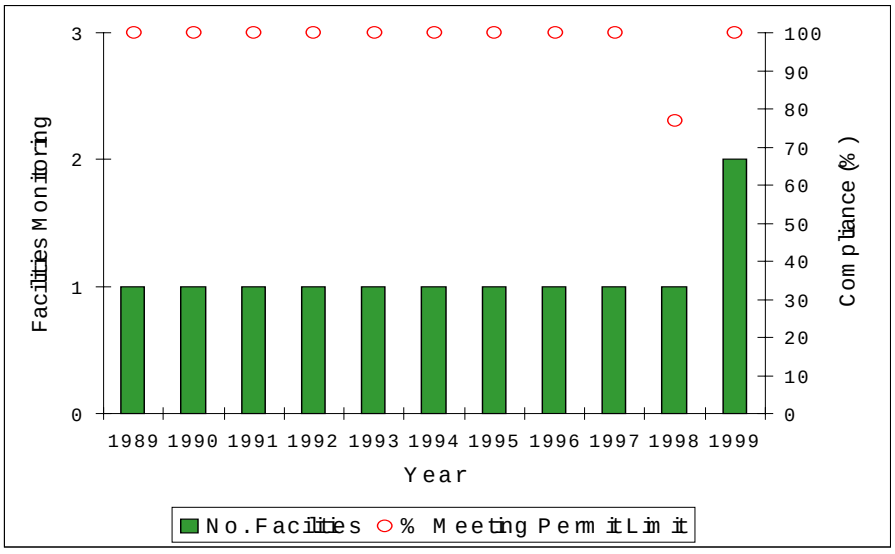
DWQ has systematically monitored and reported fish kill events across the state since 1996. Field reports since 1996 have generally shown light fish kill activity (ten or less events) in the Chowan River basin each year (NCDENR-DWQ, 1999a). This basin generally exhibited fewer conditions that have given rise to frequent kill activity in other coastal areas. Such conditions include eutrophication, stratification and low dissolved oxygen, especially along shallow, poorly flushed waters. The Chowan River basin also did not experience hurricane-related fish kills in recent years as compared with the more southern Neuse River and Cape Fear River basins.

3.3.3 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DWQ's Aquatic Toxicology Laboratory.

The Aquatic Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge. A summary of compliance for the Chowan River basin from 1986 through 1998 is presented in Figure A-13 below.

Facilities with toxicity problems during the most recent two-year review period are discussed in appropriate subbasin chapters in Section B.



These numbers were calculated by determining whether a facility was meeting its ultimate permit limit during the given time period, regardless of any SOCs in force.

This is not the actual number of tests performed, but the number of opportunities for limit compliance evaluation. Assumptions were made about compliance for months where no monitoring took place based on data previous to that month. Facilities compliant in a given month were assumed to be in compliance during months following until the next actual monitoring event. This same policy was applied to facilities in noncompliance.

Figure A-13 Summary of Compliance with Aquatic Toxicity Tests in the Chowan River Basin

3.3.4 Ambient Monitoring System Program

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collection of physical and chemical water quality data. North Carolina has over 400 monitoring stations statewide, including 14 stations in the Chowan River basin (Table A-21). Locations of the Chowan River basin ambient stations are presented in individual subbasin maps in Section B. These stations are sampled monthly for 27 parameters.

Table A-21 Ambient Monitoring System Stations within the Chowan River Basin

Subbasin/ Station Code	Station	County	Classification*
03-01-01			
D0000050	Nottaway River at US 258 near Riverdale, VA	Southampton, VA	II Estuarine
D0001200	Blackwater River at Horseshoe Bend at Cherry Grove, VA	Southampton, VA	II Estuarine
D0001800	Blackwater River 150 yards upstream from the mouth near Wyanoke	Gates	B NSW
D0010000	Chowan River near Riddicksville	Hertford	B NSW
D6250000	Chowan River at US 13 at Winton	Hertford	B NSW
D8356200	Chowan River at CM 16 near Gatesville	Hertford	B NSW
03-01-02			
D4150000	Potecasi Creek at NC 11 near Union	Hertford	C NSW
D5000000	Meherrin River at SR 1175 near Como	Hertford	B NSW
03-01-03			
D8430000	Chowan River 200 yards downstream from Holiday Island	Chowan	B NSW
D8950000	Chowan River at Colerain	Bertie	B NSW
03-01-04			
D9490000	Chowan River at Edenhouse	Bertie	B NSW
D999500C	Albemarle Sound near Edenton mid channel	Chowan	SB
D999500N	Albemarle Sound near Edenton north shore	Chowan	B NSW
D999500S	Albemarle Sound near Edenton south shore	Chowan	SB

***** An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-17).

3.4 Other Water Quality Research

North Carolina actively solicits "existing and readily available" data and information for each basin as part of the basinwide planning process. Data meeting DWQ quality assurance objectives are used in making use support determinations. Data and information indicating possible water quality problems are investigated further. Both quantitative and qualitative information are accepted during the solicitation period. High levels of confidence must be present in order for outside quantitative information to carry the same weight as information collected from within DWQ. This is particularly the case when considering waters for the 303(d) list. Methodology for soliciting and evaluating outside data is presented in *North Carolina's 2000 § 303(d) List* (NCDENR-DWQ, October 2000). The next data solicitation period for the Chowan River is planned for 2004.

DWQ data solicitation includes the following:

- Information, letters and photographs regarding the uses of surface waters for boating, drinking water, swimming, aesthetics and fishing.
- Raw data submitted electronically and accompanied by documentation of quality assurance methods used to collect and analyze the samples. Maps showing sampling locations must also be included.
- Summary reports and memos, including distribution statistics and accompanied by documentation of quality assurance methods used to collect and analyze the data.

Contact information must accompany all data and information submitted.

DWQ solicited data from other water sampling programs conducted in the Chowan River basin; however, no data meet quality and accessibility requirements considered necessary for use support assessments, 303(d) list or adjustment of biological and chemical monitoring sites.

3.4.1 Division of Environmental Health Shellfish Sanitation and Recreational Water Quality Section

The Shellfish Sanitation and Recreational Water Quality Section of the Division of Environmental Health is responsible for monitoring and classifying coastal waters as to their suitability for shellfish harvesting for human consumption and inspection and certification of shellfish and crustacea processing plants. The section also administers the recreational beach monitoring program and posts advisories, under the guidance of the State Health Director, for those waters not suitable for bodily contact activities.

The Shellfish Sanitation Program is conducted in accordance with the guidelines set by the Interstate Shellfish Sanitation Conference (ISSC) contained in the *National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish Model Ordinance*. The NSSP is administered by the US Food and Drug Administration (FDA). Classifications of coastal waters for shellfish harvesting are done by means of a Sanitary Survey which includes: a shoreline survey of sources of pollution, a hydrographic and meteorological survey, and a bacteriological survey of growing waters. Sanitary Surveys are conducted of all potential shellfish growing areas in coastal North Carolina, and recommendations are made to the Division of Marine Fisheries of which areas should be closed for shellfish harvesting.

The Recreational Beach Monitoring Program determines the quality of coastal waters and beaches for suitability for bodily contact activities. Shoreline surveys of potential sources of pollution that could affect the area are also conducted. Swimming advisories are posted when bacteriological standards are exceeded or point source discharges are found.

Water samples are collected and analyzed for fecal coliform bacteria from numerous sampling stations located throughout the coastal area for both the shellfish and recreational programs. The recreational monitoring program also tests waters for *Escherichia coli*.

3.4.2 Virginia's Water Quality Monitoring

A portion of the Chowan River basin is located in the State of Virginia, managed as the Chowan River and Dismal Swamp basin. The basin is located in the southeastern portion of Virginia and covers 4,061 square miles of the Chowan River and Chowan River basin's headwaters. The basin is bordered by the James River basin and the small coastal river basins to the east, the Roanoke River basin to the west, and the Virginia/North Carolina state line to the south. The basin is approximately 145 miles in length and varies from 10 to 50 miles in width (Virginia, 2000).

Virginia reported the following percentages of impaired waters in its 2000 305(b) report: aquatic life (88.02 miles partially supporting, 647.89 miles not supporting, 0.12 estuary miles not supporting); and swimming (235.09 miles partially supporting, 49.86 miles not supporting, 0.12 estuary miles partially supporting). The various causes associated with the impairment include benthic macroinvertebrate population impacts, pH, organic enrichment/low DO, pathogen indicators, industrial point sources, agriculture, hydromodification, urban runoff/storm sewers, natural sources and source unknown (Virginia, 2000).

Virginia needs to develop 648 TMDLs on 600 impaired waters in the state. Several TMDLs in the Chowan River and Dismal Swamp basin are slated for completion in 2006: Roses Creek (benthic macroinvertebrate community issues, fecal coliform and unknown causes), Hurricane Branch UT (benthic macroinvertebrate community issues), West Neck Creek (fecal coliform) and Nawney Creek (fecal coliform).

For more information, visit the Virginia Department of Environmental Quality's webpage at http://www.deq.state.va.us/tmdl/10yrsch.html.

3.5 Use Support Summary

3.5.1 Introduction to Use Support

Waters are classified according to their best intended uses. Determining how well a water supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality. Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) are being met.

For example, waters classified for fishing and secondary contact recreation (Class C for freshwater) are rated as fully supporting if data used to determine use support did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR).

Use support ratings for surface waters:

- *Fully Supporting (FS)*
- *Partially Supporting (PS)*
- *Not Supporting (NS)*
- *Not Rated (NR)*

Impaired waters categories:

- *Partially Supporting*
- *Not Supporting*

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the subbasin chapters in Section B so that data, management and the need to address the identified concerns are not lost.

Beginning in 2000 with the Roanoke River basin, an approach to assess ecosystem health and human health risk is applied to use support categories. Six categories are used to assess this approach: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary

recreation, water supply and "other" uses. Each of these categories relates to the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the multiple use support categories, as shown in Table A-29. For many waters, a use support category will not be applicable (NA) to the best use classification of that water (e.g., drinking water supply is not the best use of a Class C water). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water. For more detailed information regarding use support methodology, refer to Appendix III.

3.5.2 Comparison of Use Support Ratings to Streams on the Section 303(d) List

Section 303(d) of the Clean Water Act requires states to identify waters not meeting standards. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. See Appendix IV for a description of 303(d) listing methodology.

Waters are placed on North Carolina's 303(d) list primarily due to a partially or not supporting use support rating. These use support ratings are based on biological and chemical data. When the state water quality standard is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either biological ratings or water quality standards.

Use support ratings and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list since water quality improvement has been attained. In other cases, the new data will show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality standards are being met. Swamp waters may have been on previous impaired waters lists due to depressed dissolved oxygen and/or pH levels. These waters will remain on the impaired waters list until swamp studies, biological and chemical, have been completed and use support has been reassessed. Thus, some inconsistencies remain between the 303(d) list and the Chowan Basinwide Water Quality Plan.

3.5.3 Use Support Ratings for the Chowan River Basin

Aquatic Life/Secondary Recreation

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (802.6 miles) in the Chowan River basin. Table A-22 presents use support ratings by subbasin for both monitored and evaluated waters in the aquatic life/secondary recreation category. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table A-23.

Approximately 36 percent of stream miles (288.2) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. Impaired waters account for 2.8 percent of the total stream miles and 7.8 percent of monitored stream miles (Table A-23).

Table A-22 Aquatic Life/Secondary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin in Miles (1995-2000)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-01-01	39.8	22.5	0	347.0	409.3
03-01-02	45.5	0	0	241.0	286.5
03-01-03	14.1	0	0	16.8	30.9
03-01-04	7.8*	0	0	68.1	75.9
Total Miles	**107.2 miles**	**22.5 miles**	**0 miles**	**672.9 miles**	**802.6 miles**
Percent	13.3%	2.8%	0%	83.8%	--

* = 15,600.4 acres of Albemarle Sound are FS.

Table A-23 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Chowan River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**107.2**	**13.3%**		**107.2**	**37.2%**
Impaired	**22.5**	**2.8%**		**22.5**	**7.8%**
Partially Supporting	*22.5*	*2.8%*		*22.5*	*7.8%*
Not Supporting	*0*	*0%*		*0*	*0%*
Not Rated	**672.9**	**84.0%**		**158.5**	**55.0%**
Total	**802.6**			**288.2**	

* = Percent based on total of all waters, both monitored and evaluated. ** = Percent based on total of all monitored waters.

Fish Consumption

Like the aquatic life/secondary recreation use support category, the fish consumption use support category is also applied to all waters in the state. Approximately five percent of stream miles in the Chowan River basin were monitored for the fish consumption use support category during this basinwide cycle. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there is a regional advisory limiting consumption of shark, swordfish, king mackerel, tilefish as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) for elevated methlymercury levels. Because of this advisory, all waters south and east of Interstate 85 are

considered partially supporting the fish consumption use on an evaluated basis. Refer to Section 4.3 for more information on fish consumption advisories. Table A-24 presents use support ratings by subbasin for monitored streams in the fish consumption use support category. Only 39.8 miles of the basin were monitored during the 1995-2000 basinwide planning cycle. A basinwide summary of current fish consumption use support ratings is presented in Table A-25.

Although considered impaired, the data indicated that metals concentrations were non-detectable or at levels below current USEPA, USFDA and North Carolina criteria (Section 3.3.2).

Table A-24 Fish Consumption Use Support Ratings for Monitored Waters Listed by Subbasin (1995-2000)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-01-01	0	39.8	0	0	39.8
03-01-02	0	0	0	0	0
03-01-03	0	0	0	0	0
03-01-04	0	0	0	0	0
Total	**0**	**39.8 miles**	**0**	**0**	**39.8 miles**
Percent	**0**	**100%**	**0**	**0**	**--**

Table A-25 Fish Consumption Use Support Summary Information for Waters in the Chowan River Basin (2000)

Fish Consumption Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**0.0**			**0.0**	**0%**
Impaired	**802.6**	**100%**		**39.8**	**100%**
Partially Supporting	**802.6**	*100%*		*39.8 miles*	*100%*
Not Supporting	*0*			*0*	*0*
Not Rated	**0.0**			**0.0**	**0**
TOTAL	**802.6**			**39.8**	

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Primary Recreation

There are 105.4 miles currently classified for primary recreation in the Chowan River basin. Table A-26 presents use support ratings by subbasin for monitored and evaluated waters in the primary recreation category. A basinwide summary of current primary recreation use support ratings is presented in Table A-27.

Table A-26 Primary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin in Miles (1995-2000)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-01-01	39.8	0	0	0	39.8
03-01-02	11.7	0	0	1.9	13.6
03-01-03	14.1	0	0	12.8	26.9
03-01-04	7.8	0	0	17.3	25.1
Total Miles	**73.4 miles**	**0 miles**	**0 miles**	**32 miles**	**105.4 miles**
Percent	69.6%	0%	0%	30.4%	--

Table A-27 Primary Recreation Use Support Summary Information for Waters in the Chowan River Basin (2000)

Primary Recreation Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**73.4**	**69.6%**		**73.4**	**100%**
Impaired	**0**	**0**		**0**	**0**
Partially Supporting	*0*	*0*		*0*	*0*
Not Supporting	*0*	*0*		*0*	*0*
Not Rated	**32.0**	**30.4%**		**0**	**0%**
TOTAL	**105.4**	**---**		**73.4**	**-----**

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Use Support Summary

There are 22.5 impaired stream miles in the aquatic life/secondary recreation use support category and no impaired waters in the primary recreation use support category (Table A-28). All waters are considered impaired for the fish consumption use support category due to a regional fish consumption advisory for bowfin, largemouth bass, chain pickerel and king mackerel, although only one stream was monitored to assess this category. There were no waters impaired in the primary recreation use support category. The water supply use support category was not assessed in this basin because there are no surface water drinking water supplies. Descriptions of impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each waterbody are discussed in detail in the appropriate subbasin chapter.

Color maps showing current use support ratings for the Chowan River basin are presented in Figure A-14. Only waters where fish tissue has been monitored during this basinwide cycle are shown as impaired for fish consumption on the maps. When use support ratings have been assigned to more than one category for a particular water, the rating that represents the most severe impairment is shown on the map.

Table A-28 Monitored Impaired Waters within the Chowan River Basin (as of 2000)[1]

Impaired Water	Subbasin	Chapter in Section B	Classification	Use Support Categories/Rating– Impaired Miles (or Acres)				
				Aquatic Life/ Secondary Recreation	Fish Consumption	Primary Recreation	Water Supply	Potential Sources
Wiccacon River	03-01-01	1	C NSW	PS - 22.5 mi	*	N/A	N/A	NP
Chowan River	03-01-01	1	B NSW	FS	PS - 39.8 mi	FS	N/A	Mercury

* These waters are impaired because of a regional fish consumption advisory for bowfin, largemouth bass and chain pickerel. However, they were not monitored for the fish consumption category during this basinwide cycle. Refer to Section A, Part 4.3 for further information.

FS	Fully Supporting	N/A	Not Applicable
PS	Partially Supporting	NP	Nonpoint Sources

Notes

[1] These waters are currently, or will be placed, on the 303(d) list. TMDL and/or management strategy will be developed to address causes and sources of impairment. Refer to Appendix IV for further information regarding 303(d) listing methodology.

INSERT

Figure A-14 Use Support Map of the Chowan River Basin

Chapter 4 -
Water Quality Issues Related to the Entire Chowan River Basin

4.1 Overview

The 1997 Chowan River Basinwide Water Quality Management Plan included several recommendations to address water quality issues in the basin. Most of these recommendations were for specific stream segments and are discussed separately in the individual subbasin chapters in Section B. This chapter discusses water quality issues that relate to the entire Chowan River basin. Habitat degradation, including channelization and loss of riparian vegetation, is the main water quality issue in the basin.

4.2 Biological Monitoring Issues

DWQ strives to properly evaluate the health of biological communities throughout the state. Swamp stream systems, nonwadeable waters and coldwater fisheries have presented unique challenges. This section discusses some of these challenges. Refer to Appendix III for further information.

4.2.1 Draft Criteria for Assessing Benthic Macroinvertebrates in Swamp Streams

Extensive evaluation, conducted by DWQ, of swamp streams across eastern North Carolina suggests that different criteria must be used to assess the condition of water quality in these systems. Swamp streams are characterized by seasonally interrupted flows, lower dissolved oxygen and sometimes, lower pH. Sometimes they also have very complex braided channels and dark-colored water. Since 1995, benthic swamp sampling methods have been used at over 100 sites in the coastal plain of North Carolina, including more than 20 reference sites. In 2000, seven sites on swamp streams in the Chowan River basin were sampled by DWQ. Preliminary investigations indicate that there are at least five unique swamp ecoregions in the NC coastal plain, and each of these may require different biocriteria. The lowest "natural" diversity has been found in low-gradient streams (especially in the outer coastal plain) and in areas with poorly drained soils.

DWQ has developed draft biological criteria that may be used in the future to assign bioclassifications to these streams (as is currently done for other streams and rivers across the state). However, validation of the swamp criteria will require collecting data for several years from swamp stream reference sites. The criteria will remain in draft form until DWQ is better able to evaluate such things as: year-to-year variation at reference swamp sites, effects of flow interruption, variation among reference swamp sites, and the effect of small changes in pH on the benthic community. Other factors, such as whether the habitat evaluation can be improved and the role fisheries data should play in the evaluation, must also be resolved. While it may be difficult to assign use support ratings to these swamp streams, these data can be used to evaluate

changes in a particular stream between dates or to evaluate effects of different land uses on water quality within a relatively uniform ecoregion.

4.2.2 Draft Criteria for Assessing Fish Communities

In the past, fish communities in some streams were sampled by DWQ, and scores were assigned using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of twelve parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score.

However, during the late 1990s, application of the NCIBI was restricted to wadeable streams that can be sampled by a crew of 2-4 persons using backpack electrofishers and following the DWQ Standard Operating Procedures (NCDEHNR, 1997). Work began in 1998 to develop a fish community boat sampling method that could be used in nonwadeable coastal plain streams. Plans are to sample 10-15 reference sites with the boat method once it is finalized. As with the benthic in swamp streams, several years of reference site data will be needed before criteria can be developed with confidence to evaluate the biological integrity of large streams and rivers using the fish community.

4.3 Fish Consumption Advisories

The NC Department of Health and Human Services (NCDHHS) has developed guidelines to advise people to what fish are safe to eat. DWQ considers uses of waters with a consumption advisory for one or more species of fish to be impaired. Elevated methylmercury levels have been found in shark, swordfish, king mackerel, tilefish, largemouth bass, bowfin (or blackfish), and chain pickerel (or jack). As of April 2002, these fish are under an advisory.

4.3.1 Mercury Related Fish Consumption Advisories

The presence and accumulation of mercury in North Carolina's aquatic environment are similar to contamination observed throughout the country. Mercury has a complex life in the environment, moving from the atmosphere to soil, to surface water and into biological organisms. Mercury circulates in the environment as a result of natural and human (anthropogenic) activities. A dominant pathway of mercury in the environment is through the atmosphere. Mercury that has been emitted from industrial and municipal stacks into the ambient air can circulate across the globe. At any point, mercury may then be deposited onto land and water. Once in the water, mercury can accumulate in fish tissue and humans. Mercury is also commonly found in wastewater. However, mercury in wastewater is typically not at levels that could be solely responsible for elevated levels in fish.

The NC Department of Health and Human Services issues fish consumption advisories for those fish species which have median and/or average methylmercury levels at 0.4 mg/kg or greater. These fish include shark, swordfish, king mackerel, tilefish as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) caught in North Carolina waters south and east of Interstate 85. As a result of these advisories, DWQ considers all waters in the Chowan River

basin to be partially supporting the fish consumption use support category. Refer to Appendix III for more information regarding use support ratings and assessment methodology.

DWQ has sampled fish tissue from a variety of species at one location in the Chowan River basin. Fish samples were collected on the Chowan River near Gatesville during August 2000. The survey was conducted to obtain baseline metals data prior to operation of the Nucor steel mill near Tunis (Hertford County). Metals concentrations, except mercury, were non-detectable or at levels below current USEPA, USFDA and North Carolina criteria.

Specific Fish Consumption Advisories

Fish is an excellent source of protein and other nutrients. However, several varieties of saltwater and NC freshwater fish may contain high levels of mercury, which may pose a risk to human health. These guidelines will help you make healthy food choices.

Women of Childbearing Age (15-44 years), Pregnant Women, Nursing Women and Children under 15:

- **Do not eat** shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish are all high in mercury.
- **Eat up to two meals* per week of other fish.**

Other Women, Men and Children 15 years and older:

- **Eat no more than one meal* per week** of shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish are all high in mercury.
- **Eat up to four meals* per week of other fish.**

* A "meal" is 6 ounces of cooked fish for adults and children 15 years and older, and 2 ounces of cooked fish for younger children.

4.3.2 Dioxin Related Fish Consumption Advisories

Dioxin contamination is found worldwide, including a portion of the Albemarle Sound westward of Bull Bay and Harvey Point to the Roanoke River. Dioxin is typically generated through high temperature combustion processes, chemical bleaching of pulp, and through the production of chlorinated phenols and their derivatives. Dioxins can bioaccumulate in animal tissues, creating human health concerns such as reproductive impairment, carcinogencity and even death. Dioxin binds tightly with sediment, food particles and organic matter in the water column, thus, leaving only low concentrations dissolved in the water column.

Due to dioxin's bioaccumulation properties, the Department of Health and Human Services (NCDHHS) recommends that in fish advisory areas fish consumption should be limited to two meals per person per month. Children and pregnant or nursing women should not consume any

fish from the Albemarle Sound. Consumption of herring, shellfish and shad (including roe) is not considered a health risk.

Chowan River: The Chowan River from the Virginia border to Albemarle Sound was placed under a fish consumption advisory in 1990 for all species except herring and shad due to dioxin contamination from International Paper, formerly known as Union Camp, in Franklin, Virginia. Yearly monitoring by International Paper in North Carolina indicated that dioxin levels gradually decreased in fish from the Chowan River and Meherrin River after new bleaching technologies were instituted in 1990 to improve effluent quality.

In March 1998, the advisory was partially lifted, leaving carp and catfish as the only two species still considered unsafe to eat. The advisory was completely lifted in early 2000 after dioxin levels from all stations and species remained below the recommended level for two consecutive years (1998 and 1999) (Williams, 2000). The sampling of catfish species by International Paper is scheduled to continue through the year 2001 to verify the reduction in dioxin concentrations.

Specific Fish Consumption Advisories

Albemarle Sound: Dioxin has prompted an advisory since March 2001 in the Albemarle Sound from Bull Bay to Harvey Point, west to the mouth of the Roanoke River and north to the mouth of the Chowan River at the US Highway 17 Bridge. During the 1980s, officials recognized that dioxin, a carcinogenic by-product of the chlorine bleaching process, was accumulating in fish tissue. Weyerhaeuser Company, located at the mouth of Welch Creek in the Roanoke River basin, previously discharged directly to the creek. In 1988, Weyerhaeuser made improvements and relocated the discharge to the Roanoke River. Weyerhaeuser is required by DWQ to provide extensive monitoring in the Roanoke River from Williamston down the Roanoke and out into the Albemarle Sound as far as Bull Bay. Data recently collected by Weyerhaeuser Company indicate a decline in dioxin concentrations. In October 2001, the advisory was partially lifted for game fish. However, an advisory remains in place for bottom-dwelling fish such as carp and catfish.

For more information regarding fish consumption advisories, visit the NC Department of Health and Human Services website at http://www.schs.state.nc.us/epi/fish/current.html or call (919) 733-3816.

4.3.3 2002 Recommendations

DWQ, in cooperation with Weyerhaeuser Company, will continue to monitor for dioxin contamination and will work closely with the Department of Health and Human Service's Division of Public Health to lift the advisory when there is no longer a risk to human health from consumption of fish.

DWQ Mercury Workgroup

DWQ is committed to characterizing methylmercury exposure levels and determining if NPDES sources need to be controlled. DWQ formed an internal Mercury Workgroup to improve communication from all programs which directly affect mercury issues (i.e., Pretreatment, Environmental Sciences, Basinwide and Estuary Planning, etc.). The workgroup meets as

needed to share information and determine next steps in addressing mercury issues associated with the aquatic environment.

Improved Ambient Sampling Techniques

DWQ aims to stay abreast of new technology and sampling techniques to ensure that water quality data are accurate, precise and of highest value. In 2000, DWQ started training water quality sampling staff on the new EPA Method 1631 technique. Current monitoring using a higher detection limit (EPA Method 245.1) has consistently yielded non-detected values, and DWQ aims to use the 1631 method to allow detection levels three orders of magnitude lower than EPA Method 245.1.

