HIWASSEE RIVER BASINWIDE WATER QUALITY MANAGEMENT PLAN

May 1997

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This document was approved and endorsed by the NC Environmental Management Commission on May 8, 1997 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 Hiwassee River Basin.

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Bottom Right: Lake Chatuge, NC Division of Water Resources

FOREWORD

Clean water is critical to the health, economic well-being and quality of life of those living or working in the Hiwassee River basin. Most water users in the basin, including industry, agriculture, tourists, and the residents of the basin, rely on water for basic needs. These basic needs include water supply and/or disposal of treated wastewater. In addition, many businesses and residents of the Hiwassee River basin rely directly or indirectly on the basin's 986 miles of rivers and streams to meet their recreational needs and to supply a source of living through tourism. To these groups and the public they serve, it is important that the basin's waters support viable fisheries, that the waters be relatively safe (low risk of contracting water-borne disease) and that they be aesthetically desirable (free of objectionable colors, odors and smells). Yet maintaining clean water becomes increasingly difficult and more expensive as the population grows, as land is developed and as competition for its resources heighten.

The majority of the surface waters in the basin are of good quality. Approximately 10% of the waters in the basin are classified as Outstanding Resource Waters or High Quality Waters. About 23% of the waters in the basin are classified as Water Supply Watersheds. The Hiwassee River basin contains three state listed endangered mussel species. There are eight other aquatic faunal species listed by North Carolina as either of Special Concern or Significantly Rare.

While most of the waters in the basin are fully supporting their designated uses, there are segments of two streams (Brasstown Creek and Valley River) which were found to be impaired based on Division of Water Quality monitoring. There are reasons to be concerned about the quality of some other waters in the basin which were rated as Support Threatened. These waters include Junaluska Creek and portions of the Valley River. The causes of water quality degradation are from both point and nonpoint sources of pollution.

Growth and development is expected to become a more important water quality issue in the basin. The resulting construction of roads, driveways, commercial and recreational areas and homes must be undertaken with proper care to prevent sediments from reaching surface waters. In addition, forestry and agricultural practices should be done using best management practices to avoid erosion and the resulting sedimentation to streams.

Preserving and enhancing the quality of water in the basin is beyond the capabilities of any one agency or group. State and federal government regulatory programs will play an important part, but much of the responsibility will be at the local level. Those who live, work and recreate in the basin have the most at stake.

This document provides a summary of the causes and sources of water pollution in the basin, the status of the basin's water quality, a summary of water quality rules and statutes that apply to water quality protection in the basin, and recommended strategies to protect and enhance the quality of the surface waters in the Hiwassee River basin. The *Hiwassee River Basinwide Water Quality Management Plan* is a planning document that will be used as a guide by the NC Division of Water Quality (formerly Division of Environmental Management) in carrying out its water quality program responsibilities in the basin.

Beyond that, it is hoped that the plan will provide a framework for cooperative efforts between the various stakeholders in the basin toward a common goal of protecting the basin's water resources while accommodating reasonable economic growth.

TABLE OF CONTENTS

Chapter	Title	Page
FOREWORD		i
TABLE OF CONTENTS		ii
EXECUTIVE SUMMARY		xi
1.	INTRODUCTION	*1* - 1
1.1	Purpose of this Document	*1* - 1
1.2	Guide to Use of this Document	*1* - 2
1.3	North Carolina's Basinwide Management Approach	*1* - 3
1.4	Basinwide Responsibilities within the DWQ Water Quality Section	*1* - 5
	References Cited: Chapter 1	*1* - 6
2.	GENERAL BASIN DESCRIPTION	*2* - 1
2.1	Hiwassee Basin Overview	*2* - 1
2.2	Basin Hydrology	*2* - 5
2.3	Local Government and Planning Jurisdictions	*2* - 6
2.4	Land Cover, Population and Growth Trends	*2* - 6
2.4.1	General Land Cover	*2* - 6
2.4.2	Population, Growth Trends and Tourism in the Basin	*2* - 11
2.5	Important Natural Resources	*2* - 17
2.5.1	Waterfalls	*2* - 17
2.5.2	Lakes	*2* - 17
2.5.3	Rare Aquatic Faunal Species	*2* - 17
2.6	Animal Operations	*2* - 21
2.6.1	Registered and Certified Operations	*2* - 21
2.7	Surface Water Classifications and Standards in the Hiwassee River Basin	*2* - 22
2.8	Water Use in the Hiwassee River Basin	*2* - 23
2.8.1	Local Government Water Supply Plans and General Water Use	*2* - 23
2.8.2	Water Withdrawal and Transfer Registration	*2* - 25
2.9	Minimum Streamflow Requirements	*2* - 25
	References Cited: Chapter 2	*2* - 26
3.	CAUSES OF IMPAIRMENT AND SOURCES OF WATER POLLUTION	*3* - 1
3.1	Introduction	*3* - 1
3.2	Causes of Impairment	*3* - 1
3.2.1	Sedimentation	*3* - 2
3.2.2	Fecal Coliform Bacteria	*3* - 7
3.2.3	Toxic Substances	*3* - 7
3.2.4	Oxygen-Consuming Wastes	*3* - 9
3.2.5	Nutrients	*3* - 10
3.3	Point Sources of Pollution	*3* - 10
3.3.1	Defining Point Sources	*3* - 10

TABLE OF CONTENTS (Continued)

Chapter	Title	Page
	3.3.2 Wastewater Point Source Discharges in the Hiwassee River Basin	3 - 10
	3.3.3 Stormwater Point Source Discharges in the Hiwassee River Basin	3 - 16
3.4	Nonpoint Sources of Pollution	3 - 16
	3.4.1 Agriculture	3 - 16
	3.4.2 Urban/Residential	3 - 19
	3.4.3 Construction	3 - 19
	3.4.4 Timber Harvesting	3 - 20
	3.4.5 Mining	3 - 21
	3.4.6 Onsite Wastewater Disposal	3 - 22
	3.4.7 Solid Waste Disposal	3 - 22
	References Cited: Chapter 3	3 - 23
4.	WATER QUALITY IN THE HIWASSEE RIVER BASIN	4 - 1
4.1	Introduction	4 - 1
4.2	Water Quality Monitoring Programs in the Hiwassee River Basin	4 - 1
	4.2.1 Benthic Macroinvertebrate Monitoring	4 - 2
	4.2.2 Fisheries Monitoring	4 - 2
	4.2.3 Lakes Assessment Program (including Phytoplankton)	4 - 3
	4.2.4 Aquatic Toxicity Monitoring	4 - 3
	4.2.5 Ambient Monitoring System	4 - 3
	4.2.6 Other Water Quality Monitoring Programs	4 - 7
4.3	Narrative Water Quality Summaries by Subbasin	4 - 10
	4.3.1 Chatuge Lake and Hiwassee River (Subbasin 04-05-01)	4 - 10
	4.3.2 Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)	4 - 15
4.4	Use Support: Definitions and Methodology	4 - 20
	4.4.1 Introduction to Use Support	4 - 20
	4.4.2 Interpretation of Data	4 - 20
	4.4.3 Assessment Methodology - Freshwater Bodies	4 - 21
	4.4.4 Assigning Use Support Ratings	4 - 23
4.5	Use Support Ratings for the Hiwassee River Basin	4 - 24
	4.5.1 Streams and Rivers	4 - 24
	References Cited: Chapter 4	4 - 29
5.	WATER QUALITY PROGRAMS AND PROGRAM INITIATIVES IN THE BASIN	5 - 1
5.1	Introduction	5 - 1
5.2	State and Federal Legislative Authorities for North Carolina's Water Quality Program	5 - 1
	5.2.1 Federal Authorities for NC's Water Quality Program	5 - 1
	5.2.2 State Authorities for NC's Water Quality Program	5 - 2
5.3	Surface Water Classifications and Water Quality Standards	5 - 2

TABLE OF CONTENTS (Continued)