Regional Mercury Study

In an effort to better manage state waters that may have methylmercury issues, DWQ initiated a study through EPA 104(b)(3) funds. The study aims to provide information that may be used in water quality standard and TMDL development. The study goals include:

- determining levels of ambient mercury in the surface water system;
- estimating site-specific total mercury: methylmercury translators to evaluate water quality criteria;
- develop site-specific water to fish bioaccumulation factors; and
- determine levels of mercury in treatment plant effluent.

DWQ aims to complete this study in 2003, and results will be available to the public. For more information, contact the DWQ Planning Branch Modeling/TMDL Supervisor at (919) 733-5083.

DWQ will continue to host an internal workgroup to stay abreast of current mercury issues. The public has voiced concerns that DWQ should be working on the ecological components and consequences of mercury bioavailability to biota in these areas and the biogeochemical cycling and production of methylmercury from associated wetlands along these streams. Though the workgroup does not have a mandate to conduct research into mercury, the workgroup will better communicate its purpose and accomplishments to the public through periodic updates on the DWQ website.

DWQ will also provide interested members of the public with an overview of the new ambient monitoring sampling technique to gather feedback and insights on how DWQ can best accomplish its data collecting goals.

DWQ will continue to monitor concentrations of various contaminants in fish tissue across the state and will work to identify and reduce wastewater contributions of mercury to surface waters. The Division of Air Quality (DAQ) evaluates mercury levels in rainwater on a regular basis through the EPA Mercury Deposition Network. EPA continues to focus on nationwide mercury reductions from stack emissions and through pollution prevention efforts. Pollution prevention efforts are being investigated on a state and federal level to reduce mercury emissions.

4.4 Growth and Development and Stormwater Management

4.4.1 Introduction

Urbanization often has greater hydrologic effects than any other land use, as native watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and yards. Urbanization results in increased surface runoff and correspondingly earlier and higher peak flows after storms. Flooding frequency is also increased. These effects are compounded when small streams are channelized (straightened) or piped and storm sewer systems are installed to increase transport of drainage waters downstream. Bank scour from these frequent high flow events tends to enlarge urban streams and increases suspended sediment. Scouring also destroys the variety of habitat in streams leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

Larger waters are impacted from the cumulative effect of freshwater runoff transporting bacteria and other contaminants farther out into the estuary. Urban runoff carries a wide variety of contaminants to streams including oil and grease from roads and parking lots, street litter, bacterial contaminates and pollutants from the atmosphere. Generally, there are a larger number of point source discharges in urban areas. Cumulative impacts from habitat alterations, point and nonpoint source pollution can cause severe impairment to urban streams. Runoff increases with increasing development (impervious surfaces). Research over the past 15 years consistently demonstrates a strong correlation between the imperviousness of a drainage basin and the health of its receiving waters (Arnold and Gibbons, 1996). Mallin et al. (2000) showed that with increasing impervious surfaces there is an increase in fecal coliform delivery to estuarine waters. Restoration strategies that address the source and transport of contaminants are more appropriate than developing complicated models, because of the complex hydrology of coastal waters and the life-cycle of fecal coliform bacteria.

The presence of intact riparian buffers and/or wetlands in urban areas can lessen these impacts, and restoration of these watershed features should be considered where feasible; however, the amount of impervious cover should be limited as much as possible. Wide streets, huge cul-de-sacs, long driveways and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas.

Projected population growth over the next twenty years (2000-2020) for the Chowan River basin varies among subbasins (Table A-9). Winton is currently the fastest growing municipality in the basin with an increase in population of 20 percent from 1990 to 2000. Population in Edenton, Jackson, Severn and Woodland increased over the same 10-year period. However, the majority of municipalities in the basin experienced a net decrease in their population. As populations flux, so do developed areas. Some local governments in the Chowan River basin have prioritized water quality planning; however, proactive planning efforts at the local level are needed across the entire basin in order to assure that development is done in a manner that minimizes impacts to water quality. A lack of good environmental planning was identified by participants at the public workshops as a threat to water quality in the Chowan River basin.

4.4.2 Recommendations for Addressing Growth, Development and Stormwater Impacts

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains water quality. These planning efforts will need to find a balance between water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases, as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin.

Land Use Planning Efforts

At the Governor's request, a series of public meetings were held across the state in 1999 to kick off the "21st Century Communities Task Force". The seven-member task force conducted public meetings to look at growth issues across the state. The task force is to report its findings to a special legislative commission on growth and issue a final report.

Planning Recommendations for New Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking & narrower slots).
- Place sidewalks on only one side of residential streets.
- Minimize culvert pipe and hardened stormwater conveyances.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.

A Land Use Plan Review Team authorized by the CRC has recommended better implementation of land use plans and involvement of local governments in the basinwide planning process. In 1998, the CRC suspended the Coastal Area Management Act land use plan updates in order to review and improve the program. Seeking input from local stakeholders, DCM convened a group of external experts, the Land Use Plan Review Team, representing different interests in coastal North Carolina. In September 2000, the team provided the CRC with a set of recommendations to restructure the existing land use planning program. Since land use plans affect permit decisions, growth patterns and community visions, any revisions to the process can potentially have widespread impact to coastal decision-making and inevitably water quality. Therefore, DWQ will play an active role in land use planning discussions, especially with respect to water quality concerns.

The team developed several recommendations, some of which directly impact DWQ. DWQ provided feedback during the development of these recommendations, actively seeks to improve existing communication links with DCM, and continues to stay abreast of events as the recommendations evolve into implementation.

The new coastal land use planning guidelines under consideration by the CRC stress the importance of healthy water. From the requirements of the pre-planning scoping process to the elements of local plans, the new guidelines will ask local governments to do more to protect water quality. One of the goals of the proposed guidelines is to maintain, protect and, where possible, enhance water quality in all coastal wetlands, rivers, streams and estuaries. That effort begins at the local level. The guidelines will require local governments to adopt policies to ensure that coastal water quality is improved or maintained. Chief among these policies are

those that prevent or control stormwater discharges as it is a leading cause of water quality problems along the coast. Local policies, such as impervious surface limits, vegetated riparian buffer creation and wetlands protection, can help lessen the negative impacts of stormwater runoff on coastal waters. The guidelines also will require local governments to develop policies and land use categories that protect open shellfish waters and restore closed or conditionally approved shellfish waters. The Coastal Resources Commission anticipates the revision and adoption of new land use planning rules to go into effect by August 2002.

A detailed summary of the Land Use Plan Review Team recommendations is available through the DCM website at http://dcm2.enr.state.nc.us/. DWQ continues to support these team suggestions, including:

- Development of a "how to" manual to assist local governments in developing high quality land use plans.
- Involvement of coastal local governments in state basinwide planning and seeking application of a land use planning requirement in all areas of coastal river basins are strongly encouraged.
- Strengthen the ties between basinwide planning for water quality and CAMA land use plans, especially focusing on participation in basinwide planning. The team also recommends that the CRC coordinate with the Environmental Management Commission to expand the role of local government and local land use plans in the basinwide water quality planning process. Three specific steps are recommended:
    - ► The database and strategies contained in the basinwide plans should be loosely tailored to the requirements for land use plans.
    - ► The EMC should incorporate local land use policies in basinwide plans.
    - ► Local governments should be encouraged by the CRC to participate in the scoping process for basinwide plans.
- Measures to encourage greater intergovernmental coordination in the development of land use plans.

DWQ will review local land use plans with DCM for communities in the Chowan River basin to help identify impaired or impacted shellfish harvesting waters and make recommendations to reduce future increases in bacterial contamination related to development and land use changes. DWQ will also support local government and community group endeavors to protect and improve shellfish harvesting waters. This will include providing educational opportunities to increase the understanding of technical issues, as well as assisting with identifying funds for restoration and protection projects.

For more information on the CAMA land use process, contact a DCM land use planner at (252) 808-2808 or visit the program on-line at http://dcm2.enr.state.us/.

Public education is needed in the Chowan River basin in order for citizens to understand the value of urban planning and stormwater management. Action should be taken by county governments and municipalities to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box, refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection.

Developing Coastal Habitat Protection Plans

DMF is in the process of developing Coastal Habitat Protection Plans (CHPP) with DWQ and DCM. These plans will identify existing and potential threats to habitats important to coastal fisheries and recommend actions to restore and protect them. The plans will also provide a framework for adoption of rules to protect habitats vital to coastal fisheries. The plans will help to assure consistent actions among the Coastal Resources Commission (CRC), Environmental Management Commission (EMC) and the Marine Fisheries Commission (MFC). For more information on these plans, contact the Habitat Protection Section at (252) 726-7021 or visit the CHPP website at http://www.ncfisheries.net/habitat/chpp1.htm.

North Carolina Coastal Nonpoint Source Program (Section 6217)

Section 6217 of the Federal 1990 Coastal Zone Act Reauthorization Amendments (CZARA) requires every state participating in the Coastal Zone Management Act program to develop a Coastal Nonpoint Pollution Control Program (CNPCP). The purpose of this requirement, as stated in the Act, is to "strengthen the links between federal and state coastal zone management and water quality management programs and to enhance state and local efforts to manage land use activities that degrade coastal waters and coastal habitats." To accomplish these goals, the federal agencies established 56 Management Measures that are to be used by each state to address the following nonpoint source pollution categories:

- *Agricultural Sources*
- *Forestry*
- *Urban Areas* (urban runoff; construction activities; existing development; on-site disposal systems; pollution prevention; and roads, highways and bridges)
- *Marinas and Recreational Boating* (siting and design; and marina and boat operation/maintenance)
- *Hydrologic Modification* (channelization and channel modification; dams; and streambank and shoreline erosion)
- *Wetlands, Riparian Areas and Vegetated Treatment Systems*

At the federal level, the CNPCP is administered jointly by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA). Within North Carolina, the state program, referred to as the Coastal Nonpoint Source Program (CNPSP), is administered by DWQ and the DCM. The state program currently has one full-time staff person located in the Nonpoint Source Planning Unit of DWQ.

The core of the state's CNPSP will be increased through communication and coordination between DWQ and key state agencies that have regulatory responsibilities for controlling nonpoint sources of pollution. This increased dialogue will be facilitated in part by the state's CNPSP Coordinator and will allow for identification of gaps, duplications, inadequacies or inefficiency of existing programs and policies. Responsibilities of the state program coordinator will include participation in the NPS Workgroup to represent coastal water quality interests. The workgroup is involved with the continual refinement of the 319 Grant Program and development of North Carolina's 2001 NPS Management Program Update. The CNPSP Coordinator will also participate in the development and implementation of the basinwide management plans for the

coastal draining rivers; serve as a liaison between DWQ and DCM; and participate in the development of nonpoint source educational materials. For more information about this program, contact the Coastal Nonpoint Source Program Coordinator at (919) 733-5083 or visit http://h2o.enr.state.nc.us/nps/czara.htm.

Implementation of Coastal Resources Commission 30-Foot Buffer Rules

In November 1999, the Coastal Resources Commission (CRC) enacted rules designed to protect coastal waters. The rules require a 30-foot buffer for new development along coastal shorelines in the 20 CAMA counties. The new rules became effective in August 2000. Visit http://dcm2.enr.state.nc.us/ for more information on these rules.

Stormwater Programs

In addition to the current NPDES stormwater permitting, DWQ is developing a permitting and program strategy to address the EPA proposed Phase II stormwater permitting program requirements. The Phase II program will be directed towards smaller municipalities and construction sites. At present, Phase II requirements will be handled with existing state staff. For more information on the state NPDES stormwater program, contact the Stormwater and General Permits Unit at (919) 733-5083.

DWQ administers a number of programs aimed at controlling stormwater runoff in the Chowan River basin. These include: 1) in the "coastal" counties as defined by the Coastal Area Management Act (CAMA); 2) NPDES stormwater permit requirements for industrial activities and municipalities; and 3) NPDES stormwater permit requirements for construction or land development activities on one acre of land or more. For more detailed information on current and proposed stormwater rules, refer to Section 2.7.

Recommendations for Local Governments, Community Groups and Chowan River Basin Citizens to Address Impacts

Because of limited resources and authority, the various state agencies listed above cannot completely address impacts to surface waters. Local governments, community groups and citizens often have more local knowledge and are directly affected by degraded water quality, and therefore, have a responsibility for protecting and restoring waters.

Local Governments

Local governments should consider water quality impacts in all aspects of government operations. Land use planning should discourage development in wetlands and areas draining to sensitive coastal areas. Land use plans should incorporate preservation and limited development of land adjacent to waters. Best management practices should be implemented during all land-disturbing activities to reduce runoff and delivery of contaminants to waters. Local governments should work together and with the NCDENR agencies to develop strategies for reducing sources and delivery of contaminants to waters.

Community Groups

Environmental groups, community organizations and fisherman groups should make efforts to address water quality issues by becoming involved. Attendance and participation in DWQ's Basinwide Planning Program, The Coastal Habitat Protection Planning Program, City Council meetings, County Commissioner and Planning Board meetings will be essential in addressing water quality issues.

Marina Operators

There are many marina areas on the coast and inland. Marina operators should enroll in programs like the Clean Marinas Program to minimize impacts of these activities on water quality. For more information on this program, visit the NC Marine Trade Association's webpage at http://www.ncmta.com/ or call (910) 962-3351.

4.5 Effects of Hurricanes on Water Quality

The Chowan River basin in North Carolina is periodically subjected to hurricanes and tropical storms. Aquatic ecosystems and water quality can, and do, recover from the wind damage and extensive flooding that result from these storms. However, human activities in hurricane-prone areas can greatly increase the extent and severity of water quality and ecosystem impacts, as well as the system's recovery time.

In September 1999, Hurricane Floyd made landfall in North Carolina, only a few days after Hurricane/Tropical Storm Dennis made two passes across the eastern part of the state. Flooding in eastern North Carolina was higher and more extensive than any ever recorded. Many towns and homes were completely flooded, bridges and buildings were washed downstream, animal waste lagoons breached, and wastewater treatment plants were inundated. Floyd resulted in more fatalities than any hurricane since 1972 and thousands were left homeless (Bales, 2000). In terms of water quality impacts, DWQ scientists note that the Pasquotank River basin did not experience hurricane-related fish kills in recent years as compared with the more southern areas such as the Neuse River and Cape Fear River basins (NCDENR-DWQ, 1999).

4.5.1 Contaminants

Floods can transport large amounts of materials from the land into surface waters, inundate areas that are contaminated with various substances, flood wastewater treatment facilities that may be located in or near the floodplain, and result in the failure of animal waste lagoons. The large volume of water transported during Hurricane Floyd demonstrated that flooding could result in the transport of a large mass of pollutants through watersheds and into the estuaries of eastern North Carolina. Pollutants that can be carried into waters during large floods include excess nutrients (nitrogen, phosphorus and organic carbon), bacteria and other pathogens, pesticides and fuels, and sediment. As a result of contamination by these pollutants, dissolved oxygen can be depleted, causing stress (or death) to fish and other aquatic life. Salt concentrations in the estuaries can also be affected by the large volume of freshwater flowing into the system within a short period of time.

4.5.2 De-Snagging

The Natural Resources Conservation Services' (NRCS) Emergency Watershed Protection (EWP) is responsible for emergency de-snagging (removal of piles of woody debris from stream and river channels) activities. The EWP program is intended to respond to watersheds impacted by natural disasters such as hurricanes, floods and fire. The purpose of the program is to restore watershed functions to predisaster conditions. Areas selected for debris removal are based on the amount and location of debris and the increased risk of flooding to improved property (including cropland), or public safety (primarily roads and bridges). Location maps and a description of all proposed work are sent to appropriate federal and state agencies for review and comment prior to contracting the work. The program's intent is to consider environmental concerns.

The activity of debris removal is of great interest to DWQ as the excessive removal of debris can impact the aquatic habitat and aquatic life within a stream reach. The decision to remove debris is made by considering topography, proximity of improved property subject to damage, location of culverts, bridges and other restrictions, comparison of costs and benefits, and potential environmental impacts. NRCS, along with other state and federal agencies, is in the process of developing guidelines for debris removal that will improve the decision-making process with regard to eligibility and damage thresholds, as well as improving the standards and specifications for removing woody debris in a manner that leaves enough to provide suitable habitat. Debris removal under EWP is not intended to remove all debris from stream channels, only that which causes or may cause an increased risk of flooding or streambank erosion.

Woody debris is the predominant habitat for benthic macroinvertebrates in larger, slower-moving coastal stream and wetland systems. Therefore, removal of these snags removes the habitat available for aquatic life. If care is not taken in properly removing woody debris, the streambanks and streambed can be altered as well as causing moderate to severe habitat degradation.

4.5.3 2002 Recommendations

DWQ is aware of the need to remove obstructions to water flow, including snags, near bridges or other structures in emergency situations because of safety concerns, to reduce economic loss in the event of natural disasters, and to reduce the risk of flooding. NRCS has recently adopted an Interagency Coordination and Implementation Plan for the EWP program that allows for a direct and ongoing role for several agencies to play in the implementation process. The method in which snags are removed, the amount of debris that is removed, and the sites selected should all be chosen following a thorough review by the various agencies responsible for the implementation of the EWP program. Local governments that receive additional funding for this type of activity should also implement the same management strategies as outlined in the EWP implementation plan to reduce impacts to water quality, aquatic habitat and aquatic life.

4.6 Wetland Loss

4.6.1 Introduction

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 away from streams also have important water storage capacity and pollutant removal potential. Section A, Part 2.6 contains more specific information on the ecological significance of wetlands in the Chowan River basin.

4.6.2 Physical Impacts to Wetlands and Streams

DWQ has issued approvals for wetland filling activities since the mid-1980s; however, in 1989, the Environmental Management Commission directed DWQ to begin reviewing wetland fill and stream alteration activities using a review sequence of (1) avoidance, (2) minimization, and (3) mitigation of wetland impacts. Rules finalized in 1996 required wetland values, such as whether or not the wetland is providing significant uses or whether the filling activity would remove or degrade those uses, be considered. The rules also specify wetland and stream mitigation ratios and type and location of projects to make the mitigation process more predictable and manageable for the regulated community. DWQ's emphasis continues to be on water quality and the essential role that wetlands play in maintaining water quality. The issuance of a 401 Water Quality Certification by DWQ is required before the US Army Corps of Engineers can issue a Section 404 Permit authorizing the fill or alteration of wetlands and/or streams in North Carolina.

Despite efforts to protect and restore wetland and stream functions on the part of DWQ and many other agencies and organizations in North Carolina, there is still an annual net loss of wetlands and streams statewide. DWQ and Division of Land Resources (DLR) regulate construction activities near streams and wetlands. These regulatory programs ensure that construction projects cause minimal damage to these resources and that unavoidable impacts are addressed through mitigation projects. Restoration projects are also funded through the Wetland Restoration Program (WRP), Section 319 Program, Clean Water Management Trust Fund, and Division of Water Resources Grant Program that can help offset stream and wetland impacts (NCDENR-DWQ-WRP, 1998).

DWQ tracks wetland and stream losses that are authorized through the issuance of a 401 Water Quality Certification. In addition to the permitted wetland and stream impacts that are tracked by DWQ, an unknown amount of permanent wetland and stream losses also occurs. Projects that affect less than one-third of an acre of wetland or less than 150 linear feet of stream are not required to receive written confirmation from DWQ, and therefore, might not be reported. The magnitude of unauthorized impacts to wetlands and streams is not known.

In June 1998, a federal court declared that the US Army Corps of Engineers' Tulloch Rule, which prohibited the ditching and draining of wetlands, was illegal. As a result, during FY 1999-2000, approximately 9,220 acres of wetlands on about 80 sites (mostly in southeastern NC) were ditched and drained. This activity stopped in March 1999 when DWQ began to enforce its wetland standards. DWQ, EPA and DLR have spent an extensive amount of time visiting each of these sites to check for compliance with environmental rules. Most of these wetlands were slated to be restored by December 2000.

Over the past six years (1995-2000), DWQ issued permits for approximately 90.59 acres of wetland fill and alteration activities in the Chowan River basin (Table A-29). Two of the largest projects occurred in the Chowan River subbasin 03-01-04, which includes Rockyhock Creek to the Albemarle Sound and involved 47.32 acres of permitted wetland impacts. NC Department of Transportation (DOT) requested a permit for wetland impacts associated with the US-17 construction in Chowan and Bertie counties. The permit affected approximately 26.17 acres in 1996. DOT was also responsible for the 19.86 acres affected in 1997 due to US-17 bridge construction activities in Bertie County. Most of the projects that occur in this basin which are associated with wetland permits do not have wetland impacts. Instead, the projects have stream impacts. Table A-30 provides summary information on the amount of permitted wetland mitigation activities in the basin.

Table A-29 Permitted Wetland Impacts Activities (in Acres) by Subbasin and Year

Subbasin Number	1995	1996	1997	1998	1999	2000	Total
03-01-01	3.49	1.12	0.79	1.16	2.4	1.04	**10.0**
03-01-02	17.99	1.81	2.06	1.58	0.9	0.07	**24.41**
03-01-03	0.06	0.01	0.1	0.2	0.9	0	**1.27**
03-01-04	0.7	27.17	20.15	0.37	4.85	1.67	**54.91**
Total Acres	**22.24**	**30.11**	**23.1**	**3.31**	**9.05**	**2.78**	**90.59**

Table A-30 Permitted Wetland Mitigation Activities (in Acres) by Subbasin and Year

Subbasin Number	1995	1996	1997	1998	1999	2000	Total
03-01-01	0.0	0.0	0.0	0.0	9.43	0.0	**9.43**
03-01-02	6.6	0.0	0.0	0.0	0.0	0.0	**6.6**
03-01-03	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
03-01-04	0.0	124.14	59.36	0.0	4.0	0.0	**187.5**
Total Acres	**6.6**	**124.14**	**59.36**	**0.0**	**13.43**	**0.0**	**203.53**

Overall, there have been 113 more acres of wetlands permitted for mitigation than for impacts in the basin. However, there have been some net losses in wetlands by year and by basin.

Comparing the number of acres of wetland impacts to the number of acres of wetland mitigation activities, each year there has typically been more wetland acres mitigated than impacts permitted. The years 1995, 1998 and 2000 are exceptions.

4.6.3 2002 Recommendations

Through protecting wetlands, local decision-makers can reduce the likelihood of nonpoint source contamination of surface waters. DWQ recommends that local governments consider the value of wetlands and include protection of wetlands in land use plans. DWQ will provide funding source information upon request to local governments for opportunities to restore, enhance or create wetlands.

4.7 Chowan River Basin Wastewater Discharger Issues

4.7.1 Chowan River Nutrient Sensitive Waters (NSW) Strategy

1997 Recommendations

Nutrient enrichment in the Chowan River basin continues to be a primary water quality concern. Since the application of the Nutrient Sensitive Waters (NSW) management strategy, reductions in nutrient loads have been achieved and algal blooms have been less frequent and shorter in duration. As of 1990, installation of control measures for agricultural nonpoint sources through the Agricultural Cost Share Program had resulted in a six percent reduction in North Carolina's total phosphorus input (DEM, 1990). Also, many point source discharges in the basin have converted their facilities to land application operations, reducing nutrient loads to the surface waters. Overall, as of 1990, the nitrogen reduction goal of 20 percent had been accomplished and total phosphorus had been reduced by 29 precent (goal of 35 percent).

Major points of the 1990 management strategy include:

- Reduction in phosphorus inputs from point and nonpoint sources by 35-40 precent
  - *Point Sources*
    - Land application systems for municipal wastewater treatment plants
    - Phosphorus limits of 1 mg/l in the North Carolina portion of the basin
  - *Nonpoint Sources*
    - Target funds from the Agriculture Cost Share Program to the Chowan River basin
- Reduction of nitrogen inputs from all sources by 20 percent
  - *Point Sources*
    - Land application systems for municipal wastewater treatment plants
    - Nitrogen limits of 3 mg/l in the North Carolina portion of the basin
  - *Nonpoint Sources*
    - Target funds from the Agriculture Cost Share Program to the Chowan River basin

The 1997 plan recommends continuing the 1990 NSW management strategy.

Current Status

Over $1,942,634 of Agriculture Cost Share funding has been directed toward the basin over the last five years. DWQ and the Division of Soil and Water Conservation continue to collaborate on efforts to protect and restore water quality in the Chowan River basin due to agricultural impacts. DWQ does not have flow data for the Chowan River, limiting DWQ scientists' ability to conduct long-term records of "load". DWQ continues to measure concentrations and document response measures.

All municipal POTWs have switched to non-discharge systems for treatment of domestic wastewater, and are required to meet total nitrogen and total phosphorus limits for new and expanding private systems that discharge nutrient-bearing wastes.

4.7.2 Discharges of Oxygen-Consuming Waste to Swamp Waters

Most of the freshwater in the Chowan River basin is swampy with naturally low dissolved oxygen (DO), low pH, and low or zero flow during summer months. Wastewater discharges that discharge effluent with high biological oxygen demand have the potential to further reduce DO in these swampy streams. Models to evaluate the impact of discharges to swamp streams have not been developed.

4.7.3 2002 Recommendations

The Chowan River NSW recommendations from 1997 will remain in effect. DWQ continues to issue permits for point sources using the NSW management strategy that involves nitrogen and phosphorus limits and land application requirements. DWQ will conduct a 15-year status analysis on nutrient reduction efforts in the Chowan River basin. Anticipated date of availability is 2005. The DWQ modelers and NPDES permittees will review the information, reevaluate current permit limitations, and revise as necessary based on this analysis.

DWQ will pursue reclassification of streams that have swampy characteristics to include the supplemental classification Sw that identifies the swampy nature of these streams. New and expanding discharges will be carefully considered on a case-by-case basis.

4.8 Priority Issues for the Next Five Years

4.8.1 Introduction

Clean water is crucial to the health, economic and ecological well-being of the state. Tourism, water supplies, recreation and a high quality of life for residents are dependent on the water resources within any given river basin. Water quality problems are varied and complex. Inevitably, water quality impairment is due to human activities within the watershed. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge. Looking to the future, water quality in this basin will depend on the manner in which growth and development occur.

The long-range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the Chowan River basin's surface waters. In striving towards its mission, DWQ's highest priority near-term goals are to:

- identify and restore impaired waters in the basin;
- identify and protect high value resource waters and biological communities of special importance; and
- protect unimpaired waters while allowing for reasonable economic growth.

4.8.2 Strategies for Restoring and Protecting Impaired Waters

Impaired waters are those waters identified in Section A, Chapter 3 as partially supporting (PS) or not supporting (NS) their designated uses based on DWQ monitoring data. These waters are summarized by subbasin in Table A-28 and indicated on Figure A-14. The impaired waters are also discussed individually in the subbasin chapters in Section B.

These waters are impaired, at least in part, due to nonpoint sources (NPS) of pollution. The tasks of identifying nonpoint sources of pollution and developing management strategies for these impaired waters are very resource intensive. Accomplishing these tasks are overwhelming, given the current limited resources of DWQ, other agencies (e.g., Division of Land Resources, Division of Soil and Water Conservation, Cooperative Extension Service, etc.) and local governments. Therefore, only limited progress towards restoring NPS impaired waters can be expected during this five-year cycle unless substantial resources are put toward solving NPS problems. Due to these restraints, this plan has no NPS management strategies for streams with NPS problems.

DWQ plans to further evaluate the impaired waters in the Chowan River basin in conjunction with other NPS agencies. After evaluation, the agencies will develop management strategies for a portion of these impaired waters for the next Chowan River Basinwide Water Quality Plan, in accordance with the requirements of Section 303(d) (see Part 4.8.3 below).

4.8.3 Addressing Waters on the State's 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a priority. The waters in the Chowan River basin that are on this list are presented in the individual subbasin descriptions in Section B. For information on listing requirements and approaches, refer to Appendix IV.

Section 303(d) of the federal Clean Water Act requires states to develop a 303(d) list of waters not meeting water quality standards or which have impaired uses. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not adequately been developed for specific impaired waters. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

There are approximately 2,387 impaired stream miles on the 303(d) list in NC. The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters.

Section B

Water Quality Data
and
Information by Subbasin

Chapter 1 -
Chowan River Subbasin 03-01-01
Includes the Upper Chowan River, Wiccacon River and Ahoskie Creek Watershed

1.1 Water Quality Overview

Subbasin 03-01-01 at a Glance

Land and Water

Total area:	579 mi^2
Land area:	569 mi^2
Water area:	10 mi^2

Population Statistics

1990 Est. pop.:	24,884 people
Pop. density:	44 persons / mi^2

Land Cover (%)

Forest / Wetland:	73%
Surface Water:	2%
Urban:	<1%
Cultivated Crop:	24%
Pasture / Managed Herbaceous:	1%

The upper Chowan River subbasin is located in the northeastern coastal plain of North Carolina. The Chowan River originates in Virginia and flows southeastward toward Albemarle Sound. The Chowan River is formed at the border of Virginia and North Carolina by the confluence of the Nottoway and Blackwater Rivers. The Chowan River basin includes 1,315 square miles in North Carolina, but the largest part of the drainage basin (3,575 mi^2) drain from Virginia. Major tributaries to the Chowan River in this subbasin include the Wiccacon River and Ahoskie Creek. A map of this subbasin including water quality sampling locations is presented as Figure B-1.

DWQ conducted ambient, benthic macroinvertebrate, fish tissue and fish community sampling in this subbasin. Bioclassifications for these sample locations are presented in Table B-1. The current sampling resulted in impaired ratings for one stream in this subbasin - Wiccacon River. Use support ratings are summarized in Table B-2. Refer to Appendix III for a complete listing of monitored waters and use support ratings. The entire subbasin is designated as Nutrient Sensitive Waters.

Portions of Merchants Millpond State Park and Chowan Swamp State Natural Area are also located in this subbasin. The Chowan Swamp State Natural Area, administered by the Department of Parks and Recreation, protects more than 6,000 acres. Merchants Millpond supports a diverse assemblage of aquatic herbs including several rare species.

The largest municipalities in this subbasin include Ahoskie, Aulander and Winton. Ahoskie and Aulander experienced a net decrease in population ranging from 0.3 percent to 26.6 percent between 1990 and 2000. Winton experienced a 20.1 percent increase over the same ten-year period. This is the most populated subbasin in the Chowan River basin with a population of 24,884.

Currently, five facilities hold NPDES permits in the subbasin, all of which are minor permits. There are no individual stormwater permits issued in the subbasin; however, there are 15 general permits. The Indalex facility, discharging into Ahoskie Creek, is the only facility required to

Figure B-1 Chowan River Subbasin 03-01-01

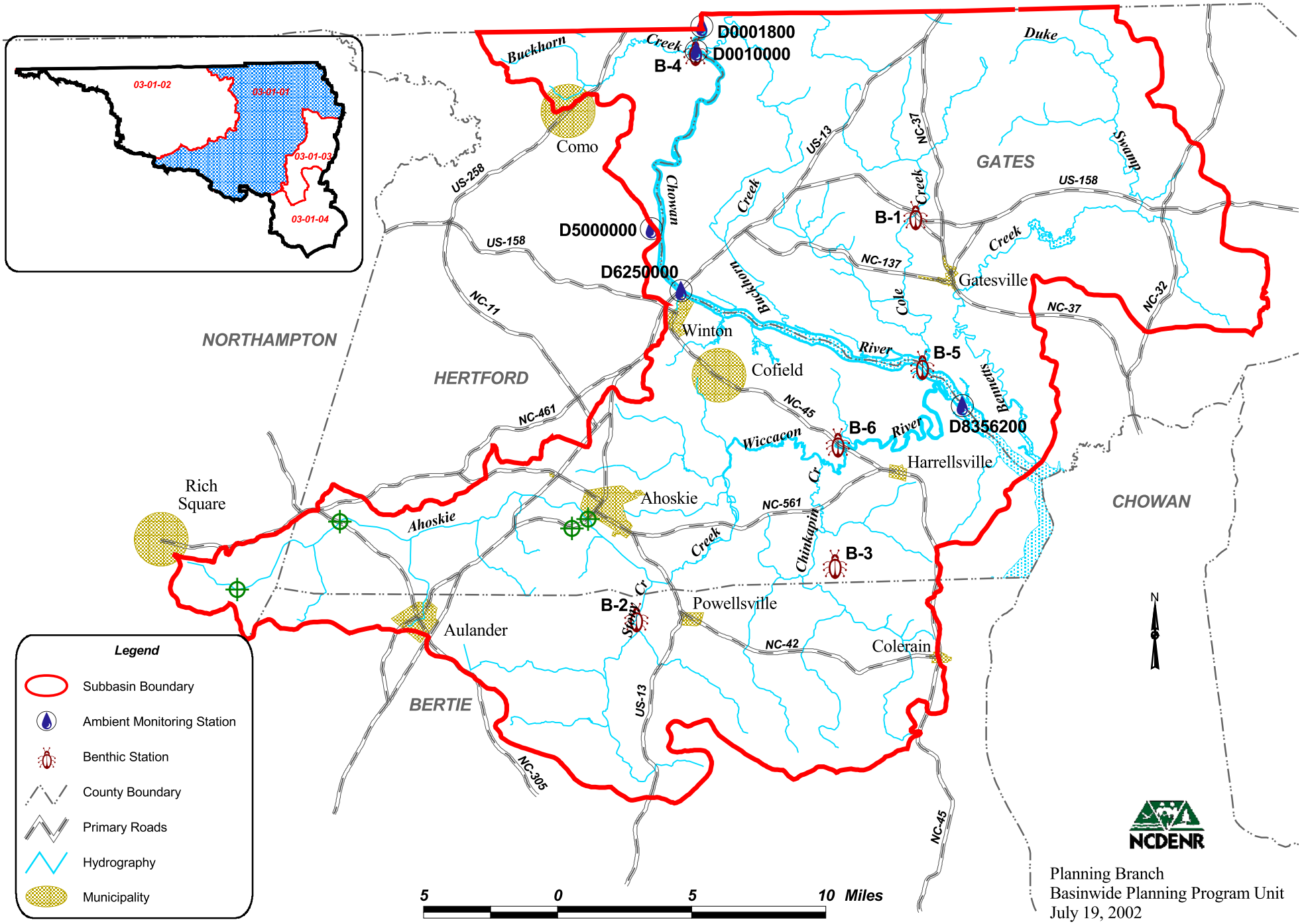


Table B-1 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (2000) for Chowan River Subbasin 03-01-01

Site(s)	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates (B)				
B-1	Cole Creek	Gates	NC 58	Not Rated
B-2	Stony Creek	Bertie	SR 1235	Not Rated
B-3	Chinkapin Creek	Hertford	SR 1432	Not Rated
B-4	Chowan River	Hertford	Near Riddicksville	Good-Fair
B-5	Chowan River	Gates	Near Gatesville	Good
B-6	Wiccacon River	Hertford	SR 1433	Fair
Fish Community (F)*				
F-1	Ahoskie Creek	Hertford	NC 42	Not Rated
F-2	Chinkapin Creek	Hertford	SR 1432	Not Rated
Ambient Monitoring				***Problem Parameters***
D0000050	Nottaway River	Riverdale, VA	US 258 near Riverdale, VA	DO
D0001200	Blackwater River	Southampton, VA	Horseshoe Bend at Cherry Grove, VA	DO
D0001800	Blackwater River	Gates	150 yards upstream from mouth near Wyanoke	DO
D0010000	Chowan River	Hertford	near Riddicksville	DO
D6250000	Chowan River	Hertford	US 13 at Winton	DO
D8356200	Chowan River	Hertford	CM 16 near Gatesville	None observed

* Refer to Section A, Part 3.3 for more information on fish community and benthic macroinvertebrate bioclassifications.

Table B-2 Use Support Ratings Summary (2000) for Monitored and Evaluated[2] Freshwater Streams (Miles) in Chowan River Subbasin 03-01-01

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/ Secondary Recreation	39.8	22.5	0	347.0	409.3
Fish Consumption[2, 3]	0	39.8	0	0	39.8
Primary Recreation	39.8	0	0	0	39.8

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

[2] For the fish consumption use support category, only monitored stream miles are presented.

[3] These waters are impaired because of a regional fish consumption advisory. Refer to Section A, Part 4.3 for further information.

perform whole effluent toxicity testing in the subbasin. The Indalex facility has met permit limits or target values prior to and during 2000.

Benthic macroinvertebrate data indicate water quality in the upper Chowan River is Good to Good-Fair. The recent benthic macroinvertebrate sampling indicate a slight decline in water quality since 1995, although the uppermost site remains Good-Fair. All of the sampling areas receive large amounts of agricultural runoff, and water quality problems are likely related to the low dissolved oxygen concentrations that occurred during the summer.

The Chowan River near the Gatesville site was sampled for the first time during the summer of 2000. There were very low dissolved oxygen concentrations in the bottom waters; however, scientists did not attribute this to either natural or anthropogenic conditions.

Three of the six benthic macroinvertebrate stations exhibit swamp-like characteristics, and they were sampled for the first time through the addition of a winter sampling period in 2000. Field assessments at Cole Creek, Stony Creek and Chinkapin Creek did not indicate any serious water quality problems.

Nutrient enrichment and low dissolved oxygen may cause water quality problems in the Wiccacon River, and the river is considered to be impaired. There has been no significant change over time in the benthic community of the Wiccacon River. The Wiccacon River benthic site may have anoxic bottom water at times; however, low dissolved oxygen concentrations also occurred throughout the water column. Data did not indicate any change in water quality from 1983 to 2000, and the benthic data resulted in a Fair bioclassification. The rating reflected upstream agricultural land use and many channelized tributaries.

Fish community structure was evaluated on Ahoskie Creek and Chinkapin Creek in 2000. However, NCIBI metrics are currently being revised; therefore, a biological rating was not assigned (see Section A, Chapter 3, Part 3.3.2 and Appendix II).

Twenty-six fish tissue samples were collected from the Chowan River near Tunis during August 2000 and analyzed for metal contaminants in order to obtain baseline data prior to the operation of the Nucor steel mill in Hertford County. Metals concentrations, except mercury, were non-detectable or at levels below current USEPA, USFDA and North Carolina criteria (Draft Basinwide Assessment Report 2001).

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report-Chowan River Basin* (NCDENR-DWQ, January 2002), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.ncu.us/bar.html or by calling (919) 733-9960.

1.2 Status and Recommendations for Previously Impaired Waters

The 1997 Chowan River Basinwide Plan identified three impaired stream segments in this subbasin. These streams are discussed below. This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives

recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each stream.

1.2.1 **Ahoskie Creek** (27.8 miles from source to Wiccacon River)

1997 Recommendations
Ahoskie Creek also known as Ahoskie Swamp or Bear Swamp (from source to Wiccacon River) was previously considered impaired. Its impairment was based on benthic macroinvertebrate and fish data. Nonpoint source pollution from agriculture and channelization were considered to be the probable cause of impairment. The 1997 basin plan recommended that the Nonpoint Source Team help clarify and characterize agricultural activities in the area and consider them for targeting of the team's remediation efforts.

Status of Progress
The Nonpoint Source Team chose against focusing on Ahoskie Creek and instead focused on broader issues that could impact the entire basin.

It has been determined that criteria for assigning a bioclassification to Ahoskie Creek were inappropriate. Currently the creek is not rated. Ahoskie Creek and its tributaries west of NC 13, as well as other streams have been channelized. In addition, some tributaries of Merchant's Millpond also have been channelized.

Benthic samples from Stony Creek and Chinkapin Creek, tributaries to Ahoskie Creek, did not indicate a problem with either enrichment or low dissolved oxygen.

2002 Recommendations
2000 biological sampling indicates that Ahoskie Creek and its tributaries west of NC 13, as well as other streams have been channelized. At the Ahoskie Creek benthic sampling site, the location had an impacted riparian zone on one side and poor instream habitat. Therefore, Ahoskie Creek remains a concern for the state. DWQ will work with the Division of Soil and Water Conservation to address the likely agricultural impacts to the creek. DWQ will also notify local agencies of water quality concerns regarding these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source program agency contacts are listed in Appendix VI.

1.2.2 **Wiccacon River (Hoggard Swamp)** (22.5 miles from source to Chowan River)

1997 Recommendations
Channelization, nonpoint source pollution from agricultural activities, and increasing number of animal operations are suspected to have contributed to impairment in the Wiccacon River. The 1997 basin plan recommended that the Nonpoint Source Team help clarify and characterize agricultural activities in the area and consider them for targeting of the team's remediation efforts.

Status of Progress
The Nonpoint Source Team chose against focusing on the Wiccacon River and instead focused on broader issues that could impact the entire basin.

Currently, the Wiccacon River is partially supporting aquatic life based on a Fair bioclassification at SR1433. The watershed is in agricultural land use and many of the tributary streams to the river are channelized.

2002 Recommendations
A progressive program to implement nonpoint source pollution controls is recommended to reduce the nutrient and sediment loading. Such a program will need to be developed and implemented at the local level. DWQ will provide technical assistance and funding information to local communities to assist in this effort. In addition, DWQ will notify local agencies of water quality concerns regarding these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding.

1.2.3 Merchants Millpond (Bennetts Creek)

1997 Recommendations
Due to an over abundance of aquatic weeds, the 1997 basin plan noted threats to the Millpond's designated uses (mostly canoeing and fishing). In an effort to combat the loss of use in the Millpond, it was recommended that the Nonpoint Source Team consider this area as a target for some of its future efforts in order to prevent any further degradation.

Status of Progress
The Nonpoint Source Team did not choose the Millpond as an area of focus; instead, the team focused on broader issues that could impact the entire basin. Merchants Millpond is currently not rated.

2002 Recommendations
A progressive program to implement nonpoint source pollution controls is recommended to reduce the nutrient and sediment loading. Such a program will need to be developed and implemented at the local level. DWQ will provide technical assistance and funding information to local communities to assist in this effort. In addition, DWQ will notify local agencies of water quality concerns regarding these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding.

1.3 Status and Recommendations for Newly Impaired Waters

There are 39.8 freshwater miles which are partially supporting that were monitored for fish consumption. All waters in this subbasin are currently partially supporting (PS) on an evaluated basis in the fish consumption use support category because of a regional fish consumption advisory for shark, swordfish, king mackerel, tilefish, largemouth bass, bowfin (or blackfish), and chain pickerel (or jack). Refer to page 55 for more information on this issue.

1.4 Other Water Quality Impacts and Recommendations

The surface waters discussed in this section are fully supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not considered impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found in Section A, Part 3.5.

Water quality problems in the Chowan River basin are varied and complex. Inevitably, many of the water quality impacts noted are associated with human activities within the watershed. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for the waters discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source program agency contacts are listed in Appendix VI.

1.4.1 **Upper Chowan River** (1.8 miles from Virginia state line to Near Riddicksville)

The upper Chowan River was considered support threatened in the 1997 plan due to a stressed aquatic system that experienced threats of algal blooms.

1997 Recommendations

Because the upper Chowan bridges both Virginia and North Carolina, the recommendation was for North Carolina to improve communication with Virginia to promote actions to reduce nutrient levels entering the state from the headwaters.

The abandoned CF Industries fertilizer plant has been associated with contaminated groundwater due to the plant's operation. The state has been concerned about potential groundwater seepage into the Chowan River which is susceptible to algal blooms under certain conditions. Groundwater chromium levels were found in sufficient quantities to trigger the Resource Conservation and Recovery Act (RCRA), but with respect to water quality, the nutrients contained in the waste presented a continued concern. DWQ was working to finalize the non-discharge permit with CF Industries to allow for groundwater remediation.

Status of Progress

DWQ recommended improving communication with the State of Virginia in order to promote actions to reduce nutrient levels crossing over the state border. North Carolina has actively pursued interstate collaboration through working towards a Memorandum of Agreement (MOA) between the two states. Instituted through the Albemarle-Pamlico National Estuary Program, North Carolina signed a MOA with Virginia's Department of Conservation and Recreation in October 2001. In addition, both states have jointly funded a Watershed Field Coordinator

position to facilitate discussions regarding the Albemarle, Chowan and Coastal Watersheds (see Section C for more information).

Since the 1997 plan, DWQ has finalized and issued a non-discharge permit to CF Industries for groundwater remediation by extraction and land application. The facility, characterized as a Superfund site, has a clay wall built around the site to minimize further groundwater seepage. During the last ten years, there have been flows above the level of the dyke; however, recent efforts have reduced the water overflow challenges and the groundwater has stabilized below the dyke. The DWQ Washington Regional Office remains in communication with the Division of Solid and Hazardous Waste to ensure permit limits are adhered to.

2002 Recommendations

In an effort to solidify the interstate efforts currently underway, the two states will begin to implement the MOA. In addition, Virginia and North Carolina should continue to fund the Watershed Field Coordinator position through the NC Albemarle-Pamlico National Estuary Program to ensure the continuity and stabilization of this effort.

DWQ should remain abreast of activities in Virginia towards developing a watershed-based forum for water quality in the upper Chowan, part of Virginia's Watershed Conservation Roundtable effort. Once this effort is underway, DWQ should participate in the discussions, share data and management strategies, and foster interstate basin management as much as feasible.

The Chowan River had 1.8 miles listed on the state's Section 303(d) list as having low dissolved oxygen potentially due to agriculture, intensive animal feeding operations, or natural swamp conditions. DWQ will determine whether the low DO is due to natural conditions. The upper Chowan River is one of two stream segments selected in the Chowan River basin to undergo the Swamp Waters Study Plan. If the study indicates that the low pH values and DO concentrations in the upper Chowan River are due to natural conditions, DWQ staff will pursue removing the river from the Section 303(d) List and submit a request for reclassification of the river from C NSW to C NSW Sw.

For more information on the Swamp Waters Study Plan, contact the DWQ Planning Branch Modeling/TMDL Unit at (919) 733-5083 or visit the program's website at http://h2o.enr.state.nc.us/tmdl/.

1.5 Additional Issues of Concern within the Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in the Chowan River basin. Permitted wastewater dischargers, non-permitted wastewater dischargers, priority areas for conservation and priority areas for restoration were all identified by participants at the public workshop as significant issues in the Chowan River basin.

1.5.1 NPDES Facilities

DWQ reviews NPDES effluent data by analyzing monthly averages of water quality parameters over a two-year period, screening for criterion in excess of state standards for conventional and toxic pollutants. Three NPDES permit holders in the subbasin violated their monthly discharge limitations during this period.

The Gates County School located at Buckland exceeded its fecal coliform limits by greater than 40 percent in the fourth quarter of 1998 and the first quarter of 1999. In addition, the facility exceeded its limitations by 20 percent in four months over the two quarters. The T.S. Cooper Elementary School operated by the Gates County School System exceed its ammonia limits by greater than 40 percent over the first and second quarters of 1999. In addition, the facility exceeded its limits by 20 percent in five months over the same two quarters. The facilities are operational; however, they have maintenance challenges. DWQ has levied fines and has established a record of chronic noncompliance, but DWQ does not recommend issuing a Special Order by Consent (SOC) to remedy the noncompliance issues. Instead, DWQ's Washington Regional Office will continue to provide technical assistance to the schools.

Indalex, Incorporated exceeded its total suspended solid limits by greater than 40 percent in the third and fourth quarters of 1999.

1.5.2 Non-Discharge Facilities

There have been both public and governmental concerns about the construction and maintenance of wastewater and industrial waste infrastructure. The sanitary waste that is going to the Winton Wastewater Treatment Plant from Nucor is within tolerance. Apparently, the water quality concerns associated with Nucor are more focused on the industrial waste for which a lagoon must be constructed. DWQ also has concerns about the planned construction of the lagoon.

DWQ's Washington Regional Office will continue to work with Nucor on their lagoon site plans, construction and operation. Nucor should aim to provide more information to the public about its facility to address some of the public's concern about the plant's operation.

Chapter 2 -
Chowan River Subbasin 03-01-02
Includes the Meherrin River and Potecasi Creek Watershed

2.1 Water Quality Overview

Subbasin 03-01-02 at a Glance

Land and Water

Total area:	494 mi^2
Land area:	491 mi^2
Water area:	3 mi^2

Population Statistics

1990 Est. pop.:	22,713 people
Pop. density:	46 persons / mi^2

Land Cover (%)

Forest / Wetland:	65%
Surface Water:	<1%
Urban:	<1%
Cultivated Crop:	32%
Pasture / Managed Herbaceous:	1%

This subbasin includes the Meherrin River and its tributary streams, the largest of which is Potecasi Creek. The Meherrin flows into North Carolina from Greensville County, Virginia. A map of this subbasin including water quality sampling locations is presented as Figure B-2.

DWQ collected ambient, benthic macroinvertebrate and fish community sampling in this subbasin. Bioclassifications for these sample locations are presented in Table B-3. Table B-4 summarizes use support ratings in subbasin 03-01-02. Refer to Appendix III for a complete listing of monitored waters and use support ratings. The entire subbasin is designated as Nutrient Sensitive Waters.

Significant natural heritage areas are located within the watershed, including the Meherrin River Swamp and Meherrin River Slopes and Swamp.

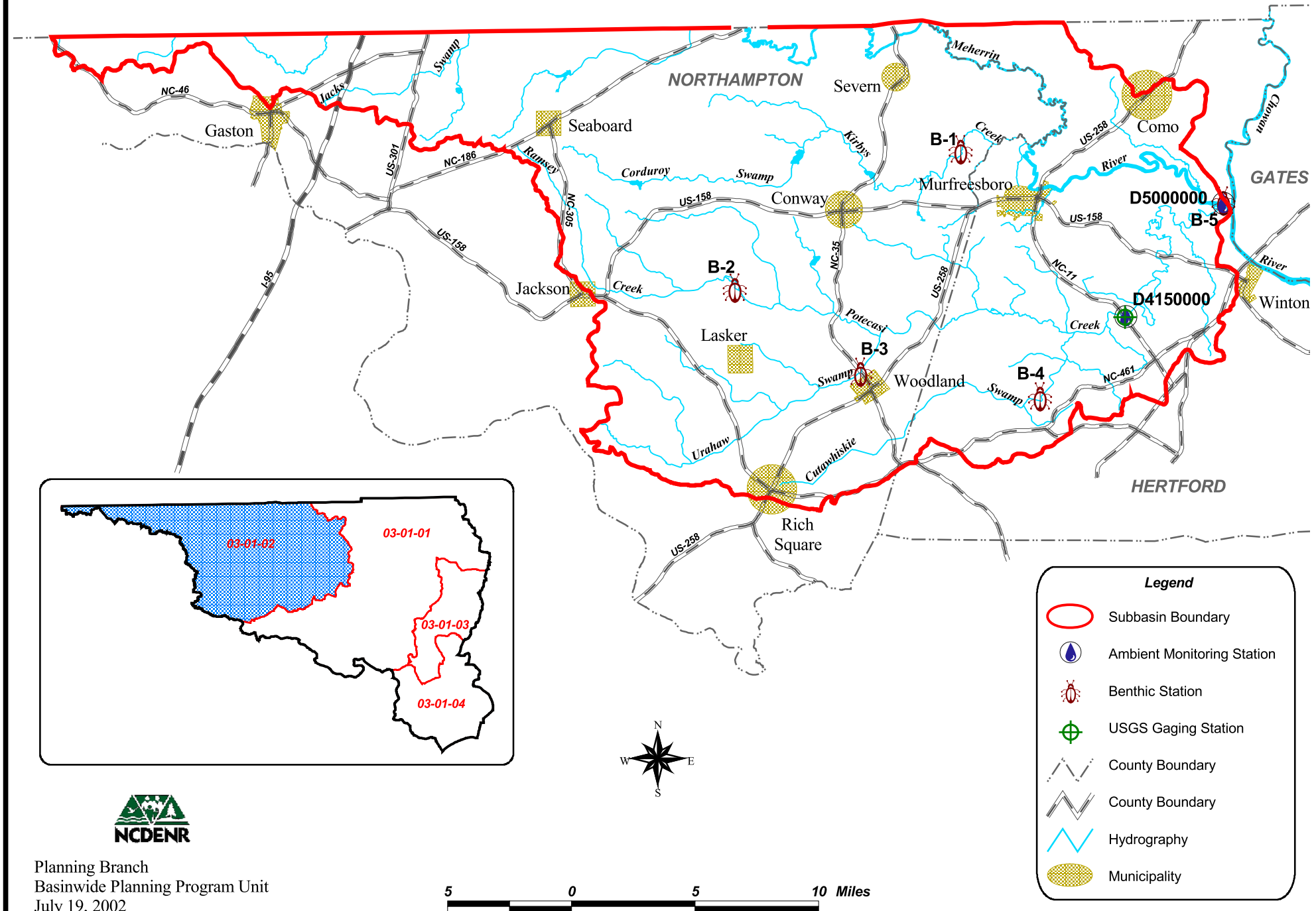
The largest municipalities in this subbasin include Murfreesboro, Gaston and Rich Square. Each of these municipalities experienced a net decline in population over the 1990 to 2000 time period. This subbasin is the second most populated subbasin in the Chowan River basin, and it has a population density at 46 persons/square mile.

There are no NPDES facilities in this subbasin. However, there is one individual stormwater permit issued to Georgia-Pacific Resins, Inc. and seven general permits in the area.

Benthic macroinvertebrate field sampling indicated Good water quality in the Meherrin River. Kirbys Creek, Potecasi Creek, Urahaw Swamp and Cutawhiskie Creek were sampled but not rated.

Although bioclassifications were not given to several streams in the subbasin, habitat degradation was noted during field visits. Severe stress was noted at both the Potecasi Creek and Urahaw Swamp sites. Cutawhiskie Swamp had moderate to severe bank erosion, little canopy and a narrow riparian zone on one bank.