Chapter	Title	Page
5.4	North Carolina's Point Source Control Program	5 - 4
5.4.1	NPDES Wastewater Discharge	5 - 5
5.4.2	NPDES Stormwater Discharges	5 - 6
5.5	Nonpoint Source Control Programs	5 - 7
5.6	Program Initiatives in the Hiwassee River Basin	5 - 13
5.6.1	Federal Initiatives	5 - 14
5.6.2	State Agency Initiatives	5 - 16
5.6.3	Local Government and Citizen Initiatives	5 - 20
5.6.4	Corporate Initiatives	5 - 21
5.6.5	Regional Organizations and Commissions	5 - 23
5.7	Integrating Point and Nonpoint Source Pollution Control Strategies	5 - 23
5.8	Potential Sources of Funding for Water Quality Projects	5 - 24
	References Cited: Chapter 5	5 - 27
6.	MAJOR BASINWIDE WATER QUALITY CONCERNS AND RECOMMENDED MANAGEMENT STRATEGIES	6 - 1
6.1	Introduction	6 - 1
6.2	Major Water Quality Concerns and Priority Issues	6 - 2
6.2.1	Growth and Development	6 - 2
6.2.2	Priority Issues as Identified by Workshop Participants	6 - 4
6.2.3	Priority Issues and Recommended Actions Identified by the Nonpoint Source (NPS) Team Members	6 - 4
6.2.4	Priority Issues and Recommended Actions Identified by the Year of the Mountains Commissions	6 - 7
6.3	Strategies for Restoring Impaired and "Threatened" Waters	6 - 8
6.3.1	What are the Impaired Waters?	6 - 8
6.3.2	What are the "Threatened Waters"?	6 - 8
6.3.3	How are Waters Prioritized for Restoration or Protection	6 - 9
6.4	Priority Issues and Recommended Management Strategies by Subbasin	6 - 10
6.4.1	Chatuge Lake and Hiwassee River (Subbasin 04-05-01)	6 - 10
6.4.2	Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)	6 - 11
6.5	Identification and Protection of Highly Valued Resource Waters	6 - 12
6.5.1	Overview of High Quality and Outstanding Resource Waters as well as Special Classifications and Habitats	6 - 12
6.5.2	Strategies for Controlling Discharge to High Quality Waters (HQWs) and Outstanding Resource Waters (ORWs)	6 - 13
6.6	General Management Strategies for Protecting Water Quality in the Basin	6 - 14
6.6.1	Management Strategies for Growth and Development in Western North Carolina	6 - 14
6.6.2	Management Strategies for Controlling Sedimentation	6 - 15
6.6.3	Management Strategies for Urban and Industrial Stormwater Control	6 - 22
6.6.4	Management Strategies for Controlling Fecal Coliform Bacteria	6 - 25
6.6.5	Management Strategies for Controlling Toxic Substances	6 - 27
6.6.6	Management Strategies for Oxygen-Consuming Wastes	6 - 27
	References Cited: Chapter 6	6 - 28

TABLE OF CONTENTS (Continued)

Chapter	Title	Page
7.	FUTURE INITIATIVES	7 - 1
7.1	Overview of Hiwassee River Basinwide Goals and Objectives	7 - 1
7.2	Future Activities in the Hiwassee River Basin	7 - 1
7.2.1	Nonpoint Source Control Strategies and Priorities/Nutrient Reduction Efforts	7 - 1
7.2.2	The Hiwassee River Basin Nonpoint Source Team	7 - 1
7.2.3	Improved Monitoring Coverage and Coordination with other Agencies	7 - 2
7.2.4	Use Restoration Waters (URW) Program	7 - 3
7.3	Programmatic Initiatives	7 - 3
7.3.1	NPDES Program Initiatives	7 - 3
7.3.2	Use of Discharger Self-Monitoring Data	7 - 4
7.3.3	Promotion of Non-Discharge Alternatives/Regionalization	7 - 4
7.3.4	Coordinating Basinwide Management with the Construction Grants and Loans Program	7 - 4
7.3.5	Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities	7 - 4

APPENDICES

Appendix	Title	Page
I	Division of Water Quality, Water Quality Section Organizational Duties Chart	A - I - 1
II	North Carolina's Surface Water Classifications and Water Quality Standards	*A - II* - 1
	• Summary of North Carolina's Water Quality Classifications and Standards • Anti-Degradation Policy and High Quality Waters (15A NCAC 2B .0201) • Outstanding Resource Waters (15A NCAC 2B .0216) • Surface Water Classifications Assigned to Waters in the Hiwassee River Basin	
III	Water Quality Data Collected by DWQ	*A - III* - 1
	• Benthic Macroinvertebrate Sampling • Fisheries Studies • Lakes Assessment Program • Aquatic Toxicity Monitoring	
IV	NPDES Permit Requirements for Trout Farms	*A - IV* - 1
V.	Lists Of Best Management Practices And NPS Contacts	*A - V* - 1
	• Agriculture	*A - V* - 2
	• Urban Runoff	*A - V* - 8
	• Sedimentation and Erosion Control	*A - V* - 9
	• Onsite Wastewater Disposal	*A - V* - 10
	• Solid Waste Disposal	*A - V* - 13
	• Forestry	*A - V* - 14
	• Mining	*A - V* - 16
VI.	Existing Point and Nonpoint Source Water Quality Programs	*A - VI* - 1
VII.	USDA Forest Service Transportation System Management Guidelines	*A - VII* - 1
VIII.	Potential Sources of Funding for Projects to Address Point Sources	*A - VIII*- 1
IX.	Potential Sources of Funding for Projects to Address Nonpoint Sources	*A - IX* - 1
X.	List of 303(d) Waters in the Hiwassee River Basin	*A - X* - 1
XI.	Hiwassee River Basin Workshop Comments	*A - XI* - 1