Figure B-2 Chowan River Subbasin 03-01-02



NCDENR

Planning Branch
Basinwide Planning Program Unit
July 19, 2002

Table B-3 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (2000) for Chowan River Subbasin 03-01-02

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1	Kirbys Creek	Northampton	SR 1362	Not Rated
B-2	Potecasi Creek	Northampton	SR 1504	Not Rated
B-3	Urahaw Swamp	Northampton	NC 35	Not Rated
B-4	Cutawhiskie Swamp	Hertford	SR 1141	Not Rated
B-5	Meherrin River	Hertford	SR 1175	Good
Fish Community*				
F-1	Cutawhiskie Swamp	Hertford	SR 1141	Not Rated
Ambient Monitoring				***Problem Parameters***
D4150000	Potecasi Creek	Hertford	near Union	DO
D5000000	Meherrin River	Hertford	at SR 1175 near Como	DO

* Refer to Section A, Part 3.3 for more information on fish community and benthic macroinvertebrate bioclassifications.

Table B-4 Use Support Ratings Summary (2000) for Monitored and Evaluated[2] Freshwater Streams (Miles) in Chowan River Subbasin 03-01-02

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/ Secondary Recreation[2]	45.5	0	0	241.0	286.5
Primary Recreation	11.7	0	0	1.9	13.6

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

[2] These waters are impaired because of a regional fish consumption advisory. Refer to Section A, Part 4.3 for further information.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report-Chowan River Basin* (NCDENR-DWQ, January 2002), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.ncu.us/bar.html or by calling (919) 733-9960.

2.2 Status and Recommendations for Previously Impaired Waters

The 1997 Chowan River Basinwide Plan identified two impaired stream segments in this subbasin. This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for these streams.

2.2.1 **Potecasi Creek** (45.6 miles from source to NC 11 near Union)

1997 Recommendations
Potecasi Creek had Fair water quality as described in the 1997 plan. The impairment source was thought to be nonpoint source runoff from agriculture (especially increasing numbers of animal operations) and channelization. The 1997 basin plan also noted that the low pH values and DO concentrations found in the creek could be due to natural conditions. Due to the nonpoint source pollution issues, the 1997 basin plan recommended that the Nonpoint Source Team help clarify and characterize agricultural activities in the area and consider them for targeting of the team's remediation efforts.

Status of Progress
Potecasi Creek is currently not rated. The Nonpoint Source Team chose against focusing on Potecasi Creek and instead focused on broader issues that could impact the entire basin.

2002 Recommendations
DWQ will conduct field evaluations to determine if DO and pH characteristics are associated with naturally occurring swamp conditions. In addition, DWQ will provide a compilation of specific criteria that may help in identifying streams that should be recognized as having swamp characteristics (NCDENR-DWQ, 2000). Potecasi Creek is one of two waterbodies selected in the Chowan River basin to undergo the Swamp Waters Study Plan.

For more information on the Swamp Waters Study Plan, contact the DWQ Planning Branch Modeling/TMDL Unit at (919) 733-5083 or visit the program's website at http://h2o.enr.state.nc.us/tmdl/.

A progressive program to implement nonpoint source pollution controls is recommended to reduce the nutrient and sediment loading. Such a program will need to be developed and implemented at the local level. DWQ will provide technical assistance and funding information to local communities to assist in this effort. DWQ will notify local agencies of water quality concerns regarding these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding.

2.2.2 **Cutawhiskie Creek** (17.8 miles from source to SR1141, Hertford)

1997 Recommendations
Cutawhiskie Creek had Fair water quality associated with nonpoint source runoff from agriculture (especially increasing numbers of animal operations) and channelization. The 1997 basin plan recommended that the Nonpoint Source Team help clarify and characterize agricultural activities in the Cutawhiskie Creek area and consider them for targeting of the team's remediation efforts.

Status of Progress
Cutawhiskie Creek is currently not rated. The Nonpoint Source Team chose against focusing on Cutawhiskie Creek and instead focused on broader issues that could impact the entire basin.

2002 Recommendations

A progressive program to implement nonpoint source pollution controls is recommended to reduce the nutrient and sediment loading. DWQ scientists noted that Cutawhiskie Creek had several habitat degradation issues including channelization, riparian zone impacts and erosion.

DWQ will continue to work with the Division of Soil and Water Conservation as well as local governments to minimize channelization impacts on local water quality. In addition, DWQ will provide educational materials upon request to the public regarding riparian zone maintenance. Such a program will need to be developed and implemented at the local level. DWQ will provide technical assistance and funding information to local communities to assist in this effort. In addition, DWQ will notify local agencies of water quality concerns regarding these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding.

2.3 Status and Recommendations for Newly Impaired Waters

No additional stream segments were rated as impaired based on recent DWQ monitoring (1995-2000).

Chapter 3 -
Chowan River Subbasin 03-01-03
Includes Catherine Creek to Rockyhock Creek

3.1 Water Quality Overview

Subbasin 03-01-03 at a Glance

Land and Water

Total area:	123 mi^2
Land area:	100 mi^2
Water area:	23 mi^2

Population Statistics

1990 Est. pop.:	4,731 people
Pop. density:	47 persons / mi^2

Land Cover (%)

Forest / Wetland:	40%
Surface Water:	19%
Urban:	<1%
Cultivated Crop:	40%
Pasture / Managed Herbaceous:	<1%

This subbasin contains the middle section of the Chowan River, above Rockyhock Creek and below Bennett Creek, including the Indian Creek and Catherine Creek tributaries. A map including water quality sampling locations is presented as Figure B-3.

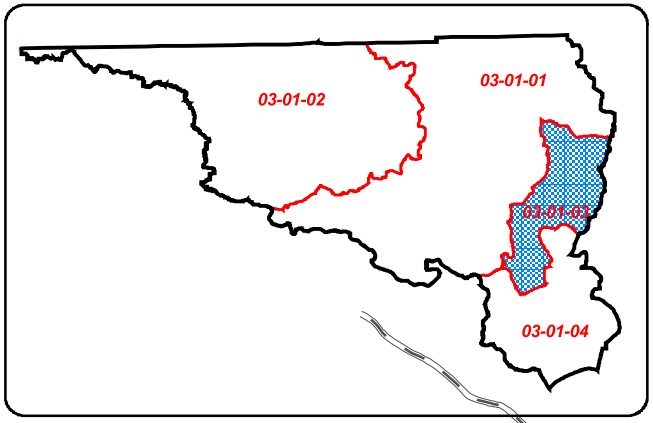
DWQ has not conducted biological sampling in this subbasin; however, DWQ does collect ambient sampling data. In addition, International Paper conducts fish tissue monitoring. Use support ratings are summarized in Table B-6. Refer to Appendix III for a complete listing of monitored waters and use support ratings.

The entire subbasin is designated as Nutrient Sensitive Waters. This subbasin contains the Colerain/Cow Island Swamp and Slopes Natural Heritage Areas. Perhaps the most important wetland community in this Chowan River basin is Tidal Cypress-Gum Swamp, which is found along much of the shoreline of the Chowan River.

The largest municipality in the subbasin is Colerain with a population of approximately 221 persons. Colerain experienced a net decrease in population of 8 percent between 1990 and 2000. According to 1990 census data, this is the least populated subbasin in the Chowan River basin with a population of 4,731. This subbasin closely compares to the basin population density average of 47 persons/square mile.

There are currently two NPDES permit holders in the basin, one minor and one major. In addition, there exist three facilities with individual stormwater permits. United Piece Dye Works is required to conduct whole effluent toxicity testing. The facility experienced failing chronic toxicity tests in the fall of 1998. Though no absolute cause-effect relationship was established, removal of algal growth in the wastewater treatment plant seemed to solve the toxicity problem. The facility has not failed a test since September 1998.

Figure B-3 Chowan River Subbasin 03-01-03



NC-37
NC-32
Walton Pond
Creek
GATES
Trotman
Warwick
Creek
Creek
NC-45
NC-561
HERTFORD
D8430000
NC-37
Chowan
Indian
PERQUIMANS
BERTIE
NC-42
Colerain
NC-32
CHOWAN
D8950000
River

N
W
E
S

Legend

- Subbasin Boundary
- Ambient Monitoring Station
- Benthic Station
- USGS Gaging Station
- County Boundary
- Private Roads
- Municipality

5 45 0 5 Miles

NCDENR

Planning Branch
Basinwide Planning Program Unit
July 19, 2002

Table B-5 DWQ Monitoring Locations (2000) for Chowan River Subbasin 03-01-03

Site	Stream	County	Location	Problem Parameter
Ambient Monitoring				
D8430000	Chowan River	Chowan	200 yards downstream Holiday Island	None observed
D8950000	Chowan River	Bertie	at Colerain	None observed

* Refer to Section A, Part 3.3 for more information on fish community and benthic macroinvertebrate bioclassifications.

Table B-6 Use Support Ratings Summary (2000) for Monitored and Evaluated[2] Freshwater Streams (Miles) in Chowan River Subbasin 03-01-03

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/ Secondary Recreation[2]	14.1 miles	0	0	16.8 miles	30.9 miles
Primary Recreation	14.1 miles	0	0	12.8 miles	26.9 miles

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

[2] These waters are impaired because of a regional fish consumption advisory. Refer to Section A, Part 4.3 for further information.

International Paper, formerly Union Camp, conducts fish tissue monitoring. Historical samples indicated significant dioxin contamination, especially in catfish, but recent samples along the lower Chowan appear to be decreasing due to facility improvements. A fish consumption advisory was lifted in 2000 after dioxin in fish tissue concentrations were shown to be at safe levels for 1998-1999. Refer to Section A, Part 4.3 for more information on this issue.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report-Chowan River Basin* (NCDENR-DWQ, January 2002), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.ncu.us/bar.html or by calling (919) 733-9960.

3.2 Status and Recommendations for Previously Impaired Waters

The 1997 Chowan River Basinwide Plan identified one segment of the Chowan River as impaired in this subbasin. This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for this stream segment.

3.2.1 **Chowan River** (5.5 miles from below Holiday Island near Harrellsville to Marker 17 at Colerain)

1997 Recommendations

In the 1997 Chowan River Basin Plan, this portion of the Chowan River was noted to have continued problems with nuisance algal blooms related to excess nutrients and low pH levels. Although the NSW management strategy had been in place since 1982, DWQ recommended the need for continued implementation of the NSW management strategy, specifically focusing on reducing nutrient inputs from nonpoint sources of pollution.

The 1997 basin plan noted that Chowan River from the Virginia Border to the Albemarle Sound (at Highway 17 bridge) was under a fish consumption advisory since 1990 for all fish except herring, shellfish and shad (including roe). Refer to page 56 for more information on this issue.

Status of Progress

The Chowan River in this subbasin is currently fully supporting. Reduction in nutrient inputs has led to a steady decline in both the frequency and intensity of algal blooms. This trend is evident in comparing recent phytoplankton data from the Chowan River near Colerain (1995-2000) to data from 1990-1994 (NCDENR, 1997). Only a single bloom occurred in July 1998 during the last five years while two nuisance blooms were reported from 1990-1994.

2002 Recommendations

DWQ continues to issue permits for point sources using the NSW management strategy that involves nitrogen and phosphorus limit and land application requirements. DWQ scientists will conduct a 15-year status analysis on nutrient reduction efforts in the Chowan River basin, publishable in 2005. The DWQ Modelers and NPDES Permitters will review the information, reevaluate current permit limitations, and revise as necessary.

3.3 Status and Recommendations for Newly Impaired Waters

No additional stream segments were rated as impaired in this subbasin based on recent DWQ monitoring (1995-2000).

Chapter 4 -
Chowan River Subbasin 03-01-04
Includes Rockyhock Creek to Albemarle Sound

4.1 Water Quality Overview

Subbasin 03-01-04 at a Glance

Land and Water

Total area:	177 mi^2
Land area:	152 mi^2
Water area:	45 mi^2

Population Statistics

1990 Est. pop.:	10,146 people
Pop. density:	67 persons / mi^2

Land Cover (%)

Forest / Wetland:	41%
Surface Water:	25%
Urban:	<1%
Cultivated Crop:	31%
Pasture / Managed Herbaceous:	2%

This subbasin includes a small northwest portion of the Albemarle Sound, including Salmon Creek, Edenton Bay, Pembroke Creek and the west side of the mouth of the Chowan River, below US 17. A map including water quality sampling locations is presented as Figure B-4.

DWQ conducted ambient, phytoplankton and benthic sampling in this subbasin. Bioclassifications for these sample locations are presented in Table B-7. Table B-8 summarizes uses support ratings for subbasin 03-01-04. Refer to Appendix III for a complete listing of monitored waters and use support ratings.

This subbasin contains portions of the Chowan Game Land, a track managed by the Wildlife Resources Commission. This property is one of four publicly-owned conservation lands in the subbasin.

The subbasin population, based on 1990 census data, is 10,146. It has a population density at 67 persons/square mile, making it the most densely populated subbasin in the entire Chowan River basin. Edenton is the largest municipality in the subbasin with a population of 5,394. Between the years of 1990 and 2000, Edenton grew by approximately 2.4 percent.

Currently there are four NPDES minor permits and nine general permits. No facilities are required to conduct whole effluent toxicity testing under their permit conditions.

Benthic macroinvertebrate sampling indicated that the water quality in the Chowan River near Edenton has generally remained Good-Fair since 1983. A swamp sample at Eastmost Swamp, a tributary to Salmon Creek, did not indicate any major water quality problems. DWQ sampled Eastmost Swamp, a swamp stream that may receive rapid runoff from adjacent agricultural land. Data did not indicate that enrichment is a problem. However, habitat degradation was noted, including channelization and lack of pools.

Figure B-4 Chowan River Subbasin 03-01-04

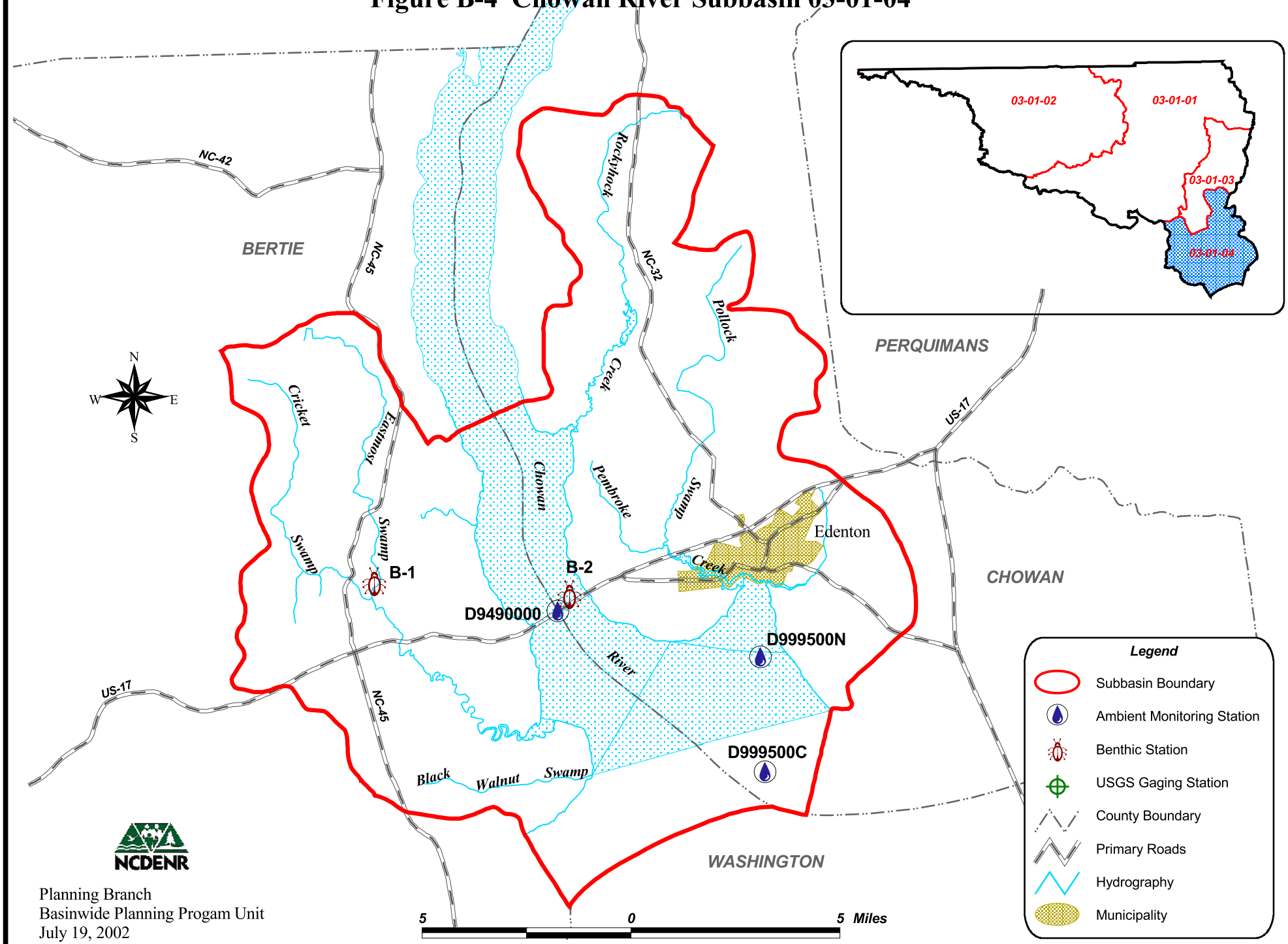


Table B-7 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (2000) for Chowan River Subbasin 03-01-04

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1	Eastmost Swamp	Bertie	SR 1361	Not Rated
B-2	Chowan River	Chowan	US 17	Good-Fair
Ambient Monitoring				***Problem Parameter***
D9490000	Chowan River	Bertie	at Edenhouse	None observed
D999500C	Albemarle Sound	Chowan	near Edenton mid channel	None observed
D999500N	Albemarle Sound	Chowan	near Edenton north shore	None observed
D999500S •	Albemarle Sound	Chowan	near Edenton south shore	None observed

• Station not shown on map.

* Refer to Section A, Part 3.3 for more information on fish community and benthic macroinvertebrate bioclassifications.

Table B-8 Use Support Ratings Summary (2000) for Monitored and Evaluated[2] Freshwater Streams (Miles) in Chowan River Subbasin 03-01-04

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/ Secondary Recreation[2]	7.8 miles *	0	0	68.1 miles	75.9 miles
Primary Recreation	7.8 miles	0	0	17.3 miles	25.1 miles

* 15,600.4 acres of Albemarle Sound – FS.

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

[2] These waters are impaired because of a regional fish consumption advisory. Refer to Section A, Part 4.3 for further information.

In comparing 1995-2000 data to 1980-1994 data, algal blooms have experienced a steady decline in frequency and intensity. Only two blooms of nuisance blue-green algae were reported from 1990-1994, while only one blue-green bloom occurred during 1995-2000. Throughout the last five-year sampling period, phytoplankton biovolumes were relatively low. High biovolumes occurred in August 1999 and July 2000.

DWQ did not collect fish tissue samples in this basin. However, high concentrations of metals (especially copper) have been reported (Riggs et al., 1993) for some sites in Edenton Bay near marinas. This study determined the concentrations and distributions of heavy metals and phosphorus pollutants associated with organic-rich muds in the Albemarle estuarine system. The temporal impacts of agriculture, urbanization and industry were determined, as were the interrelationships between sediment/water column interactions and resultant chronic effects of heavy metals on the estuarine system.

The Division of Environmental Health's Recreational Waters Testing Program conducts sampling on the Chowan River at the Mount Gould Lodge site. There were no advisories posted for this sampling site. Therefore, the 0.2 miles (1.4 acres in radius) of the Class SB waters around the site are fully supporting their primary recreation use.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report-Chowan River Basin* (NCDENR-DWQ, January 2002), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.ncu.us/bar.html or by calling (919) 733-9960.

4.2 Status and Recommendations for Previously Impaired Waters

The 1997 Chowan River Basinwide Plan identified one segment of the Chowan River impaired in this subbasin. This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for these stream segments.

4.2.1 **Chowan River** (14.5 miles from Colerain to US Highway 17 at Edenhouse)

1997 Recommendations

The 1997 basin plan identified the mainstem of the Chowan River as impaired due to nutrient concerns. In an effort to address the excess nutrient concerns, DWQ recommended that United Piece Dye Works (UPDW) submit the results of their study on the bioavailability of nitrogen in the river. In addition, the state recommended that UPDW continue annual studies on nitrogen bioavailability to determine the changes in nitrogen when different dyes are used. Finally, the 1997 plan recommended that UPDW perform an economic feasibility report on the costs of reducing total nitrogen from 20 mg/l to 3 mg/l.

Status of Progress

UPDW submitted their economic feasibility report to DWQ in 1997. This information will be informative during the NPDES permit reissuance process. DWQ reissued the NPDES permit in1998 with total nitrogen (TN) mass limits (based on 5.5 mg/l and HB 515 requirements) beginning after January 1, 2003. Until that time, UPDW has a TN limit of 20 mg/l. Preliminary feedback indicated that UPDW may seek a variance to the TN mass limit based on bioavailability issues. However, as of January 2001, DWQ has not received any additional information to support a variance. This segment of the Chowan River is currently fully supporting.

2002 Recommendations

If UPDW seeks a variance on the new total nitrogen mass limits, DWQ should foster an interoffice discussion to ensure that the NPDES staff, regional water quality staff, modeling staff and basinwide planning staff are fully abreast of the proposal and variance ramifications on water quality.

4.3 Status and Recommendations for Newly Impaired Waters

No additional stream segments were rated as impaired in this subbasin based on recent DWQ monitoring (1995-2000).

4.4 Other Issues and Recommendations

The surface waters discussed in this section are fully supporting designated uses based on recent DWQ monitoring; however, these data revealed some impacts to water quality. Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended.

4.4.1 Projected Population Growth

Growth management within the next five years will be imperative in order to maintain good water quality in this subbasin. Growth management can be defined as the application of strategies and practices that help achieve sustainable development in harmony with the conservation of environmental qualities of an area. On a local level, growth management often involves planning and development review requirements that are designed to maintain or improve water quality. Refer to Section A, Part 4.4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

4.4.2 NPDES Facilities

The Town of Edenton treats its wastewater in a lagoon/land application wastewater treatment plant that is currently under a Special Order by Consent (SOC) issued by the state. The SOC requires expansion of the wastewater treatment plant or reduction of flow by collection system structural improvements.

The Chowan County Water Plant at Valhalla discharges saline backwash to a nearby unlined DOT borrow pit. The public has informed DWQ that the local groundwater is getting saltier due to the discharge. Chowan County is working towards rerouting the discharge point to below the nearby millpond and directly discharging the saline effluent. DWQ recommends a full permit review because of the change in the discharge location. DWQ will work with the local landowners, county and Division of Water Resources regarding the discharge permit location.

Section C

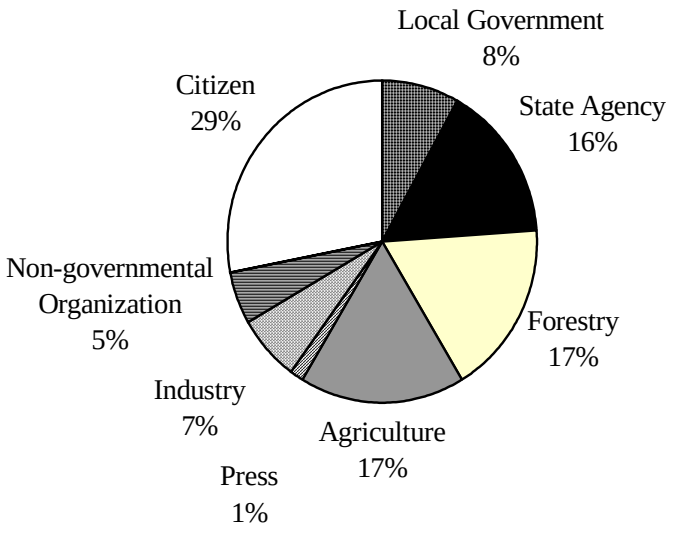
Current and Future Water Quality Initiatives

Chapter 1 -
Current Water Quality Initiatives

1.1 Workshop Summaries

Two workshops were held in the Chowan River basin in Edenton and Ahoskie in March 2001. The Albemarle-Pamlico National Estuary Program's Chowan Regional Council and the NC Cooperative Extension Service sponsored the workshops. There were 75 people in attendance representing a wide variety of interests.

Chowan River Basin Workshops 2001



DWQ staff gave presentations about basinwide planning and an overview of recommendations in the 1997 plan and what has been accomplished since. Representatives from other state agencies and several local initiatives spoke, including the Wetlands Restoration Program, the Albemarle-Pamlico Citizen's Water Quality Monitoring Program, Chowan College's Monitoring Program, Arrowhead Beach's Monitoring Program, and the Albemarle-Pamlico National Estuary Program's Chowan Regional Council. In addition to the presentations, several local initiatives shared information about their programs through written materials. Workshop attendees were asked to discuss the following questions in small groups:

1) *What are the main threats to water quality in the basin?*
2) *Where are the problem areas or waters? And what recommendations do you have for addressing these problem areas/waters?*
3) *Who should address the problems? (i.e., local agencies, organizations, etc.)*

The discussion on these questions was very productive. Comments and responses were recorded. A general summary providing common ideas and viewpoints expressed by more than one group is presented below. DWQ considered these comments while drafting the revised Chowan River Basinwide Water Quality Plan and will continue to use these comments to guide water quality activities in the Chowan River basin. Detailed workshop notes are included as Appendix V.

Important Issues Basinwide

At the public workshops, the public had the opportunity to list some water quality concerns that they had regarding the Chowan River basin. Some of the concerns were basinwide rather than subbasin specific (Table C-1).

Table C-1 Basinwide Concerns Voiced at the Chowan River Basin Public Workshops

Issue	Recommendation	Responsible Party
♦ Bank Erosion	♦ Explore, look into alternatives to hard stabilization	♦ NCSU ♦ CAMA
♦ Agriculture BMP Effectiveness determination	♦ Continue forest BMPs and forest practice guidelines ♦ Monitoring ♦ Continue cost share programs and fine tune them ♦ Provide tax credit for no-till equipment - expand and increase	♦ NC Forest Service ♦ DWQ ♦ NRCS ♦ Soil & Water ♦ FSA ♦ NC State Government
♦ Address septic systems/land application	♦ Education ♦ Continue to look at alternative systems ♦ Provide financial assistance for repairs ♦ Require pumpout (i.e., every 5 years) ♦ State of NC is forcing municipalities to install land application sites without much support for success or flexibility to make it work.	♦ Health Department ♦ NC Cooperative Extension Service (NCES) ♦ County Government
♦ Riparian Vegetation	♦ Buffers between development at waterside and waters ♦ Not allowing a landowner to trim trees within 50 feet of river even when the river is 2 miles wide and water temperature is not affected.	♦
♦ Out board motors traffic and impacts	♦ Learn more about this issue – especially EPA's new emission standards ♦ Education	♦ EPA

Please refer to Section A, Chapter 4 for discussion of some of these issues. All groups commented that nonpoint source pollution; primarily from failing septic systems, changes in land use, or agricultural inputs; was a major threat to water quality in the Chowan River basin.

1.2 Federal Initiatives

1.2.1 Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration projects. Approximately $1 million is available annually for demonstration and education projects across the state. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or

research associated with nonpoint source pollution. Information on the North Carolina Section 319 grant program, including application deadlines and requests for proposals, are available online at http://h2o.enr.state.nc.us/nps/bigpic.htm.

Chowan Nonpoint Source Team

A water quality project was funded through the Section 319(h) grant in 1998. The Chowan Nonpoint Source (NPS) Team headed the project. The project seeks to evaluate the potential water quality benefits of a variety of best management practices (BMPs) which could be incorporated into row-crop agriculture, septic systems and municipal waste systems. The BMPs focus on reducing nutrients, sometimes associated with sediment runoff into waters. The following activities were accomplished through the project:

- 1000 acres of cotton converted from conventional management to cover cropping and/or reduced tillage.
- Implementation and evaluation of 1000 feet of field borders in conjunction with and without animal waste applications for sediment and nutrient reduction.
- Implementation and evaluation of one poultry litter dry stack storage structure for nutrient reduction.
- Adoption and utilization of weather monitoring to assist in forecasting leafspot disease for peanuts.
- Conducted two training sessions for agricultural agents, one each for row crops and animal waste management. Conducted six education meetings for agricultural producers, three each for row crops and animal waste management. Conducted one community meeting for nonagricultural issues.

For more information on the Section 319 program, contact the DWQ Planning Branch Nonpoint Source Planning Unit at (919) 733-5083 or visit the program's website at http://h2o.enr.state.nc.us/nps/bigpic.htm.

1.3 State Initiatives

1.3.1 NC Agriculture Cost Share Program

The North Carolina Agriculture Cost Share Program was established in 1984 to help reduce the sources of agricultural nonpoint source pollution to the state's waters. The program helps owners and renters of established agricultural operations improve their on-farm management by using Best Management Practices (BMPs). These BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface water and groundwater pollution. The Agriculture Cost Share Program is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned control measures and technical specifications are completed. The annual statewide budget for BMP cost sharing is approximately 6.9 million.

Many farmers in the Chowan River basin have taken advantage of funding through the Agriculture Cost Share Program to install BMPs. From 1995 to 2000, approximately $1,942,634 was dedicated to efforts in the Chowan River basin (Figure C-1).

Some of the Agriculture Cost Share projects provided partial or full funding toward:

- Queen's Creek- Shad Project
- Town of Edenton Wetlands Project behind Hospital on Granville Street
- Filbert's Creek/Pembroke Creek/Edenton Bay - Albemarle RC&D/NRCS/NCSU Project
- Edenton Airport/Bayliner Boat Site Wetland and Swamp Restoration

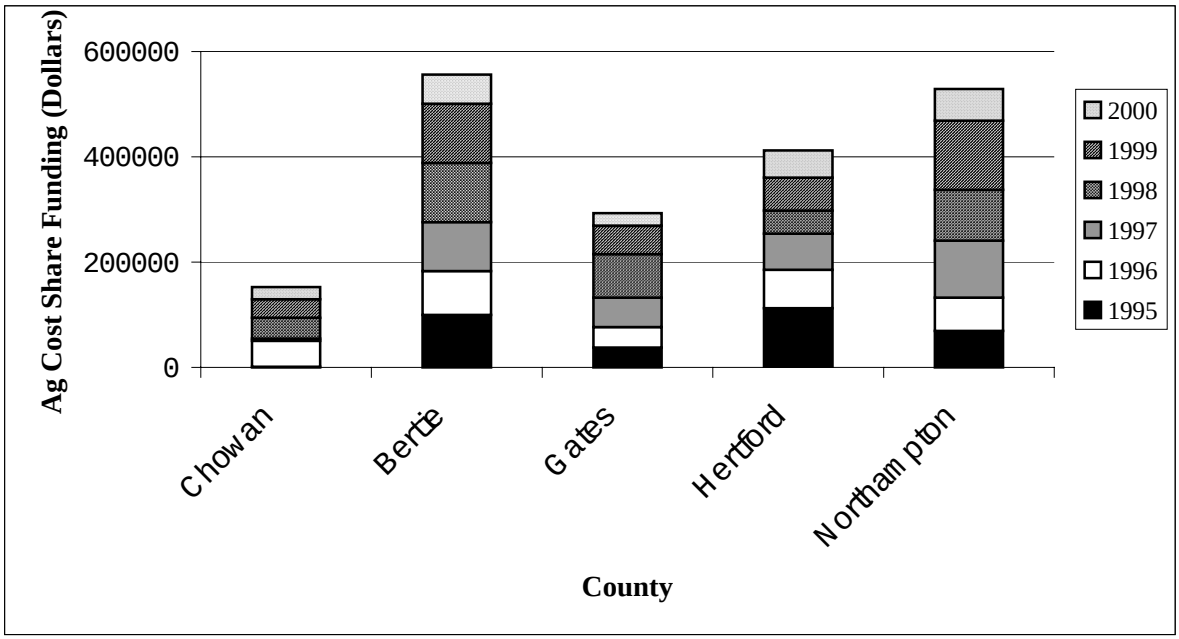


Figure C-1 Agriculture Cost Share Program Dollars Expended (1995-2000) in Counties in the Chowan River Basin (Source: NC Division of Soil and Water Conservation)

Some of the county lines cross multiple river basins; therefore, some of the expenditures in Gates, Chowan, Bertie and Northampton counties may be due to projects in the Roanoke or Chowan River basins.

Soil and Water Conservation District contacts for the Chowan River basin are included in Appendix VI or visit the website at http://www.enr.state.nc.us/DSWC/files/acs.htm for more information.

1.3.2 NC Division of Water Quality and NC Division of Coastal Management Collaboration

North Carolina's Division of Coastal Management (DCM) and the Division of Water Quality (DWQ) share similar goals regarding water quality, and each program recognizes the value of enhanced coordination in accomplishing program missions. In an effort to enhance coordination, the two programs have agreed to work towards many improved collaborative efforts. These

efforts are intended to increase communication through periodic updates, increased review of each other's work products, and joint efforts to provide guidance and technical support between local land use planning programs and basinwide water quality planning.

Some of the agreements include the following:

- DCM will provide written annual updates to DWQ on all types of permit activities occurring in the coastal region when the CAMA Permitted Activities Database is operational. Until that time, DCM will provide file access to any DWQ staff to compile the data themselves. This information will inform DWQ of potential impending cumulative effects of permits issued through CAMA.
- DWQ will periodically contact DCM district offices to relay information and gain feedback about the development or implementation of basinwide water quality plans.
- DWQ will discuss the draft basinwide water quality plan with DCM during the public review phase before soliciting the EMC's endorsement.
- DWQ will provide water quality use support methodology updates to DCM staff.
- DCM and DWQ to discuss the information provided to local land use planners (i.e., data packet, water quality designation information, etc.) on an annual basis.
- DCM to update DWQ periodically on local land use plan certifications.
- DCM to update DWQ on incremental reviews of local land use plan implementation pending recent regulation amendments.
- DCM and the CRC should encourage local governments to participate in the Basinwide Planning Program throughout its planning cycle. DCM will share local governments' contact information with DWQ and distribute DWQ programmatic information. DCM staff will also attend basinwide planning workshops and public meetings to the extent they can.
- DCM will provide a list to DWQ of each local government updating its land use plan at least annually. DWQ will provide each local government updating its plan a summary of the applicable water quality and basinwide plan information contained within that local government's jurisdiction. DWQ will provide the information based on the DWQ basinwide planning scale.
- DWQ will incorporate or at least acknowledge applicable local policies contained in certified local land use plans in the development of the respective basinwide plans. In Section C of the basinwide plans, DWQ will identify those local governments that have developed or implemented programs directed toward water quality restoration or protection.
- DWQ will review all draft local land use plans, provide comments to DCM within 30 days identifying potential problem areas, make suggestions for improvements, and identify violations or potential violations of water quality regulations.
- DCM will update DWQ periodically on the status of permitting analysis/cumulative and secondary impacts assessment. DCM and DWQ will work cooperatively to determine the Permitted Activities database query needs. Once the permit tracking system is operational, DCM will provide access for DWQ to conduct queries.
- DCM and DWQ will discuss the information provided in the *Reviewer's Guide for the Consideration of Cumulative and Secondary Impacts of Proposed Development in NEPA/SEPA Documents* specifically related to coastal water quality.
- DCM and DWQ to discuss DCM's guidelines for assessing and mitigating cumulative and secondary impacts during the CAMA permitting process.

For more information, contact the DWQ Planning Branch at (919) 733-5083.

1.3.3 NC Wetlands Restoration Program

The North Carolina Wetlands Restoration Program (NCWRP) is a nonregulatory program responsible for implementing wetland and stream restoration projects throughout the state. The major goal of the NCWRP is to restore or improve the vital functions provided by wetlands, streams, and riparian buffer zones within the context of local watershed management and overall aquatic ecosystem health. These vital functions include water quality protection, erosion control, flood prevention, fisheries and wildlife habitat, and recreational opportunities. The NCWRP is not a grant program. Instead, it funds wetland, stream and riparian zone projects directly through the Wetlands Restoration Fund.

Restoration sites are targeted through the development and use of Watershed Restoration Plans (formerly called "Basinwide Wetland and Riparian Restoration Plans"). These plans are developed, in part, using information compiled in DWQ's Basinwide Water Quality Plans and Basinwide Assessment Reports. The NCWRP Plans evaluate resource data and existing water quality initiatives within local watersheds in order to select "Targeted Local Watersheds". Targeted Local Watersheds are areas with the greatest need and opportunity for stream and wetlands restoration efforts, and where NCWRP resources can be most efficiently focused for maximum restoration benefit. The NCWRP Watershed Restoration Plans are updated every five years, generally on the same timeline as DWQ's Basinwide Water Quality Plans.

The NCWRP is also working to develop comprehensive Local Watershed Plans within selected high priority hydrologic units across the state. These locally focused plans will identify candidate sites for wetlands or stream restoration projects, in addition to providing a collaborative forum for the development of a comprehensive package of water quality protection practices.

The NCWRP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example, the NCWRP's efforts can complement projects funded through the Section 319 Nonpoint Source Program. Integrating wetlands and riparian restoration components with 319-funded and/or Clean Water Management Trust Fund projects will often optimize the overall water quality benefits within a given watershed.

The NCWRP actively seeks landowners [both public and private] within the Chowan River basin who potentially have restorable stream, wetland or riparian buffer sites.

Table C-2 lists the NCWRP's targeted Local Watersheds in the Chowan River basin. Further details about these watersheds are provided in the appropriate subbasin chapter in Section B.

Table C-2 Wetlands Restoration Program Targeted Local Watersheds (2000)

Subbasin	Targeted Local Watershed Name(s)	Targeted Local Watershed Number(s)*
03-01-01	Ahoskie Creek	03010203050011
03-01-01	Chowan River	03010203030020
03-01-01	Lower Ahoskie Creek	03010203050030
03-01-01	Wiccacon River	03010203060040
03-01-02	Upper Potecasi Creek	03010204210010
03-01-02	Cutawhiskie Swamp	03010204200010
03-01-02	Lower Potecasi Creek	03010204210030

* The numbers listed are the last five digits of the 14-digit Hydrologic Unit (HU) for each Local Watershed.

For more information about participating in the NCWRP, please call (919) 733-5208) or visit the DWQ website at http://h2o.enr.state.nc.us/ (click on Wetlands Restoration Program).

1.3.4 Clean Water Management Trust Fund

The Clean Water Management Trust Fund offers approximately $40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters and establishing a network of riparian buffers and greenways. In the Chowan River basin, four projects have been funded for a total of $5,378,810. The largest amount of funding ($3,285,810) was for restoration of water quality in the Edenton area. Table C-3, outlines the projects.

Table C-3 Projects in the Chowan River Basin Funded by the Clean Water Management Trust Fund (as of April 2001)

Stream or Watershed	Project	Project Lead	Amount Funded
Edenton Area	Restoration	Edenton	$3,285,810
	Stormwater	Edenton Chowan Development Corporation	$880,000
	Wastewater	Murfreesboro	$176,000
	Wastewater	Seaboard	$1,037,000

For more information on the CWMTF or these grants, call (252) 830-3222 or www.cwmtf.net.

1.3.5 Coastal Nonpoint Pollution Control Program

The goal of the CNPCP is to strengthen the links between federal and state coastal zone management and water quality management programs and to enhance state and local efforts to manage land use activities that degrade coastal waters and habitats. As required by the federal mandate, the CNPCP must implement, where necessary, the management measures identified by

the federal agencies that address various sources of nonpoint source pollution. Detailed descriptions of the management measures, where they are intended to be applied, their effectiveness, and their costs can be found in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* at the following website at http://www.epa.gov/owow/nps/MMGI/.

The CNPCP will develop a 15-year strategy to ensure implementation of the applicable management measures to protect and restore water quality. The immediate and primary focuses of the program will be on improving and protecting the quality of shellfishing waters; increasing the awareness of coastal nonpoint source related issues in the state; and providing resources that enable the improvement of the water quality component of DCM's Local Land Use Plans.

For additional information on the program, contact the DWQ Planning Branch Nonpoint Source Unit at (919) 733-5083.

The North Carolina Coastal Nonpoint Pollution Control Program (CNPCP) is a federally mandated program that is administered jointly by the NC Department of Environment and Natural Resource's Division of Water Quality and Division of Coastal Management. The National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) administer the Program jointly at the federal level. North Carolina is currently seeking final approval of its program from NOAA and EPA.

1.3.6 Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP), a federal and state partnership, aims to improve water quality and wildlife habitat by reducing pollutants entering surface waters. The five-year, $274 million program which began in March 1999 has a goal of enrolling 100,000 acres of crop and pastureland in four Nutrient Sensitive Waters watersheds: Chowan, Tar-Pamlico, Neuse and Jordan Lake. North Carolina's funding comes from the Clean Water Management Trust Fund, North Carolina's Wetlands Restoration Program and North Carolina's Agriculture Cost Share.

In an effort to improve water quality and to take out marginally productive farmland, CREP targets: farmland that has been cropped for two of the last five years or marginal pastureland; and areas adjoining a creek, stream, river, ditch or wetland.

Landowners can enroll in term or permanent easements, both of which may be potentially eligible for state tax credits, federal tax deductions and cost share funding.

Some BMPs that occur on these lands include: riparian forested buffers, grass filter strips, hardwood tree planting and wetland restoration. In the Chowan River basin, there have been several projects placing lands in the CREP program including: Northampton County (1349 acres), Hertford County (118acres) and Gates County (278 acres).

For more information on the CREP program, contact a CREP Specialist at (919) 715-6107 or visit the program's website at http://www.enr.state.nc.us/DSWC/files/crepmain.htm.

1.3.7 Albemarle-Pamlico National Estuary Program

The Albemarle-Pamlico National Estuary Program (APNEP), formerly known as the Albemarle-Pamlico Estuarine Study (APES), was among the first National Estuary Programs established by the EPA in 1987. The mission of the APNEP is to identify, restore and protect the significant resources of the Albemarle-Pamlico estuarine ecosystem. Unlike traditional regulatory approaches to environmental protection, the APNEP is a cooperative effort jointly sponsored by NCDENR and the EPA that targets a broad range of issues and engages local communities in the process.

The program focuses not just on improving water quality in the region's estuaries, but on maintaining the integrity of the whole system - its chemical, physical and biological properties, as well as its economic, recreational and aesthetic values. Important components of the APNEP are the consideration of water quality, fisheries resources, land and water habitats, and the interaction of humans with the natural resources of the estuarine system. The APNEP is designed to encourage local communities to take responsibility for managing the resources in their respective jurisdictions.

Comprehensive Conservation and Management Plan

Since 1987, research generated by the APNEP has been instrumental to the development of a Comprehensive Conservation and Management Plan (CCMP). This plan is composed of recommendations for management strategies that address concerns in the Albemarle-Pamlico Sounds region and to protect the system's estuarine resources.

During the development of the CCMP, the APNEP was guided by a 95-member Management Conference that represented diverse interests. Four committees were responsible for identifying problems in the estuarine system, generating research where gaps in knowledge existed, increasing public awareness of environmental issues, and finding solutions to address those issues. As a result of these efforts, more is known about the Albemarle-Pamlico estuarine system than ever before.

CCMP Development Involved Diverse Interests Including:

- Federal and state government
- University researchers
- Environmental groups
- Agriculture representatives
- Forestry interests
- Industry representatives
- Developers
- Fishers
- Local elected officials

One of the recommendations of the CCMP was to develop regional councils in each of the five major river basins of the Albemarle-Pamlico watershed for the purpose of fostering public input into the APNEP program. In 1995, an Executive Order was issued by the Governor of North Carolina calling for the creation of these regional councils. The Chowan River Basin Regional Council is highlighted below.

Currently, the APNEP is administered and staffed by DWQ; however, staff works closely with the EPA's Office of Water to implement the many objectives and key management actions contained in the APNEP's CCMP.

Chowan River Basin Regional Council

Each regional council is comprised of elected and appointed county and municipal officials, representatives from agriculture, silviculture, commercial and recreational fishing, conservation, environmental science, business/industry and tourism groups. Each council is charged with identifying and implementing a project that utilizes innovative or unique management strategies to address a priority watershed problem. Regional councils provide a forum for public, special interest and local government involvement in the APNEP.

The Chowan River Basin Regional Council (CRBRC) has been active, meeting approximately four times per year. Highlights of accomplishments thus far include:

- Invited a Nucor representative as a member of the Chowan Regional Council. A major focus of the council remains with the siting and operation of the Nucor steel recycling facility located on the banks of the Chowan River.
- Toured the Nucor facility.
- Discussed the development of Coastal Habitat Protection Plans for the Chowan River basin and the Coastal Ocean with Division of Marine Fisheries' Coastal Habitat Protection Plan staff.
- Discussed the development of the 2002 Chowan River Basinwide Water Quality Plan with the DWQ basin planner.
- Co-sponsored public workshops conducted by DWQ regarding development of the 2002 Chowan River Basinwide Water Quality Plan.
- Provided input into an updated directory of NC and VA agency contacts with assistance from APNEP/VADCR liaison.

Interstate Collaboration Efforts

North Carolina and Virginia have jointly funded a Watershed Field Coordinator position to facilitate discussions regarding the Albemarle, Chowan and Coastal Watersheds. The position aims to:

- Facilitate and foster coordination and communication between Virginia's Watershed Roundtables and NC's River Basin Regional Councils.
- Compile information from local jurisdictions that will aid in the Albemarle Pamlico National Estuary Program's Comprehensive Conservation and Management Plan's work plans, targeting and monitoring of progress.
- Assist in preparing regionally targeted fact sheets, news releases and other articles for publishing purposes.
- Assist with event planning and facilitation.
- Work closely with DWQ basin planners regarding specific informational needs to be included in the basinwide plans for the Chowan River basin.

For more information on the Watershed Field Coordinator's activities, call (757) 925-2468. For more information on the Albemarle-Pamlico National Estuary Program, call (919) 733-5083 or visit the program's website at http://h2o.enr.state.nc.us/nep/.

1.3.8 Citizens' Water Quality Monitoring Program

The Albemarle-Pamlico National Estuary Program's (APNEP) Citizens' Water Quality Monitoring Program (CWQMP) is a network of private citizens who monitor ambient, surface water quality in the Albemarle-Pamlico Estuary and its tributaries. This program began as an initiative by the Pamlico-Tar River Foundation, to protect, preserve and promote the quality of the Tar-Pamlico River and its watershed. In 1991, the CWQMP was expanded under the Albemarle-Pamlico National Estuary Program to include all waters located within the Albemarle-Pamlico Watershed Basin.

The CWQMP focuses upon three areas of activity: 1) baseline monitoring; 2) targeted monitoring and surveys; and 3) water quality education. Program participants receive support in many forms: water quality education and training, equipment and supplies, data management and analysis, and network opportunities.

Participants in the CWQMP primarily monitor "vital signs" of the estuary. Specifically, volunteers monitor dissolved oxygen, pH, salinity, air and water temperatures, and turbidity to gauge the general health or quality of water in the estuary. Using basic, but accurate water quality test kits, citizen volunteers analyze water samples, observe qualitative factors such as weather conditions and other visual indicators, and record their results. All data collected are forwarded to the program office where staff compiles the information and enters the data into report form for citizen and government agency use. Often, these monitoring efforts serve as useful supplements to existing governmental activities.

For additional information, please contact the CWQMP by calling (252) 328-1747 or visit the APNEP website at http://h2o.enr.state.nc.us/nep/.

1.3.9 Coastal Habitat Protection Plans

The North Carolina Fisheries Reform Act of 1997 requires the North Carolina Department of Environment and Natural Resources to prepare Coastal Habitat Protection Plans (CHPPs) for the "long-term enhancement of coastal fisheries associated with each coastal habitat…." The plans describe the fisheries, fishery habitats and water quality affecting coastal fisheries stocks in the eight river basins that drain to the coast of North Carolina. Although staff of the Division of Marine Fisheries (DMF) is responsible for actually writing the plans, DWQ and the Wildlife Resources Commission, as well as the Divisions of Coastal Management (DCM) and Environmental Health (DEH), are heavily involved in the program. The Environmental Management, Coastal Resources and Marine Fisheries Commissions review and approve the plans, and those commissions are responsible for any new rules necessary for implementation of the plans.

The plans are organized by geographic area, with 11 management units, including the Chowan River basin, that generally correspond with the DWQ Basinwide Planning Program units. A general source document includes regional and summary information. The management unit plans are specific to their areas, including detailed information and specific recommendations addressing conservation, habitat protection and enhancement, water quality improvement, research and monitoring, and administrative actions. A complete plan includes both the source

document and the management unit plan. The first two area plans are underway in 2001: Chowan and Coastal Ocean. All CHPPs will be finalized by July 2003, then reviewed and updated every five years.

For additional information about CHPPs, call 1-800-682-2632 (in NC). You may also visit the DMF website at http://www.ncfisheries.net/habitat/chpp1.htm.

1.3.10 NC Cooperative Extension Service

In an effort to improve the information flow in the Chowan River basin, the NC Cooperative Extension Service's local area specialized agent in water quality acquired Section 319 funding. The funding is used to develop and circulate a periodic newsletter entitled *River and Sound Advice: News about the Chowan and Chowan River Basins*. For more information, contact Marjorie Rayburn at (252) 357-1400 or by e-mail Marjorie_Rayburn@ncsu.edu.

1.4 Local Initiatives

Local initiatives continue to serve as a great asset to water quality management in the Chowan River basin. Many of the activities are summarized in this section.

1.4.1 Blackwater/Nottoway Riverkeeper

The program was established in the spring of 2000 by Riverkeeper Jeff Turner under the sponsorship of the Water Keeper Alliance, a national coalition of nearly 60 environmental advocacy patrols dedicated to reclaiming, monitoring and preserving communities and the water on which they depend.

A nonprofit organization is being developed, and a dialog with local governments and civic groups is being established. Some of the projects that the local program has undertaken are summarized here.

Water Quality Projects

The City of Franklin, VA is drained by a system of ditches converging about 30 yards upstream from the Blackwater River. A floating boom is proposed, much like those used to contain oil spills, to be installed near the mouth of the combined ditches. The boom would catch floating trash so that it could be removed before it enters the river system. The Riverkeeper program is currently gathering information to alleviate city official's concerns.

The City of Norfolk, VA established a shallow dam on the Blackwater River, in the Burdette area, shortly after World War II. The dam creates a backwater, so that Norfolk can pump water from the Blackwater River to its system of lakes in Suffolk, VA. The Riverkeeper program is gathering data on providing a means for migratory fish such as shad, herring and striped bass to spawn in the area above the dam. The Riverkeeper has requested that assistance from the Southampton County Board of Supervisors, which is awaiting a report on the subject from the county.

Other program efforts include working with the local schools to educate young people about environmental concerns, organizing "Clean the River" days, and networking with the staff and students of a local community college.

To learn more about the Water Keeper Alliance, visit their website at www.keeper.org.

1.4.2 North Carolina Coastal Federation

The North Carolina Coastal Federation (NCCF) is the state's largest nonprofit organization working to restore and protect the coast. Formed in 1982, the NCCF has grown to serve more than 5,000 members and 200 member groups. The NCCF focuses on three main areas of work including habitat restoration and protection, environmental education, and the encouragement of sound environmental programs and their enforcement.

The North Carolina Coastal Federation, Environmental Defense and the Pamlico-Tar River Foundation (PTRF) reached an agreement with the state regarding permits issued to build a steel mill on the Chowan River. The groups sued the state for approving environmental permits before completing an environmental assessment of the Nucor project and for issuing an air permit that did not comply with Best Available Control Technologies. In a second lawsuit, the groups challenged the state for issuing a CAMA permit to Nucor for the construction of a docking facility on the Chowan River. The settlement resulted in a change in the way the state does business with industry. In the future, environmental permits and plans will be held in abeyance until the environmental review process has been completed.

The North Carolina Coastal Federation and Restore Americas Estuaries are working to identify, purchase, conserve and restore areas crucial to water quality in the Chowan River basin through the Coastal Habitat Protection Plans (CHPPS). NCCF serves on the Habitat and Water Quality Committee of the Marine Fisheries Commission, which is the lead advisory group for the Coastal Habitat Protection Plans (CHPPs).

NCCF's Education Program's mission is to provide educational experiences and resources that will produce an understanding and appreciation of coastal areas, motivating participants to make informed decisions and become active stewards. The NCCF's Education Program includes field trips, teacher workshops, classroom curriculum, action projects and much more. All students and teachers will find a hands-on way to connect to North Carolina's coast.

For more information, call NCCF at (800) 232-6210 or visit their website at http://www.nccoast.org/.

Chapter 2 -
Future Water Quality Initiatives

2.1 Overall DWQ Goals for the Future

The long-term goal of basinwide management is to protect the water quality standards and uses of the surface waters in the state while accommodating reasonable economic growth. Attainment of these goals and objectives will require determined, widespread public support; the combined cooperation of state, local and federal agencies, agriculture, forestry, industry and development interests; and considerable financial expenditure on the part of all involved. With this needed support and cooperation, DWQ believes that these goals are attainable through the basinwide water quality management approach.

In addition to these efforts, DWQ will continue to pursue several programmatic initiatives intended to protect or restore water quality across the state. These include NPDES Program Initiatives, better coordination of basinwide planning, use restoration waters program for nonpoint source pollution, and improving database management and use of GIS capabilities. Summaries of these initiatives are outlined below.

NPDES Program Initiatives

In the next five years, efforts will be continued to:

- improve compliance with permitted limits;
- improve pretreatment of industrial wastes discharged to municipal wastewater treatment plants so as to reduce effluent toxicity;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination of chlorinated effluents or use of alternative disinfection methods for new or expanding facilities;
- require multiple treatment trains at wastewater facilities; and
- require plants to begin plans for enlargement well before they reach capacity.

Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling by-products of the treatment process (including reuse of nonpotable treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

DWQ requires all new and expanding dischargers to submit an alternatives analysis as part of its NPDES permit application. Non-discharge alternatives, including connection to an existing WWTP or land-applying wastes, are preferred from an environmental standpoint. If the Division determines that there is an economically reasonable alternative to a discharge, DWQ may deny the NPDES permit.

DWQ will continue to make greater use of discharger self-monitoring data to augment the data it collects. Quality assurance, timing and consistency of data from plant to plant are issues of importance. Also, a system will need to be developed to enter the data into a computerized database for later analysis.

Use Restoration Waters (URW) Program for Nonpoint Source Impairment

DWQ has developed a conceptual strategy to manage watersheds with nonpoint source impairments as determined through the use support designations. In July 1998, the state Environmental Management Commission approved the Use Restoration Waters (URW) program concept which will target all NPS impaired waters in the state using a two-part approach. The program will catalyze voluntary efforts by stakeholder groups in impaired watersheds to restore those waters by providing various incentives and other support. For locations where local groups choose not to take responsibility for restoring their impairments, the program will consider the option of developing a set of mandatory requirements for NPS pollution categories.

This URW concept offers local governments an opportunity to implement site-specific projects at the local level as an incentive ("the carrot"). If the EMC is not satisfied with the progress made towards use restoration by local committees, impairment based rules will become mandatory in those watersheds ("the stick").

These mandatory requirements may not be tailored to specific watersheds but may apply more generically across the state or region. The form of the URW program will be strongly influenced by the year-long stakeholder input process.

With more than 400 impaired watersheds or stream segments in the state, it is not realistic for DWQ to attempt to develop watershed specific restoration strategies for nonpoint source pollution. By involving the stakeholders in these watersheds, we believe we can catalyze large-scale restoration of impaired waters. We anticipate that one of the major implementation challenges of this new program will be educating public officials and stakeholders at the local level as to the nature and solutions to their impairments. To address this challenge, the state plans to develop a GIS-based program to help present information at a scale that is useful to local land management officials. Other incentives that the state might provide include seed grants and technical assistance, as well as retaining the authority to mandate regulations on stakeholders who are not willing to participate.

In cases where incentives and support do not result in effective watershed restoration strategies, mandatory impairment source management requirements would be implemented in the watershed. This is not the state's preferred alternative, as it would add to state monitoring and enforcement workload. However, in areas where it is necessary, DWQ plans to implement such requirements. In the management area, DWQ would be assisted by regulatory staff from the Divisions of Environmental Health and Land Resources to insure compliance.

For more information on the Use Restoration Waters Program, contact the DWQ Planning Branch Nonpoint Source Unit at (919) 733-5083.

Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities

DWQ is in the process of centralizing and improving its computer data management systems. Most of its water quality program data (including permitted dischargers, waste limits, compliance information, water quality data, stream classifications, etc.) will be put in a central data center which will then be made accessible to most staff at desktop computer stations. Some of this information is also being submitted into the NC Geographic Data Clearinghouse (Center for Geographic Information and Analysis or CGIA). As this and other information (including land use data from satellite or air photo interpretation) are made available to the GIS system, the potential to graphically display the results of water quality data analysis will be tremendous.

Additional Research and Monitoring Needs

DWQ staff has identified some additional research needs that would be useful for assessing, protecting and restoring the water quality of the Chowan River basin. The following list is not all inclusive. Rather, it is meant to stimulate ideas for obtaining more information to better address water quality problems in the basin. With the newly available funding programs (Clean Water Management Trust Fund and Wetlands Restoration Program) and the existing Section 319 grant program, it may be desirable for grant applicants to focus proposals on the following issues:

- *Nonpoint Sources of Pollution*. Identifying nonpoint sources of pollution and developing management strategies for impaired waters, given the current limited resources available, are an overwhelming task. Therefore, only limited progress towards restoring NPS impaired waters can be expected unless substantial resources are put towards solving NPS problems.
- *Swamp Waters Study*. Increasing population in these areas will demand more water and generate more wastewater. In addition, conversion of land from forests and farms will increase impervious surfaces producing higher than natural streamflows and cause erosion. Streams in these areas will likely remain (or become) impaired unless this growth is planned for and managed properly.
- *Cost Effective BMPs*. The state has provided a great deal of funding to the Chowan agriculture sector to share information on best management practices that protect and restore water quality while at the same time ensuring appropriate harvest yields.

2.2 DWQ Compliance and Enforcement Policy Revisions

NCDENR began implementing a new two-stage compliance and enforcement policy in 1997. Both stages of the revised policy are in effect as of July 1, 1999. The five major elements of the policy are intended to provide a comprehensive route to strengthen enforcement and heighten compliance for all dischargers and nonpoint sources of water pollution in North Carolina. The five major components of the policy are to:

1. Foster compliance through pollution prevention, technical assistance and training, reevaluate existing grant and loan funding priority criteria, and develop recognition and incentive programs.

2. Enhance enforcement through increased penalties, penalties for sewer collection systems, reduced thresholds for noncompliance, and delegation of civil penalty assessment authority to the DWQ regional office supervisors.
3. Focus on chronic and willful violators through increased use of moratoriums on expanding and additional connections, expansion of notification to the public of violators, clarification of process of determining "noncompliance", and initiation of discussion with stakeholders on possible legislative actions.
4. Assure improvement in compliance and enforcement through development of accountability measures.
5. Find and use all available resources for compliance needs with local, state and nonprofit groups.

NCDENR is also in the process of conducting an assessment of its enforcement programs. The goal of the assessment is to identify potential areas for improvement in NCDENR's efforts to enforce environmental laws and ultimately improve compliance. This effort got underway in July 1999 with two focus group meetings. If you would like to see the Scope of Work for the enforcement assessment, see NCDENR's web page at http://www.enr.state.nc.us/novs/scope.htm/.

2.3 Coordination with Other Agencies

The basinwide planning process can be used by other programs as a means of identifying and prioritizing waterbodies in need of restoration or protection efforts and provides a means of disseminating this information to other water quality protection programs. For example, the plan can be used to identify and prioritize wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. The plans can also assist in identifying projects and waterbodies applicable to the goals of the Clean Water Management Trust Fund, Wetlands Restoration Program or Section 319 grants program. Information and finalized basin plans are provided to these offices for their use and to other state and federal agencies.

DWQ would like to work more closely with the Conservation Districts in each county of the Chowan River basin to identify nonpoint sources of pollution, develop land use and land cover data, and to develop water quality management strategies for impaired watersheds within the Chowan River basin.

Division of Soil and Water Conservation and Division of Water Quality are working together to better identify causes and sources of impairment in rural streams. The two agencies will be working together to target those streams that are impaired and where implementation of best management practices would improve water quality. Refer to Section C, Chapter 1 for more information on the Agricultural Cost Share Program.

DWQ and DCM are working to ensure that local governments consider water quality impacts in their land use plan. Refer to Section A for more information.

2.4 Non-Discharge Permits

The Chowan River basin's NSW strategy imposes a non-discharge mandate for wastewater. In addition, there is a great deal of activities in the basin which use non-discharge systems. The premise is that non-discharge (land application) has the potential to affect adjacent surface waters if not properly designed and maintained. There are currently no protocols regarding water balance calculations to attach to permit applications. Therefore, there is a need for DWQ to look into the issue, hence the Water Balance Group. Per recent regulations, DWQ needs to decide what parameters need to be addressed in hydrologic evaluations (as a means of ascertaining impacts to local surface waters).

Hydrological studies will need to look at nutrient load by conducting a nutrient impacts study for surrounding surface waters. There is no comparable analysis required for BOD since there are no standards for BOD. There are no numeric standards for nutrients, but DWQ works with a sensitivity level. Some of the criteria that are considered in the water balance calculations include: rain, evapotranspiration, drainage (varies seasonally), spray irrigation (what you want to spray based on design capacity), spray available (soil assimilative capacity), and storage (what you cannot spray).

In order to conduct an effective analysis, DWQ may need to gather 12 months or more of data. An effective analysis will also require a great deal of field surveying. Since the effort will be field intensive, it will probably take longer for a permit application to evolve and get approved.

2.5 Coordination within DWQ

As a large governmental Division, DWQ has challenges regarding communication across its many programs. In an effort to improve facility construction, maintenance and permitting, DWQ will work towards holding periodic discussions with appropriate staff and other agency personnel during multiple stages of the facility permitting process: grant review, facility permitting and upon notice of violation. The DWQ Basinwide Planning Program will coordinate these discussions.

The DWQ Basinwide and Estuary Planning Unit has initiated periodic meetings with the DWQ Nonpoint Source Unit to ensure more efficient and timely communication exchanges as well as implementation oversight of basinwide water quality plan recommendations.

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Appendix I

NPDES Dischargers
and
Individual Stormwater Permits
in the
Chowan River Basin

NPDES Dischargers in the Chowan River Basin (as of March 5, 2001)

Permit	Facility	County	Region	Type		D1	D2	D3	D4	D5	Qw	Subbasin	Receiving Stream
NC0033782	Gates Co School – Gatesville Elem	Gates	Washington	Minor	Non-Municipal	3					0.005	03-01-01	Bennett Creek
NC0033791	Gates Co School – Sunbury Primary	Gates	Washington	Minor	Non-Municipal	3					0.005	03-01-01	UT Raynor Swamp
NC0033804	Gates Co School – T.S. Cooper Elem	Gates	Washington	Minor	Non-Municipal	3					0.004	03-01-01	UT Raynor Swamp
NC0043974	Gates Co School – Buckland Elem	Gates	Washington	Minor	Non-Municipal	3					0.006	03-01-01	UT Cole Creek
NC0086231	Indalex Inc.	Hertford	Washington	Minor	Non-Municipal	58	15				0.024	03-01-01	Ahoskie Creek
NC0002402	Perry-Wynns Fish Company, Inc.	Bertie	Washington	Minor	Non-Municipal	25	30				0.024	03-01-03	Chowan River
NC0003867	United Piece Dye Works / Edenton	Chowan	Washington	Major	Non-Municipal	55					1.5	03-01-03	Chowan River
NC0007552	Edenton, Town – Freemason WTP	Chowan	Washington	Minor	Non-Municipal	22					0.02	03-01-04	Filbert Creek
NC0080632	Chowan County Water Plant – Brahall	Chowan	Washington	Minor	Non-Municipal	22					not limited	03-01-04	Pollocks Swamp
NC0086291	Edenton, Town – Beaver Hill WTP	Chowan	Washington	Minor	Non-Municipal	22					not limited	03-01-04	Filbert Creek
NC0032719	Chowan County Water Plant – Valhalla	Chowan	Washington	Minor	Non-Municipal	22					not limited	03-01-04	UT Rockyhock Creek

NPDES Discharger Codes

2 Domestic Industrial / Commercial
3 Domestic Schools
15 Contact cooling water
22 Water plants and Water conditioning (Groundwater)
25 Seafood and Fish processing
30 Seafood or Fish packing
55 Textiles
58 Metal forming

NPDES Individual Stormwater Permits in the Chowan River Basin (as of April 5, 2001)

Permit #	Facility Name	Receiving Stream	Subbasin	County
NCS000251	Georgia-Pacific Resins, Inc.	UT Doolittle Millpond	03-01-02	Northampton
NCS000292	Resinall Corporation	Kirby Creek	03-01-03	Northampton
NCS000134	R. J. Reynolds Co. - Avoca Farms	Salmon Creek	03-01-03	Bertie
NCS000167	Perdue Farms, Inc.	UT Deep Creek	03-01-03	Hertford

Appendix II

Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**
- **Fish Community Assessments**

Benthic Macroinvertebrate Sampling Methods and Criteria

Freshwater Wadeable and Flowing Waters

Benthic macroinvertebrates can be collected from wadeable, freshwater, flowing waters using two sampling procedures. The NC Division of Water Quality's standard qualitative sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs (NCDEHNR, 1997). The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens), Common (3-9 specimens), or Abundant (≥10 specimens).

Several data-analysis summaries (metrics) can be produced from standard qualitative samples to detect water quality problems (Table A-II-1).

Table A-II-1 Benthos Classification Criteria for Freshwater Wadeable and Flowing Water Systems in the Coastal Plain Ecoregion

Metric	Sample Type	Bioclass	Score
EPT S	10-sample Qualitative	Excellent	> 27
		Good	21 - 27
		Good-Fair	14 - 20
		Fair	7 - 13
		Poor	0 - 6
	4-sample EPT	Excellent	> 23
		Good	18 - 23
		Good-Fair	12 - 17
		Fair	6 –11
		Poor	0 - 5
Biotic Index (range 0 – 10)	10-sample Qualitative	Excellent	< 5.47
		Good	5.47 - 6.05
		Good-Fair	6.06 - 6.72
		Fair	6.73 - 7.73
		Poor	> 7.73

These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT S) is used with DWQ criteria to assign water quality ratings (bioclassifications). "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Water quality ratings also are based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI).

Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions. Water quality ratings assigned with the biotic index numbers are combined with EPT taxa richness ratings to produce a final bioclassification, using criteria for coastal plain streams. EPT abundance (EPT N) and total taxa richness calculations also are used to help examine between-site differences in water quality. If the EPT taxa richness rating and the biotic index differ by one bioclassification, the EPT abundance value is used to determine the final site rating.

Benthic macroinvertebrates can also be collected using an EPT sampling procedure. Four rather than 10 composite qualitative samples are taken at each site: 1 kick, 1 sweep, 1 leafpack and visual collections. Only EPT groups are collected and identified, and only EPT criteria are used to assign a bioclassification.

Both EPT taxa richness and biotic index values also can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling: June - September. For samples collected outside summer, EPT taxa richness can be adjusted by subtracting out winter/spring Plecoptera or other adjustment based on resampling of summer site. The biotic index values also are seasonally adjusted for samples outside the summer season.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis.

Boat Sampling and Coastal B Criteria

Coastal B rivers are defined as waters in the coastal plain that are deep (nonwadeable) with little or no visible current under normal or low flow conditions and that have freshwater. Other characteristics may include open canopy, low pH and low dissolved oxygen. These waters require a boat for sampling. These are usually large coastal plain rivers, including the lower sections of the Alligator, Chowan, Meherrin, Neuse, Pasquotank, Perquimans, Roanoke, Tar, South, Black, Waccamaw, Wiccacon, Northeast Cape Fear and Cape Fear Rivers. In such habitats, petite Ponar dredge sampling replaces kick-net samples, but all other standard qualitative collection techniques are still useable.

The standard boat method still aims at a total of 10 composite samples per site:

- Dredges - 3 composite samples using a petite Ponar.
- Sweeps - 3 samples collected from bank habitats, sampling as much of the edge habitat as possible, including aquatic macrophytes, roots and areas of debris.
- Leaf packs/Debris wash -1 composite sample of leaves and other large particulate organic matter are to be rinsed in a wash bucket.
- Epifaunal collections - 2 composite samples of macrophytes and well-colonized logs (both in the current and along the shore.
- Visuals - should cover macrophytes, logs along the shore, and especially logs in the current.

The Biological Assessment Unit has limited data on Coastal B rivers and has had a difficult time gathering more data. Criteria have been developed based only on EPT taxa richness (Table A-II-2), although using biotic index values and total taxa richness values were also evaluated. The

criteria that are presented here will continue to be evaluated, and any bioclassifications derived from them should be considered tentative and not used for use support decisions.

Table A-II-2 Benthos Classification Criteria for Freshwater Nonwadeable, Coastal B Systems in the Coastal Plain Ecoregion

Bioclassification	EPT S
Excellent	> 11
Good	9 - 11
Good-Fair	6 - 8
Fair	3 - 5
Poor	> 3

Estuaries

Shallow (<1.5 m) estuarine waters are sampled using a D-frame dip net with a 600-700 μm mesh bag. All available subtidal benthic habitats were swept for a total of ten minutes. Some elutriation of the sample usually took place in the field to reduce sample volume, then the sample was preserved in 10% formalin with rose bengal added as a tissue stain.

At the laboratory, macroinvertebrates were separated from the sediment by visual examination. Macroinvertebrates were identified to the lowest practical taxonomic level, usually species. Abundance was recorded semi-quantitatively, with only a general indication of a taxon's abundance: Rare = 1 - 2; Common = 3 - 9; Abundant = 10 - 29; Very Abundant = 30 - 99; and Dominant >100. No more than 100 individuals of any taxon were counted since the presence of a greater number of individuals of a particular taxa at a site was no more informative, but much more costly to enumerate.

A biotic index is calculated from the individual taxon's sensitivity values (ranging from 1 to 5) and weighted for abundance using a formula commonly used in calculating freshwater biotic indices (Chutter, 1972; Hilsenhoff, 1977; Lenat, 1993):

$$BI = (\sum SV_i * N_i)/\text{Total N}$$

where SV_i is the sensitivity value of the i^{th} taxa; N_i is the abundance of the i^{th} taxa; and Total N is the number of individuals in the sample. A high Estuarine Biotic Index (EBI) value indicates many intolerant taxa and good water quality at a location, while a low EBI is indicative of stressed conditions.

References

Chutter, F. M. 1972. *An Empirical Biotic Index of the Quality of Water in South African Streams and Rivers*. Water Research. 6: 19-30.

Hilsenhoff, W. L. 1977. *Use of Arthropods to Evaluate Water Quality in Streams*. Wisconsin Department of Natural Resources. Technical Bulletin No. 100.

Lenat, D. L. 1993. *A Biotic Index for the Southeastern United States: Derivation and List of Tolerance Values, with Criteria for Assigning Water-Quality Ratings*. J. North American Benthological Society. 12: 279-290.

Flow Measurement

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. Some between-year changes in the macroinvertebrates, however, may be due largely to changes in flow. High flow years magnify the potential effects of nonpoint source runoff, leading to scour, substrate instability and reduced periphyton. Low flow years may accentuate the effect of point source dischargers by providing less dilution of wastes.

For these reasons, all between-year changes in the biological communities are considered in light of flow conditions (high, low or normal) for one month prior to the sampling date. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term mean flows. High flow is defined as a mean flow >140% of the long-term mean for that time period, usually July or August. Low flow is defined as a mean flow <60% of the long-term mean, while normal flow is 60-140% of the mean. While broad scale regional patterns are often observed, there may be large geographical variation within the state, and large variation within a single summer period.

Habitat Evaluation

The NCDWQ has developed a habitat assessment form to better evaluate the physical habitat of a stream. The habitat score has a potential range of 1-100, based on evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed to assign impairment ratings.

Table A-II-3 Benthic Macroinvertebrate Data Collected in the Chowan River Basin, 1983-1999 (Basinwide monitoring sites are in bold.)

Subbasin/Waterbody	Location	County	Index No.	Date	S	EPT S	BI	EPT BI	BioClass
03-01-01									
Chowan R	nr Riddicksville	Hertford	25	07/31/00	46	7	7.33	5.84	Good-Fair
				08/10/95	52	8	7.79	5.89	Good-Fair
				07/11/90	58	14	7.28	5.34	Excellent
				07/13/88	66	10	7.16	6.15	Good
				07/07/86	63	10	7.51	6.27	Good
				07/17/84	65	9	6.77	5.37	Good
Chowan R	nr Gatesville	Gates	25	08/01/00	62	9	7.22	4.70	Good
Cole Cr	NC 58	Gates	25-12-7	02/10/00	47	4	7.60	7.00	Not Rated
Wiccacon R	SR 1433	Hertford	25-14	08/01/00	66	6	7.88	6.80	Fair
				08/06/95	55	5	7.72	7.44	Fair
				02/16/95	27	2	8.55	6.82	Not Rated
				07/10/89	47	2	7.93	7.34	Poor
				07/09/87	60	3	7.99	7.95	Fair
				07/26/85	59	5	7.91	7.02	Fair
				07/20/83	56	4	7.87	6.72	Fair
Ahoskie Cr	NC 42	Hertford	25-14-1	08/09/95	61	7	7.67	6.19	Not Rated
				02/28/95	59	8	6.94	5.66	Not Rated
Stony Cr	SR 1235	Bertie	25-14-1-6	02/10/00	43	2	7.21	6.34	Not Rated
Chinkapin Cr	SR 1432	Hertford	25-14-3	02/10/00	60	8	6.98	6.22	Not Rated
UT Chinkapin Cr	SR 1432	Hertford	25-14-3	04/03/86	36	1	8.02	5.78	Not Rated
03-01-02									
Jacks Swp	SR 1301	Northampton	25-4-2-3	11/08/84	45	10	6.95	2.92	Not Rated
Kirbys Cr	SR 1362	Northampton	25-4-4	02/17/00	54	12	6.25	5.10	Not Rated
				03/11/97	53	18	5.71	4.65	Not Rated
				02/28/95	62	11	6.69	5.86	Not Rated
Meherrin R	SR 1175	Hertford	25-4-(5)	07/31/00	59	10	7.68	6.41	Good
			25-4-(1)	08/10/95	47	9	6.98	5.59	Good
				02/15/95	48	9	6.95	5.46	Good
				07/10/89	59	9	7.26	6.15	Good
				07/09/87	73	10	7.47	5.84	Good
				07/25/85	74	12	7.63	6.36	Excellent
				07/21/83	60	9	7.28	6.04	Good
Potecasi Cr	SR 1504	Northampton	25-4-8	02/09/00	24	1	6.97	7.78	Not Rated
Potecasi Cr	NC 11	Hertford	25-4-8	07/10/89	66	11	7.18	6.07	Not Rated
				07/07/86	53	6	7.34	5.95	Not Rated
				07/17/84	53	7	6.88	5.12	Not Rated
Urahaw Swp	NC 35	Northampton	25-4-8-4	02/09/00	20	0	6.83		Not Rated
Cutawhiskie Swp	SR 1141	Hertford	25-4-8-7	02/02/00	49	3	6.88	5.80	Not Rated
				02/28/95	46	3	7.20	5.70	Not Rated
				08/09/95	49	4	6.83	6.13	Not Rated
03-01-04									
Chowan R	US 17	Chowan	25	08/01/00	29	6	6.61	4.65	Good-Fair
				08/08/95	34	8	6.50	5.40	Good-Fair
				06/11/90	41	11	6.32	4.87	Good
				07/13/88	45	7	6.72	5.55	Good-Fair
				07/08/86	38	6	6.81	5.55	Good-Fair
				07/19/85	37	5	7.04	4.91	Fair
				07/17/84	41	8	6.61	4.91	Good-Fair
				07/13/83	42	8	7.08	5.06	Good-Fair
Eastmost Swp	SR 1361	Bertie	25-24-1	02/22/00	56	5	7.42	6.68	Not Rated

Fish Community Sampling Methods and Criteria

Sampling Methods

At each sample site, a 600-foot section of stream was selected and measured. The fish in the delineated stretch of stream were then collected using two backpack electrofishing units and two persons netting the stunned fish. After collection, all readily identifiable fish were examined for sores, lesions, fin damage or skeletal anomalies, measured (total length to the nearest 1 mm), and then released. Those fish that were not readily identifiable were preserved and returned to the laboratory for identification, examination and total length measurement. Detailed descriptions of the sampling methods may be found at http://www.esb.enr.state.nc.us/BAU.html.

Nonwadeable Streams - Small Boat Sampling Methods

At each site, a 400 m section of stream is measured off into 100 m segments. There are four segments along each shoreline and two segments down the center of the stream, for a total of 10 segments. For each of the 100 m segments, fish are collected and processed the same as those collected using the wadeable stream method. The last collection technique used at each location is a timed catfish collection effort outside the measured stream reach. Data from each of the 100 meter segments and the catfish sampling are currently treated as a separate subsample.

Evaluation and Scoring Criteria

The scoring criteria, metric performance and fish community ratings are currently being revised for wadeable streams in the coastal plain. Evaluation protocols for nonwadeable streams sampled with the small electrofishing boat are currently in development.

Table A-II-4 Fish Community Structure Data Collected in the Chowan River Basin, 1995-2000 (Current basinwide sites are bold.)

Subbasin/Waterbody	Location	County	Index No.	Date	NCIBI Score	NCIBI Rating
03-01-01						
Sarem Cr	Above Cole Cr	Gates	25-12	08/29/00	---	Not Rated
Ahoskie Cr	NC 42	Hertford	25-14-1	05/23/00	---	Not Rated
				02/28/95	---	Not Rated
Chinkapin Cr	SR 1432	Hertford	25-14-3	05/24/00	---	Not Rated
03-01-02						
Cutawhiskie Swp	SR 1141	Hertford	24-4-8-8	05/24/00	---	Not Rated
				02/28/95	---	Not Rated

Appendix III

Use Support Methodology
and
Use Support Ratings

Multiple-Category Use Support Methods

DRAFT December 11, 2001

A. Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met. For example, waters classified for fishing, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR). More specific methods are presented in Part C of this appendix.

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

B. Interpretation of Data and Information

Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classification from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with annual water supply reports from regional water treatment plant consultants.

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations. Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Refer to Part E for more information on the basis of assessments.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

C. Assessment Methodology

Use Support Categories and Uses

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories, as shown in the table below. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*.

	Use Support Categories					
Primary Classification	**Ecosystem Approach**	**Human Health Approach**				
	Aquatic Life/Secondary Recreation	**Fish Consumption**	**Primary Recreation**	**Water Supply**	**Shellfish Harvesting**	**Other**
C	X	X	N/A	N/A	N/A	X
SC	X	X	N/A	N/A	N/A	X
B	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	N/A	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. All existing data pertaining to a stream segment for each applicable use support category are entered into its record and can include, but is not limited to, use support ratings, basis of assessment, biological data, ambient monitoring data, problem parameters and potential sources. The following describes the data and methodologies used to make use support assessments for the surface water classifications (described in Section A, Chapter 3 of each basin plan) using the six use support categories. These methods will continue to be refined, as additional information becomes available.

Basis of Assessment

FS ratings are extrapolated up tributaries from monitored streams when no problematic dischargers or change in land use/cover are identified. The FS rating may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS ratings are not extrapolated to unmonitored tributaries. Refer to Part E for more information.

Problem Parameters

Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database and use support summary table. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Potential Sources

General nonpoint sources (NPS) and point sources (PS) of pollution are identified where there is sufficient information.

Aquatic Life and Secondary Recreation Use Support

The aquatic life and secondary recreation use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. The following is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life protection and secondary recreation.

Biological Data

There are two main types of biological data: benthic marcoinvertebrate and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient monitoring data and biological data are available, biological data are given greater weight.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be not rated.

Benthic Macroinvertebrate Bioclassifications

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera* and *Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

Bioclassification	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings

Pre-1999 Bioclassification	1st sample Bioclassification	Draft Use Support Rating	2nd sample Bioclassification	Final Use Support Rating
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable NR = Not Rated

The use of benthic macroinvertebrate data can be limited in some waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is not

appropriate for all swamp streams. Benthic macroinvertebrate data will not be used in waters characterized or classified by DWQ as swamp waters until the bioclassification criteria for these waters can be used with confidence. Benthic macroinvertebrate data are also not used to develop use support ratings for estuarine waters. Until bioclassification criteria for swamp and estuarine waters are developed, a designation of Not Rated (NR) will be used, and these waters will be listed as NR for aquatic life and secondary recreation use support assessments.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. The benthic macroinvertebrate data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities. For these reasons, the benthic macroinvertebrate bioclassifications provide a valuable assessment of the integrity of trout waters.

A designation of Not Impaired (NI) may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of FS.

Fish Community Bioclassification

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The NCIBI is translated into use support ratings according to the following scheme:

NCIBI	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

The NCIBI was recently revised by DWQ (NCDENR, 2001b). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamilco, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin – all waters except for those draining the Sandhills in Moore, Lee and Harnett counties and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, NC, except for the south and southwest portions of Johnston County and the eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, NC, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All non-wadeable and large streams and rivers throughout the state.

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	**1st sample Bioclassification**	**Draft Use Support Rating**	**2nd sample Bioclassification**	**Final Use Support Rating**
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable NR = Not Rated

Ambient Monitoring Data

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, for analysis. Total number of samples and percent of samples exceeding the NC water quality standards are evaluated for the development of use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the ambient data would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life/secondary recreation use support. These parameters include ammonia, dissolved oxygen, pH, chloride, arsenic, cadmium, chromium, nickel and lead. These parameters are measured against standards for a minimum of ten samples as follows:

Standards Violation	Rating
Criterion exceeded ≤10%	Fully Supporting (FS)
Criterion exceeded 11-25%	Partially Supporting (PS)
Criterion exceeded >25%	Not Supporting (NS)

Data for copper, iron and zinc are not used according to the scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. In order for an action level standard to be violated, there must be a toxicological

test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc.

Metals data for copper and iron are screened at the 85th percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85th percentile of •20 µg/l of copper and/or •2000 µg/l of iron are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being developed for zinc. If a stream does not have biological data that would deem a FS rating, then the stream can be rated PS or NS for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Three fails result in a NS rating, and two fails result in a PS rating.

It is important to note that some waters may exhibit characteristics outside the numerical standards due to natural conditions (e.g., many swamp waters are characterized by low pH and dissolved oxygen). These natural conditions do not constitute a violation of water quality standards.

NPDES Discharger Data

Aquatic Toxicity Data

For facilities that perform Whole Effluent Toxicity (WET) tests according to state NPDES discharge permit requirements, a review of the results of a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for aquatic toxicity data would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data, or has no ambient data, and that facility has failed three or more WET tests in the most recent two years, the stream is not rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

Discharge Effluent Data

NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period of data ending on August 31 of the year of biological sampling. Prior to May 31, 2000, facilities were screened for criterion 40 percent in excess of state water quality standards for conventional pollutant limitations or 20 percent in excess of state water quality standards for toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters.

After May 31, 2000, facilities are screened for criterion 20 percent in excess of state water quality standards for both conventional and toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters. Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available.

Therefore, streams will not be rated PS or NS based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

Fish Consumption Use Support

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a water. This use support category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories issued by the NC Department of Health and Human Services.

If a limited fish consumption advisory is posted at the time of use support assessment, the water is rated PS. If a no consumption advisory is posted at the time of use support assessment, the water is rated NS.

In order to separate this from other fish consumption advisories and to identify fish populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables of the basin plans. A review of the present methods for assessing the fish consumption use support category is being conducted, and methods may be modified in the future.

Primary Recreation Use Support

In addition to the use support categories applicable to Class C and SC waters, the primary recreation use support category will be assessed for all Class B, Class SA and Class SB waters where data are available. This use support category is a human health approach to assess whether waters support primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact in an organized or frequent basis. The use support rating is based on swimming advisories issued by local health departments and by the NC Division of Environmental Health (DEH) beach monitoring program.

Freshwaters

Each January, the geometric mean for ambient stations in Class B waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

When reviewing fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. Monitored Class B waters are rated FS if the geometric mean over the five-year window is less than or equal to 200 colonies per 100

ml. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. Class B waters without fecal coliform data or swimming advisories are not rated.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments. County or local health departments are asked to list those waters with swimming advisories posted for at least two months in the previous five years (ending on August 31 of the year of biological sampling).

Estuarine waters

Each January, the geometric mean for ambient stations in Class SB and SA waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

DEH fecal coliform data are used to assess estuarine (SA and SB) waters. Each January, DEH submits a letter to DWQ stating which coastal waters were posted with an advisory reporting an increased risk from swimming during the prior year. When reviewing DEH fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the DEH fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. If DEH has no data on a water, that water will not be rated.

Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters.

Department of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three

years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

DEH Classification	DEH Criteria
Approved (APP)	**Fecal Coliform Standard for Systematic Random Sampling:** The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test. **Fecal Coliform Standard for Adverse Pollution Conditions Sampling:** The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data does not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. Thus, the DWQ Class SA waters must be separated out and rated for shellfish harvesting use support. The acreage of FS, PS and NS waters are calculated using GIS showing DWQ and DEH classifications as attribute information. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as NS.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ Class SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as PS or NS. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are assessed and rated PS.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class

SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this procedure will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures-based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the frequency of closure-based methods for the 2005 Cape Fear River use support assessment and basin plan.

Interim Frequency of Closure-Based Assessment Methodology

The interim method will be used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

Interim Frequency of Closure-Based Use Support Ratings

Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	FS
Closed ≤10% of data window	Portion of CAO closed ≤10%	FS
Closed >10% to ≤25% of data window	Portion of CAO closed >10% to ≤25% of data window	PS
Closed >25% of data window	Portion of CAO closed >25% of data window	NS
N/A	CAC and P/R**	NS

* Approved waters are closed only during extreme meteorological events (hurricanes).

** CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ will work with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if biological data are collected in a basin in 2000, then the five-year window for closure data would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH and DWQ staff will define subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed will be determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to pre-emptive closures because of named storms is not counted. For example, all waters in growing area E-9 were pre-emptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened

September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for 10 days after the APP waters were reopened.

Proposed Permanent Frequency of Closure-Based Assessment Methodology

Over the next few years DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closure-based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH as CAO. PRO, RES and CAC areas will be rated NS and CAO areas will be rated FS, PS or NS based on the methodology outlined above in the interim methods. Growing areas that have been reclassified by DEH during the data window from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

Water Supply Use Support

This use support category is used to assess all Class WS waters and is a human health approach to assess whether a water can be used for water supply purposes. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated FS. Specific criteria for rating waters PS and NS are yet to be determined.

Other Uses: All Waters in the State

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for

aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

D. Use of Outside Data

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 60 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the 2000 303(d) report and shown in the table below. Level 1 data can be use with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments

Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

E. Monitored vs. Evaluated

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Because a monitored rating is based on the most recent five-year window and site-specific data, it is treated with more confidence than an evaluated rating.

FS ratings are extrapolated up tributaries to monitored streams where there are no dischargers with permit violations or changes in land use/cover. Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS are not applied to unmonitored tributaries. Refer to the following summary for the basis of assigning use support ratings.

Summary of Basis for Assigning Use Support Ratings to Freshwater Streams		
Overall Basis	**Specific Basis**	**Description**
Monitored	Monitored (M)	Monitored stream segments[a] with data[b] ≤5[c] years old.
	Monitored/Evaluated (ME)	Stream segment[a] is unmonitored, but is assigned a use support rating based on another segment of same stream for which data[b] ≤5[c] years old are available.
Evaluated	Evaluated (E)	Unmonitored streams that are direct or indirect tributaries to monitored stream segments rated FS. Must share similar land use to the monitored stream segment.
Not Rated	Not Rated (NR)	Insufficient or no data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.

a) A stream segment is a stream, or a portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (index number).
b) Major data sources include benthic macroinvertebrate and fish community bioclassifications and chemical/physical monitoring data.
c) From the year that basin monitoring was done.

F. Nutrient Enrichment Issues

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables help to describe the level of eutrophication. These include pH, chlorophyll *a*, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*). Likewise, DWQ does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is used to determine use support in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll *a*)
- third party reports
- analysis of water quality or aesthetic complaints, and taste and odor observations
- algal bloom reports
- macrophyte observations
- fish kill reports

- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission, lake associations and water treatment plant operators

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Aquatic Life and Secondary Recreation Use Support - Chowan River Basin

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
CHOWAN RIVER	From the Subbasin 03-01-01/ 03-01-03 Boundary to the Subbasin 03-01-03/03-01-04 Boundary	03-01-03	14.13		FS	ME			
CHOWAN RIVER	From the Subbasin 03-01-03/ 03-01-04 Boundary to mouth defined by a line extending in a southerly direction from Reedy Point on the north shore of Albemarle Sound to a point of land on the south side of the mouth of Black Walnut Swamp	03-01-04	7.80		FS	M			
CHOWAN RIVER	From North Carolina-Virginia State Line to the Subbasin 03-01-01/ 03-01-03 Boundary	03-01-01	39.77		FS	M		NPS	
Meherrin River (North Carolina Portion)	From first crossing at North Carolina-Virginia State Line to a point 1.0 mile upstream from US Highway 258	03-01-02	33.82		FS	M		NPS	
Kirbys Creek	From source to Meherrin River	03-01-02	13.68		NR	M		NPS	
Meherrin River	From a point 1.0 mile upstream from US Highway 258 to Chowan River	03-01-02	11.65		FS	M			
Potecasi Creek	From source to Meherrin River	03-01-02	42.46		NR	M		NPS	
Urahaw Swamp	From source to Potecasi Creek	03-01-02	14.39		NR	M		NPS	
Old Tree Swamp	From source to Potecasi Creek	03-01-02	5.15		NR	M			
Sarem Creek (Taylor Millpond)	From source to Chowan River	03-01-01	9.72		NR	M			
Cole Creek (Lilleys Millpond)	From source to Sarem Creek	03-01-01	9.45		NR	M		NPS	
Wiccacon River (Hoggard Swamp)	From source to Chowan River	03-01-01	22.52		PS	M	Low DO, Nutrients		Agriculture
Ahoskie Creek (Ahoskie Swamp, Bear Swamp)	From source to Wiccacon River	03-01-01	33.34		NR	M		NPS	

Aquatic Life and Secondary Recreation Use Support - Chowan River Basin

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
Stony Creek	From source to Ahoskie Creek	03-01-01	2.21		NR	M			
Chinkapin Creek (Cessons Millpond)	From source to Wiccacon River	03-01-01	7.12		NR	M		NPS	
Eastmost Swamp	From source to Salmon Creek	03-01-04	9.13		NR	M			
ALBEMARLE SOUND	From mouth of Chowan River, defined by a line extending in a southerly direction from Reedy Point on the north shore of Albemarle Sound to a point of land on the south side of Black Walnut Swamp to a line running across Albemarle Sound in a southerly direction from Horniblow Point (North end of Norfolk-Southern Railroad Bridge) to a point of land on the east side of Roanoke River (a line running along the railroad to the Chowan-Washington County Line, thence west along the Chowan-Washington County Line to the Bertie-Washington County Line, thence along the Bertie-Washington County Line to a point 0.1 mile above the mouth of Roanoke River, thence south east 0.1 mile to the east side of Roanoke River	03-01-04	0.00	15600.40	FS	M			

Primary Recreation Use Support - Chowan River Basin

Name	Description	Subbasin	Classification	Miles	Acres	Rating	Basis
CHOWAN RIVER	From the Subbasin 03-01-03/03-01-04 Boundary to mouth defined by a line extending in a southerly direction from Reedy Point on the north shore of Albemarle Sound to a point of land on the south side of the mouth of Black Walnut Swamp	03-01-04	B NSW	7.80		FS	M
CHOWAN RIVER	From the Subbasin 03-01-01/03-01-03 Boundary to the Subbasin 03-01-03/03-01-04 Boundary	03-01-03	B NSW	14.13		FS	M
CHOWAN RIVER	From North Carolina-Virginia State Line to the Subbasin 03-01-01/03-01-03 Boundary	03-01-01	B NSW	39.77		FS	M
Meherrin River	From a point 1.0 mile upstream from US Highway 258 to Chowan River	03-01-02	B NSW	11.65		FS	M
ALBEMARLE SOUND	From mouth of Chowan River, defined by a line extending in a southerly direction from Reedy Point on the north shore of Albemarle Sound to a point of land on the south side of Black Walnut Swamp to a line running across Albemarle Sound in a southerly direction from Horniblow Point (North end of Norfolk-Southern Railroad Bridge) to a point of land on the east side of Roanoke River (a line running along the railroad to the Chowan-Washington County Line, thence west along the Chowan-Washington County Line to the Bertie-Washington County Line, thence along the Bertie-Washington County Line to a point 0.1 mile above the mouth of Roanoke River, thence south east 0.1 mile to the east side of Roanoke River	03-01-04	B NSW	0.00	15600.40	FS	M

Fish Consumption Use Support - Chowan River Basin

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
CHOWAN RIVER	From North Carolina-Virginia State Line to the Subbasin 03-01-01/03-01-03 Boundary	03-01-01	39.77		PS	M			

Appendix IV

303(d) Listing
and
Reporting Methodology

303(d) LISTING AND REPORTING REQUIREMENTS

What is the 303(d) List?

Section 303(d) of the Clean Water Act (CWA) requires states to develop a comprehensive public accounting of all impaired waters. North Carolina's list of impaired waters must be submitted to EPA by April 1 of every even year (40 CFR 130.7). The list includes waters impaired by pollutants, such as nitrogen, phosphorus and fecal coliform bacteria, and by pollution, such as hydromodification and habitat degradation. The source of impairment might be from point sources, nonpoint sources or atmospheric deposition. Some sources of impairment exist across state lines. North Carolina lists impaired waters regardless of whether the pollutant or source of pollution is known and whether the pollutant/pollution source(s) can be legally controlled or acted upon by the State of North Carolina. More complete information can be obtained from *North Carolina's 2000 303(d) List* (http://h2o.enr.state.nc.us/mtu/), which can be obtained by calling the Planning Branch of DWQ at (919) 733-5083.

303(d) List Development

Generally, there are three steps to preparing North Carolina's 303(d) list. They are: 1) gathering information about the quality of North Carolina's waters; 2) screening those waters to determine if any are impaired and should be listed; and 3) prioritizing listed waters for TMDL development. The following subsections describe each of these steps in more detail.

Sources of Information

North Carolina considers all practical existing and readily available data and information in preparing the 303(d) list. Sources solicited for "existing and readily available data and information" include, but are not limited to the following:

- The previous 303(d) list.
- Basinwide Water Quality Plans and Assessment Reports.
- 305(b) reports.
- 319 nonpoint source pollution assessments.
- Waters where specific fish or shellfish consumption bans and/or advisories are currently in effect.
- Waters for which effluent toxicity test results indicate possible or actual excursions of state water quality standards.
- Waters identified by the state as impaired in its most recent Clean Lakes Assessment.
- Drinking water source water assessments under the Safe Drinking Water Act.
- Trend analyses and predictive models used for determining numeric and narrative water quality standard compliance.
- Data, information and water quality problems reported from local, state or federal agencies, Tribal governments, members of the public and academic institutions.

Listing Criteria

Waters whose use support ratings were not supporting (NS) or partially supporting (PS) based on monitored information in the 305(b) report are considered as initial candidates for the 303(d) list. Waters that were listed on the previously approved 303(d) list are evaluated and automatically included if the use support rating was NS, PS or not rated (NR).

Guidance from EPA on developing the 1998 303(d) lists indicates that impaired waters without an identifiable problem parameter should not be included on the 303(d) list. However, DWQ feels that waters listed in the 305(b) report as impaired for biological reasons, where problem parameters have not been identified, should remain on the 303(d) list. The Clean Water Act states that chemical, physical and biological characteristics of waters shall be restored. The absence of an identified cause of impairment does not mean that the water should not receive attention. Instead, DWQ should resample or initiate more intensive studies to determine why the water is impaired. Thus, biologically impaired waters without an identified cause of impairment are on the 2000 303(d) list.

Assigning Priority

North Carolina has developed a TMDL priority ranking scheme that reflects the relative value and benefits that a water provides to the state. The priority ranking system is designed to take into account the severity of the impairment, especially when threats to human health, endangered species or the designated uses of the water are present.

A priority of High, Medium or Low has been assigned to all waters on Parts 1, 4, 5 and 6 of the list (the following section describes these parts in more detail). A high priority is assigned to all waters that are classified as water supplies. A high priority is also automatically assigned to all waters harboring species listed as endangered or threatened under the federal Endangered Species Act (ESA). A medium priority has minimally been assigned to waters harboring state listed endangered and threatened species. As a way of addressing anti-degradation concerns, classified Outstanding Resource Waters and High Quality Waters start at the medium priority. The remaining waters on the list are prioritized according to severity of the impairment.

New Format of the List

North Carolina has begun to make the structural changes prescribed in EPA's July 13, 2000 final TMDL rule. The *2000 303(d) List* reflects many of these changes. EPA's final rule will likely eventually require 303(d) lists to be divided into four sections. North Carolina's 2000 list has been divided into six parts and reflects comments made on the proposed rules by North Carolina and other states. This six-part format meets the requirements of existing rules, and future lists will meet requirements of revised federal rules (when implemented). A summary of each part of the list is provided below. A more detailed discussion is found in the preface to the actual list document.

Part 1 - Waters impaired by a *pollutant* as defined by EPA.

"The term pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water." TMDLs will be submitted for all water/pollutant combinations listed in Part 1.

Part 2 - Waters impaired by *pollution*, not by a *pollutant*.

EPA defines *pollution* as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water" in the CWA section 502(19). EPA believes that in situations where the impairment is not caused by a *pollutant*, a TMDL is generally not the appropriate solution to the problem. In keeping with the principle that the 303(d) list is an

accounting of all impaired waters; however, these types of waters will remain on Part 2 of the list until water quality uses and standards are attained by some other means.

Part 3 - Waters for which EPA has approved or established a TMDL and water quality standards have not yet been attained.
Monitoring data will be considered when evaluating Part 3 waters for potential delisting. Waters will be moved to Part 1 of the list if updated information and data demonstrate that the approved TMDL is inadequate.

Part 4 - Waters for which TMDLs are not required.
Other required regulatory controls (e.g., NPDES permit limits, Phase I Federal Stormwater Permits, etc.) are expected to attain water quality standards by the next regularly scheduled listing cycle.

Part 5 - Biologically impaired waters with no identified cause of impairment.
Roughly half of the waters on North Carolina's 303(d) list appear on Part 5. Identification of the cause(s) of impairment will precede movement of these waters to Parts 1 and 2 of the list. EPA recognized that in specific situations the data are not available to establish a TMDL, and that these specific waters might be better placed on a separate part of the 2000 303(d) list (64 FR, 46025). Data collection and analysis will be performed in an attempt to determine a cause of impairment. North Carolina's proposed plan for managing biologically impaired waters can be found in the preface to Part 5 of the list.

Part 6 – The *proper technical conditions* do not yet exist to develop a TMDL.
"*Proper technical conditions* refers to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662). These are waters that would otherwise be on Part 1 of the list. In the proposed TMDL regulations, EPA again recognized that in some specific situations the data, analyses or models are not available to establish a TMDL, and that these specific waters might be better off on a separate part of the 2000 303(d) list (64 FR, 46025). North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. DWQ has included fecal impaired shellfish waters on this part of the list. North Carolina's approach to managing shellfish waters impaired because of fecal coliform violations is outlined in the preface to Part 6 of the list.

Scheduling TMDLs

North Carolina will submit TMDLs for each water within 13 years of its first listing, starting with the EPA-approved 1998 303(d) list. TMDLs for waters first listed in 1998 or earlier will be developed by 2011. As a general rule, TMDLs will be addressed according to highest priority in accordance with the rotating basinwide planning approach. Due to the wide range of complexities encountered in TMDL development, TMDLs will not necessarily be submitted to EPA in order of priority.

TMDLs on Part 1 of the 303(d) list are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement and "buy-in". Others

need to have a technical strategy budgeted and scheduled. Some are almost ready for submittal to EPA for approval. As the current regulations require, North Carolina has listed waters targeted for TMDL development within the next two years.

North Carolina has used "biological impairment" to place the majority of waters on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Part 5 is to be expected. It is important to understand that the identification of waters on Part 5 of the list does not mean that they are low priority waters. The problem parameter identification (PPI) approach is a high priority for the State of North Carolina. However, it should be noted that it may take significant resources and time to determine the cause of impairment. The PPI approach is also a declaration of need for more data and more time to adequately define the problems and whether they are affected by *pollution, pollutants* or a combination.

North Carolina believes it to be both practical and honest to schedule TMDL development for only those waters where we have some information about the cause of impairment. Scheduling TMDLs for waters that may not be impaired by a *pollutant* is misleading and counterproductive.

Delisting Waters

North Carolina relies heavily on the existing 305(b) reporting methodology to complete the 303(d) process. In general, waters will be removed from the 303(d) list when data show that a water is fully supporting its uses. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved 303(d) list will be removed from the 303(d) lists under the following circumstances:

- An updated 305(b) use support rating of fully supporting.
- Applicable water quality standards are being met (i.e., no longer impaired for a given *pollutant*).
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or *National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing Decisions*. Robert Wayland III, Director. Office of Wetlands, Oceans, and Watersheds. Aug 27, 1997.)
- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories.
- Typographic listing mistakes (i.e., the wrong water was identified).

Appendix V

Chowan River Basin
Workshop Summaries

CHOWAN RIVER BASIN WORKSHOPS

North Chowan Workshop
Ahoskie, North Carolina
March 22, 2001

These questions were purposed to the participants:

1: WHAT ARE THE MAIN ISSUES TO WATER QUALITY IN THE CHOWAN RIVER BASIN?

2: WHERE ARE THE PROBLEM AREAS OR WATERS AND WHAT RECOMMENDATIONS DO YOU HAVE FOR ADDRESSING THESE PROBLEMS/WATERS?

3: WHO SHOULD BE INVOLVED IN ADDRESSING THE PROBLEMS (i.e., local agencies or organizations, etc.)?

ISSUES	WHERE	RECOMMENDATIONS	WHO
♦ Overstocked with Canadian Geese	♦ Lots of areas in Merchant Millpond were cleared	♦ Institute resident goose hunting season	♦ NC Wildlife Resources Commission (WRC)
♦ Explore non-bulk head (bio-engineering) bank stabilization	♦ Development area – streams and sound	♦ Explore, look into alternatives	♦ NCSU ♦ CAMA
♦ Identify if farming Best Management Practices (BMPs) have improved water quality ♦ Erosion/nutrient load at points between rivers on north side of Albemarle Sound ♦ Sediment into rivers north and south of Albemarle Sound via drainage ditches	♦ Basinwide	♦ Continue forest BMPs & forest practice guidelines ♦ Monitoring ♦ Continue cost share programs and fine tune them ♦ Provide tax credit for no-till equipment - expand and increase	♦ NC Forest Service ♦ DWQ ♦ NRCS ♦ Soil & Water ♦ FSA ♦ NC State Government
♦ Restore fish spawning habitat	♦ Pollack Swamp and other areas	♦ Implement restoration	♦ Wetlands Restoration Program (WRP) ♦ NCSU Stream Restoration

♦ Failing septic systems ♦ State of NC is forcing municipalities to install land application sites without much support for success or flexibility to make it work. ♦ Individual residential septic tank systems and their impacts to water quality	♦ Basinwide ♦ High density areas – trailer parks ♦ Basinwide ♦ More in upper part of basin	♦ Education ♦ Continue to look at alternative systems ♦ Provide financial assistance for repairs ♦ Require pumpout (i.e., every 5 years) ♦ Be sure future sitings are appropriate locations (i.e., look at soil compatibility)	♦ Health Department ♦ NC Cooperative Extension Service (NCES) ♦ County Government
♦ Run-off in developed areas ♦ Stormwater from parking lots, farming operations (sediment, nutrients, pesticides, hog lot – sewage treatment)		♦ Education to homeowners & developers	♦ NCES ♦ Ag Service
♦ Development	♦ Chowan County ♦ Edenton ♦ Hammonds Point	♦ Develop sound land use plans ♦ Conduct county inspections on permits	♦ Local ♦ Division of Coastal Management ♦ County
♦ Status of Virginia's impact to NC waters	♦ Virginia	♦ Continue "pressure" to get memorandum of agreement with Virginia signed ♦ Land apply municipal waste (i.e., spray irrigation instead of discharge) ♦ Need communication and cooperation	♦ Legislators ♦ VA Government Legislature ♦ EPA ♦ DENR ♦ VA Dept of Conservation
♦ Wetland mitigation – mosquitoes ♦ Requiring double acreage replacement in a region that is already predominantly swampy		♦ Mitigation should be site-specific	♦ NCDOT ♦ WRP
♦ Buffers between development at waterside and waters ♦ Not allowing a landowner to trim trees within 50 feet of river even when the river is 2 miles wide and water temperature is not affected.		♦	♦
♦ Find a way to the end of CF Industries groundwater problem		♦	♦
♦ International Paper Industries: during peak discharge – the water turns brown and fish move out	♦ Chowan River	♦ Reduce nitrogen and phosphorus in discharge ♦ Increase monitoring ♦ Need status and trends document of Chowan River	♦ DENR ♦ VADCR
♦ Insufficient data relayed to citizens ♦ Insufficient problem identification ♦ Insufficient post-BMP monitoring ♦ A farmer continually plows his fields closer and closer to the road, until the field reaches the road. This area causes erosion and flooding, etc. ♦ Don't place responsibility/blame on a single group (i.e., farmers) for complex water quality problems (i.e., nutrient loading) ♦ Reduce phosphorus use by farmers (i.e., use low-phosphorus fertilizer) ♦ Need for more information and advice on how to reduce nutrient inputs (i.e., field borders)		♦ Conduct education with hard science in layman's terms with information on yield impacts	

♦ Poorly performing sanitary treatment plants due to them being undersized ♦ Sedimentation/turbidity ♦ Nutrient source loading – What are the sources? ♦ Industry, municipality, agriculture should cross education to make better solutions!		♦ Site outfalls appropriately ♦ Implement vegetated filters ♦ Use sedimentation ponds ♦ Use constructed wetlands ♦ Develop regulations ♦ Promote education ♦ Increase staffing ♦ Increase enforcement ♦ Institute local watches (i.e., Stream Watch)	♦ WRP ♦ Locals
♦ Groundwater usage vs. Chowan River surface water	♦	♦	♦
♦ Out board motors ♦ Increased traffic – jet skis impacts	♦ Chowan River	♦ Learn more about this issue – especially EPA's new emission standards ♦ Education	♦ EPA

CHOWAN RIVER BASIN WORKSHOPS

South Chowan Workshop
Edenton, North Carolina
March 27, 2001

These questions were purposed to the participants:

1: WHAT ARE THE MAIN ISSUES TO WATER QUALITY IN THE CHOWAN RIVER BASIN?

2: WHERE ARE THE PROBLEM AREAS OR WATERS AND WHAT RECOMMENDATIONS DO YOU HAVE FOR ADDRESSING THESE PROBLEMS/WATERS?

3: WHO SHOULD BE INVOLVED IN ADDRESSING THE PROBLEMS (i.e., local agencies or organizations, etc.)?

ISSUES	WHERE	RECOMMENDATIONS	WHO
♦ Over-fertilization from the residential community ♦ Nutrients ♦ Lawn fertilization ♦ Commercial/lawn care and golf course upkeep	♦ Future development ♦ Basinwide	♦ Educate ♦ Institute buffers between lawn and ditch	♦ NCES ♦ Some regulators ♦ DWQ?
♦ Septic systems and municipal systems ♦ Poor soils for septics ♦ Affect rural wells ♦ Health concerns ♦ Lack of information distributed on how to operate systems ♦ During home purchase – no paperwork relay between owners	♦ Eastern NC	♦ Distribute information at time of permitting on maintenance ♦ Survey existing geographic areas of problems – use soil survey map as indicator ♦ Ensure broader distribution of information especially to rural areas ♦ Give incentives for septic upkeep (pump-out) (i.e., Nags Head's program) ♦ Provide cost share opportunities for maintenance ♦ Allow alternative systems ♦ Educate on maintenance and operation	♦ Health Department ♦ NCES ♦ Local government

♦ Waste water treatment systems ♦ Poor compliance ♦ Land application limitations ♦ Likely high levels of violations ♦ Lack of resources to do good operation and maintenance ♦ Lack of coordination ♦ Broken hydrants?	♦	♦	♦
♦ Get info on waters that are not currently monitored	♦ Non-monitored sites	♦ Work out monitoring program logistics/glitches ♦ Need more data	♦ DWQ
♦ Livestock runoff and waste	♦ Poultry and hog operations	♦ Address – work with the animal operations	♦ DWQ
♦ Delisting on 303(d) list	♦	♦ Revisit	♦ DWQ
♦ Too many geese	♦ Merchants Mill Pond and other areas	♦ Educate ♦ Make it less attractive to the geese ♦ Hunting	♦ Fish and Wildlife Service ♦ Wildlife Resource Commission ♦ County Government
♦ Sedimentation due to agriculture ♦ Forestry ♦ Development	♦ Basinwide	♦ Encourage BMPs ♦ Encourage Conservation Reserve Enhancement Program conservation till farming ♦ Seek alternatives to bulkheads (i.e., vegetative stabilization, etc.)	♦ NRCS ♦ Soil and Water Conservation District
♦ House Bill 515 ♦ Nitrogen limit for discharge to nutrient sensitive waters ♦ Needs to address nitrogen forms (i.e., is the nitrogen bioavailable?)	♦	♦ Revisit House Bill 515 language	♦ Legislature
♦ Nucor	♦	♦ Monitor above and below plant discharge	♦ DWQ
♦ Unrecycled gray water	♦ Basinwide	♦	♦ County Health Department
♦ Land use – conversion	♦	♦	♦ County ♦ DWQ
♦ Permitted dischargers	♦	♦	♦ County ♦ DWQ
♦ Salinity – over use of water	♦	♦	♦ County ♦ DWQ
♦ Interactions with Virginia	♦	♦	♦ County ♦ DWQ
♦ Agriculture ♦ Agriculture community is: ♦ Working hard ♦ Has high participation ♦ $$ is frozen due to the state ♦ Farmers are reducing nutrients	♦ Lift Ag Cost share funding freeze ♦ Educate on land application rates and effective locations, disposal, amount of	♦	♦ Soil and Water Conservation Division for Ag Cost Share Funds ♦ NCES ♦ Master Gardener's

♦ Agriculture is an easy target for management ♦ Agriculture is blamed for residential community's impacts ♦ Increased growth and development ♦ Stormwater runoff ♦ More restrictions on agriculture sector and there is an exam with fee requirements ♦ Ignorance on where water flows – (i.e., runoff flows directly to storm drains)	applications ♦ Foster formal training		Program ♦ Dept of Agriculture Pesticide Division

Appendix VI

Chowan River Basin
Nonpoint Source Program
Description and Contacts

Statewide Nonpoint Source Management Program Description

The North Carolina Nonpoint Source Management Program consists of a broad framework of federal, state and local resource and land management agencies. More than 2,000 individuals administer programs that are directly related to nonpoint source pollution management within the state. A range of responsibilities have been delegated to county or municipal programs including the authority to inspect and permit land clearing projects or septic system performance. In the field of agriculture, a well established network of state and federal agricultural conservationists provide technical assistance and program support to individual farmers.

Staff in the DWQ Water Quality Section's Planning Branch lead the Nonpoint Source Management Program, working with various agencies to insure that program goals are incorporated into individual agencies' management plans. The goals include:

1. Coordinate implementation of state and federal initiatives addressing watershed protection and restoration.
2. Continue to target geographic areas and waterbodies for protection based upon best available information.
3. Strengthen and improve existing nonpoint source management programs.
4. Develop new programs that control nonpoint sources of pollution not addressed by existing programs.
5. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico National Estuary Program).
6. Monitor the effectiveness of BMPs and management strategies, both for surface and groundwater quality.

Coordination between state agencies is achieved through reports in the *North Carolina Nonpoint Source Management Program Update*. Reports are intended to keep the program document current and develop a comprehensive assessment identifying the needs of each agency to meet the state nonpoint source program goals. Annual reports are developed to describe individual program priorities, accomplishments, significant challenges, issues yet to be addressed, and resource needs. A copy of the latest Annual Report (FY2000) is available online at http://h2o.enr.state.nc.us/nps/nps_mp.htm.

The nature of nonpoint source pollution is such that involvement at the local level is imperative. Basinwide water quality plans identify watersheds that are impaired by nonpoint sources of pollution. Identification, status reports and recommendations are intended to provide the best available information to local groups and agencies interested in improving water quality. The plans also make available information regarding federal, state and local water quality initiatives aimed at reducing or preventing nonpoint source pollution.

The following table is a comprehensive guide to contacts within the state's Nonpoint Source Management Program. For more information, contact Alan Clark at (919) 733-5083 ext. 570. Most employees of the Department of Environment & Natural Resources, including Division of Water Quality, Division of Land Resources, and the Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

Agriculture

USDA Natural Resources Conservation Service:

Formerly the Soil Conservation Service; provides technical specialist for certifying waste management plans; certified trainers for swine applicators training sessions works with landowners on private lands to conserve natural resources helping farmers and ranchers develop conservation systems uniquely suited to their land and individual ways of doing business; provides assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems; conducts site evaluations and soil surveys; administers the Wetlands Reserve Program; offers planning assistance for local landowners for installing best management practices; offers technical assistance for the determination of wetlands on agricultural lands.

Bertie County	Paula A. Ashley	(252) 794-5305	P.O. Box 566, Windsor, NC 27986-0566
Chowan County	R. Dwane Hinson	(252) 482-4127	730 N. Granville St, Edenton, NC 27932-1735
Gates County	W. Paul Boone	(252) 358-7846	P.O. Box 265, Winton, NC 27986-0265
Hertford County	W. Paul Boone	(252) 358-7846	P.O. Box 265, Winton, NC 27986-0265
Northhampton County	Tony R. Short	(252) 534-2591	P.O. Box 218, Jackson, NC 27845-0218

Soil & Water Conservation Districts:

The local Soil and Water Conservation District Boards function under the administration of the North Carolina Soil and Water Conservation Commission (SWCC). The districts are responsible for administer the Agricultural Cost Share Program, identifying treatment areas, allocating resources, signing contractual agreements with landowners, providing technical assistance for the planning and implementation of BMPs and generally encouraging the use of appropriate BMPs to protect water quality.

Bertie County	John W. Stallings	(919) 794-2183	1001 Stoke Ave., Windsor, NC 27983
Chowan County	Louis Nixon	(252) 221-8578	3007 Rocky Hock Road, Edenton, NC 27932
Gates County	Rick Morgan	(252) 465-4122	Route 1, Box 50, Corapeake, NC 27926
Hertford County	James W. Mason	(252) 356-2670	Route 1, Box 10, Harrellsville, NC 27942
Northhampton County	William M. Stephenson	(252) 536-3077	Route 1, Box 301, Garysburg, NC 27831

Division of Soil and Water Conservation:

Provides administrative and technical assistance to the Soil & Water Conservation Districts in areas pertaining to soil science and engineering; distributes Wetlands Inventory maps for a small fee. Administers the Agriculture Cost Share Program (ACSP).

Central Office	David Williams	(919) 715-6103	512 N. Salisbury St., Raleigh, NC 27604
Central Office	Todd Hoefler	(919) 715-9630	512 N. Salisbury St., Raleigh, NC 27604
Regions V	George Stewart	(252) 946-6481	943 Washington Square Mall, Washington, NC 27889

NCDA Regional Agronomists:

Provides technical specialists for certifying waste management plans. Provides certified trainers for animal waste applicators training sessions. Tracks, monitors, and accounts for use of nutrients on agricultural lands. Identifies and evaluates the use of nutrient management plans.

Central Office	Kent Messick	(919) 733-2655	4300 Reedy Creek Road, Raleigh, NC 27607
Regional Office	Wayne Nixon	(252) 426-7210	286 Bagley Swamp Road, Hertford, NC 27944

Education

NC Cooperative Extension Service:

Provides practical, research-based information and programs to help individuals, families, farms, businesses and communities.

Bertie County	James L. Peele	(252) 794-5317	102 Dundee Street, Windsor, NC 27983
Chowan County	J. Michael Williams	(252) 482-6585	730 N. Granville St., Edenton, NC 27932
Gates County	Reba Green-Holley	(252) 357-1400	112 Court Street, Gatesville, NC 27938
Hertford County	Deborah Howard	(252) 358-7822	Tyson St., Winton, NC 27986
Northhampton County	Rose Massey	(252) 534-2711	P.O. Box 636, Jackson, NC 27845

Forestry

Division of Forest Resources:

Develop, protect, and manage the multiple resources of North Carolina's forests through professional stewardship, enhancing the quality of our citizens while ensuring the continuity of these vital resources.

Central Office	Moreland Gueth	(919) 733-2162	P.O. Box 29581, Raleigh, NC 27626-0581

Fish and Wildlife Resources

Division of Marine Fisheries

The North Carolina Division of Marine Fisheries (DMF) is responsible for stewardship of the state's marine and estuarine resources. The DMF's jurisdiction encompasses all coastal waters and extends to 3 miles offshore. Agency policies are established by the 17-member Marine Fisheries Commission and the Secretary of the Department of Environment, Health and Natural Resources.

Central Office	Jenny Hardy	(252) 726-7021	3441 Arendell St., Morehead City, NC 28557
Elizabeth City Office	Sara Winslow	(252) 264-3911	1367 US HWY 17, Elizabeth City, NC 27909

Wildlife Resources Commission:

To manage, restore, develop, cultivate, conserve, protect, and regulate the wildlife resources of the State, and to administer the laws relating to game, game and freshwater fishes, and other wildlife resources enacted by the General Assembly to the end that there may be provided a sound, constructive, comprehensive, continuing, and economical game, game fish, and wildlife program.

Central Office	Frank McBride	(252) 528-9886	P.O. Box 118, Northside, NC 27564

General Water Quality

DWQ Water Quality Section:

Control of water pollution from point sources such as municipal and industrial wastewater discharges, and from nonpoint sources that originate from agricultural drainage, urban runoff, land clearing, construction, mining, forestry, septic tanks and land application of waste; issues permits for both discharging and on-site wastewater treatment systems, conducts compliance inspections, operates an ambient water quality monitoring program, and performs a wide variety of special studies on activities affecting water quality; administers the 319 projects statewide.

Central Office	Lin Xu	(919) 733-5083	512 N. Salisbury Street, Raleigh, NC 27604
Raleigh Region	Ken Schuster	(919) 571-4700	3800 Barrett Drive, Raleigh, NC 27609
Washington Region	Jim Mulligan	(252) 946-6481	943 Washington Square Mall, Washington, NC 27889

General Water Quality

US Army Corps of Engineers:

Responsible for: investigating, developing and maintaining the nation's water and related environmental resources; constructing and operating projects for navigation, flood control, major drainage, shore and beach restoration and protection; hydropower development; water supply; water quality control, fish and wildlife conservation and enhancement, and outdoor recreation; responding to emergency relief activities directed by other federal agencies; and administering laws for the protection and preservation of navigable waters, emergency flood control and shore protection. Responsible for wetlands and 404 Federal Permits.

Wilmington District	Keith Long	(910) 251-4631	P.O. Box 1890, Wilmington, NC 28402-1890

DWQ Groundwater Section:

Groundwater classifications and standards, enforcement of groundwater quality protection standards and cleanup requirements, review of permits for wastes discharged to groundwater, issuance of well construction permits, underground injection control, administration of the underground storage tank (UST) program (including the UST Trust Funds), well head protection program development, and ambient groundwater monitoring.

Central Office	Carl Bailey	(919) 715-6169	2728 Capital Blvd., Raleigh, NC 27609
Raleigh Region	Jay Zimmerman	(919) 571-4700	3800 Barrett Drive, Raleigh, NC 27609
Washington Region	Willie Hardison	(252) 946-6481	943 Washington Sqaure Mall, Washington, NC 27889

DENR Division of Coastal Management:

Responsible for carrying out the provisions of the North Carolina Coastal Area Management Act (CAMA); processes major development permits, review all dredge and fill permit applications, and determines consistency of state and federal grants and projects with the North Carolina Coastal Management Program; prepares guildlines for a local land use planning program in twenty coastal counties; administers grants to local government for planning, permitting and beach access programs; and acquires and manages coastal and estuarine reserves as natural areas for research, education and preservation.

Central Office	Donna Moffitt	(919) 733-2293	2728 Capital Blvd, Raleigh, NC 27609
Washington Office	Terry Moore	(252) 946-6481	943 Washington Square Mall, Washington, NC 27889
Elizabeth City Office	Ted Sampson	(252) 264-3901	1367 US Hwy. 17, Elizabeth City, NC 27909

Construction/Mining

DENR Division of Land Resources:

Conducts land surveys and studies, produces maps, and protects the state's land and mineral resources. Administers the NC Sedimentation and Erosion Control Program.

Central Office	Mel Nevills	(919) 733-4574	512 N. Salisbury St., Raleigh, NC 27626
Washington Region Office	Pay McLain	(252) 946-6481	943 Washington Square Mall, Washington, NC 27889

Solid Waste

DEH Solid Waste Management:

Management of solid waste in a way that protects public health and the environment. The District includes three sections and one program -- Hazardous Waste, Solid Waste, Superfund, and the Resident Inspectors program.

Raleigh Regional Office	Ben Barns	(919) 571-4700	3800 Barrett Drive, Raleigh, NC 27609
Washington Regional Office	Chuck Boyette	(252) 946-6481 ext. 307	943 Washington Square Mall, Washington, NC 27889

On-Site Wastewater Treatment

Division of Environmental Health:

Safeguards life, promotes human health, and protects the environment through the practice of modern environmental health science, the use of technology, rules, public education, and above all, dedication to the public trust.
Services include:

- Training of and delegation of authority to local environmental health specialists concerning on-site wastewater
- Engineering review of plans and specifications for wastewater systems 3,000 gallons or larger and industrial process wastewater systems designed to discharge below the ground surface
- Technical assistance to local health departments, other state agencies, and industry on soil suitability and other site considerations for on-site wastewater systems.

Central Office - DEH	Steve Steinbeck	(919) 715-3273	2728 Capital Blvd. Raleigh, NC 27604
Bertie County	Osbourne (Don) Highsmith, Jr.	(252) 794-5303	P.O. Box 530, Windsor, NC 27983
Chowan County	Jon Morgan	(252) 482-6003	P.O. Box 72, Edenton, NC 27932
Gates County	Daniel R. McDougald	(252) 358-7833	29 Medical Center Road, Gates, NC 27937
Hertford County	Daniel R. McDougald	(252) 358-7833	29 Medical Center Road, Gates, NC 27937
Northhampton County	John L. White	(252) 534-5851	P.O. Box 635, Jackson, NC 27845

Note: The Division of Water Quality (DWQ), Division of Land Resource (DLR) and Division of Solid Waste Management Raleigh Regional Offices serve Northhampton County.

The DWQ, DLR and Division of Solid Waste Management Washington Regional Offices serve Bertie, Chowan, Currituck, Camden, Dare, Gates, Hertford, Hyde, Pasquotank, Perquimans, Tyrrell and Washington counties.

The Division of Coastal Management (DCM) Elizabeth City Field Office serves Currituck, Camden, Chowan, Gates, Pasquotank, Perquimans and Dare counties.

The DCM Washington Field Office serves Bertie, Hertford, Hyde, Tyrrell and Washington counties.

Appendix VII

Glossary
of
Terms and Acronyms

Glossary

§	Section.
30Q2	The minimum average flow for a period of 30 days that has an average recurrence of one in two years.
7Q10	The annual minimum 7-day consecutive low flow, which on average will be exceeded in 9 out of 10 years.
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing.
basin	The watershed of a major river system. There are 17 major river basins in North Carolina.
benthic macroinvertebrates	Aquatic organisms, visible to the naked eye (macro) and lacking a backbone (invertebrate), that live in or on the bottom of rivers and streams (benthic). Examples include, but are not limited to, aquatic insect larvae, mollusks and various types of worms. Some of these organisms, especially aquatic insect larvae, are used to assess water quality. See EPT index and bioclassification for more information.
benthos	A term for bottom-dwelling aquatic organisms.
best management practices	Techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point and nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Often, BMPs are applied as system of practices and not just one at a time.
bioclassification	A rating of water quality based on the outcome of benthic macroinvertebrate sampling of a stream. There are five levels: Poor, Fair, Good-Fair, Good and Excellent.
BMPs	See *best management practices*.
BOD	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed by the decomposition of biological matter or chemical reactions in the water column. Most NPDES discharge permits include a limit on the amount of BOD that may be discharged.
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.
channelization	The physical alteration of streams and rivers by widening, deepening or straightening of the channel, large-scale removal of natural obstructions, and/or lining the bed or banks with rock or other resistant materials.
chlorophyll *a*	A chemical constituent in plants that gives them their green color. High levels of chlorophyll *a* in a waterbody, most often in a pond, lake or estuary, usually indicate a large amount of algae resulting from nutrient overenrichment or eutrophication.
coastal counties	Twenty counties in eastern NC subject to requirements of the Coastal Area Management Act (CAMA). They include: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell and Washington.
Coastal Plain	One of three major physiographic regions in North Carolina. Encompasses the eastern two-fifths of state east of the *fall line* (approximated by Interstate I-95).
conductivitiy	A measure of the ability of water to conduct an electrical current. It is dependent on the concentration of dissolved ions such as sodium, chloride, nitrates, phosphates and metals in solution.
degradation	The lowering of the physical, chemical or biological quality of a waterbody caused by pollution or other sources of stress.

DENR	Department of Environment and Natural Resources.
DO	Dissolved oxygen.
drainage area	An alternate name for a watershed.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
dystrophic	Naturally acidic (low pH), "black-water" lakes which are rich in organic matter. Dystrophic lakes usually have low productivity because most fish and aquatic plants are stressed by low pH water. In North Carolina, dystrophic lakes are scattered throughout the Coastal Plain and Sandhills regions and are often located in marshy areas or overlying peat deposits. NCTSI scores are not appropriate for evaluating dystrophic lakes.
effluent	The treated liquid discharged from a wastewater treatment plant.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
EPT Index	This index is used to judge water quality based on the abundance and variety of three orders of pollution sensitive aquatic insect larvae: Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).
eutrophic	Elevated biological productivity related to an abundance of available nutrients. Eutrophic lakes may be so productive that the potential for water quality problems such as algal blooms, nuisance aquatic plant growth and fish kills may occur.
eutrophication	The process of physical, chemical or biological changes in a lake associated with nutrient, organic matter and silt enrichment of a waterbody. The corresponding excessive algal growth can deplete dissolved oxygen and threaten certain forms of aquatic life, cause unsightly scums on the water surface and result in taste and odor problems.
fall line	A geologic landscape feature that defines the line between the piedmont and coastal plain regions. It is most evident as the last set of small rapids or rock outcroppings that occur on rivers flowing from the piedmont to the coast.
FS	Fully supporting. A rating given to a waterbody that fully supports its designated uses and generally has good or excellent water quality.
GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
habitat degradation	Identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.
headwaters	Small streams that converge to form a larger stream in a watershed.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
Hydrilla	The genus name of an aquatic plant - often considered an aquatic weed.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222 subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975 square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
hypereutrophic	Extremely elevated biological productivity related to excessive nutrient availability. Hypereutrophic lakes exhibit frequent algal blooms, episodes of low dissolved oxygen or periods when no oxygen is present in the water, fish kills and excessive aquatic plant growth.
impaired	Term that applies to a waterbody that has a use support rating of partially supporting (PS) or not supporting (NS) its uses.

impervious	Incapable of being penetrated by water; non-porous.
kg	Kilograms. To change kilograms to pounds multiply by 2.2046.
lbs	Pounds. To change pounds to kilograms multiply by 0.4536.
loading	Mass rate of addition of pollutants to a waterbody (e.g., kg/yr)
macroinvertebrates	Animals large enough to be seen by the naked eye (macro) and lacking backbones (invertebrate).
macrophyte	An aquatic plant large enough to be seen by the naked eye.
mesotrophic	Moderate biological productivity related to intermediate concentrations of available nutrients. Mesotrophic lakes show little, if any, signs of water quality degradation while supporting a good diversity of aquatic life.
MGD	Million gallons per day.
mg/l	Milligrams per liter (approximately 0.00013 oz/gal).
NCIBI	North Carolina Index of Biotic Integrity. A measure of the community health of a population of fish in a given waterbody.
NH_3-N	Ammonia nitrogen.
nonpoint source	A source of water pollution generally associated with rainfall runoff or snowmelt. The quality and rate of runoff of NPS pollution is strongly dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from forested lands will generally contain much less pollution and runoff more slowly than runoff from urban lands.
NPDES	National Pollutant Discharge Elimination System.
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NS	Not supporting. A rating given to a waterbody that does not support its designated uses and has poor water quality and severe water quality problems. Both PS and NS are called impaired.
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed).
NTU	Nephelometric Turbidity Units. The units used to quantify turbidity using a turbidimeter. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions.
oligotrophic	Low biological productivity related to very low concentrations of available nutrients. Oligotrophic lakes in North Carolina are generally found in the mountain region or in undisturbed (natural) watersheds and have very good water quality.
ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
pH	A measure of the concentration of free hydrogen ions on a scale ranging from 0 to 14. Values below 7 and approaching 0 indicate increasing acidity, whereas values above 7 and approaching 14 indicate a more basic solution.
phytoplankton	Aquatic microscopic plant life, such as algae, that are common in ponds, lakes, rivers and estuaries.

Piedmont	One of three major physiographic regions in the state. Encompasses most of central North Carolina from the Coastal Plain region (near I-95) to the eastern slope of the Blue Ridge Mountains region.
PS	Partially supporting. A rating given to a waterbody that only partially supports its designated uses and has fair water quality and severe water quality problems. Both PS and NS are called impaired.
riparian zone	Vegetated corridor immediately adjacent to a stream or river. See also SMZ.
river basin	The watershed of a major river system. North Carolina is divided into 17 major river basins: Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar-Pamlico, Watauga, White Oak and Yadkin River basins.
river system	The main body of a river, its tributary streams and surface water impoundments.
runoff	Rainfall that does not evaporate or infiltrate the ground, but instead flows across land and into waterbodies.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival.
sedimentation	The sinking and deposition of waterborne particles (e.g., eroded soil, algae and dead organisms).
silviculture	Care and cultivation of forest trees; forestry.
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOCs are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance).
streamside management zone (SMZ)	The area left along streams to protect streams from sediment and other pollutants, protect streambeds, and provide shade and woody debris for aquatic organisms.
subbasin	A designated subunit or subwatershed area of a major river basin. Subbasins typically encompass the watersheds of significant streams or lakes within a river basin. Every river basin is subdivided into subbasins ranging from one subbasin in the Watauga River basin to 24 subbasins in the Cape Fear River basin. There are 133 subbasins statewide. These subbasins are not a part of the national uniform hydrologic unit system that is sponsored by the Water Resources Council (see *hydrologic unit*).
Sw	Swamp Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are common in the Coastal Plain and are often naturally discolored giving rise to their nickname of “blackwater” streams.
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses and water quality standards.
TN	Total nitrogen.
TP	Total phosphorus.
tributary	A stream that flows into a larger stream, river or other waterbody.

trophic classification	Trophic classification is a relative description of a lake's biological productivity, which is the ability of the lake to support algal growth, fish populations and aquatic plants. The productivity of a lake is determined by a number of chemical and physical characteristics, including the availability of essential plant nutrients (nitrogen and phosphorus), algal growth and the depth of light penetration. Lakes are classified according to productivity: unproductive lakes are termed "oligotrophic"; moderately productive lakes are termed "mesotrophic"; and very productive lakes are termed "eutrophic".
TSS	Total Suspended Solids.
turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. All particles in the water that may scatter or absorb light are measured during this procedure. Suspended sediment, aquatic organisms and organic particles such as pieces of leaves contribute to instream turbidity.
UT	Unnamed tributary.
watershed	The region, or land area, draining into a body of water (such as a creek, stream, river, pond, lake, bay or sound). A watershed may vary in size from several acres for a small stream or pond to thousands of square miles for a major river system. The watershed of a major river system is referred to as a basin or river basin.
WET	Whole effluent toxicity. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WS	Class WS Water Supply Water Classification. This classification denotes freshwaters used as sources of water supply. There are five WS categories. These range from WS-I, which provides the highest level of protection, to WS-V, which provides no categorical restrictions on watershed development or wastewater discharges like WS-I through WS-IV.
WWTP	Wastewater treatment plant.