LIST OF FIGURES

Figure	Title	Page
1.1	Basinwide Management Plan Schedule (1994 to 1999)	*1* - 1
1.2	Organizational Structure of the DWQ Water Quality Section	*1* - 7
1.3	Location of Division of Water Quality Regional Offices	*1* - 8
2.1	Physiographic Regions and Major River Basins of North Carolina	*2* - 2
2.2	Map of Entire Hiwassee River Watershed (Source: TVA)	*2* - 3
2.3	General Map of the Hiwassee River Basin in Relation to Neighboring River Basins	*2* - 4
2.4	Summary of Land Cover for the Hiwassee River Basin	*2* - 8
2.5	1990 Population Density by Census Block Group for the Hiwassee River Basin	*2* - 14
2.6	Percent Population Growth by Subbasin	*2* - 15
2.7	Percent Population Change for Municipalities in Hiwassee River Basin - 1980 - 1994	*2* - 16
2.8	Major Traffic Routes to the Cherokee Indian Reservation Casino	*2* - 18
2.9	High Quality Waters and Outstanding Resource Waters in the Hiwassee River Drainage Area in North Carolina	*2* - 24
3.1	Map of NPDES Dischargers in the Chatuge Lake and Hiwassee River (Subbasin 04-05-01)	*3* - 13
3.2	Map of NPDES Wastewater Dischargers in the Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)	*3* - 14
3.3	Map of the Location of NPDES Stormwater Permittees in the Hiwassee River Basin	*3* - 18
4.1	pH Concentrations for the Hiwassee River Basin. 1980 to 1995	*4* - 6
4.2	Sampling Locations in Chatuge Lake and Hiwassee River (Subbasin 04-05-01)	*4* - 12
4.3	Sampling Locations in the Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)	*4* - 16
4.4	Use Support Map for the Hiwassee River Basin	*4* - 27
4.5	Use Support for Hiwassee River Basin	*4* - 28
5.1	Southern Appalachian Assessment Study Area (Source: SAMAB 1996)	*5* - 15

LIST OF TABLES

Table	Title	Page
1.1	Basinwide Permitting and Planning Schedule for North Carolina's 17 Major River Basins (1993 through 1998)	*1* - 4
2.1	Hydrologic Divisions in the Hiwassee River Basin	2 - 6
2.2	Local Governments and Local Planning Units within the Hiwassee River Basin	2 - 6
2.3	Estimated Acreage by Broad Land Use in the Hiwassee River Basin 1982 versus 1992 (Source: NRI)	2 - 7
2.4	Description of Land Cover Types (1992 NRI - USDA SCS)	2 - 9
2.5	Descriptions of Southern Appalachian Assessment Landsat Land Cover Types	2 - 10
2.6	Land Cover for the Hiwassee River Basin based on Southern Appalachian Assessment (1990 to 1994) Landsat Data	2 - 11
2.7	Acreage and Percent of Counties within National Forest Lands (Source: USDA Forest Service)	2 - 11
2.8	Hiwassee River Basin Population (1970, 1980, and 1990) and Land Area Summaries	2 - 13
2.9	Projected Population Changes by County for Counties in the Hiwassee River Basin (NC Dept. of Administration)	2 - 16
2.10	Projected Increase in Traffic along Major Corridors as a Result of the Cherokee Indian Reservation Gambling Casino	2 - 19
2.11	Rare Aquatic Species Recorded in the Hiwassee River Basin (Source: NC Natural Heritage Program 1996)	2 - 20
2.12	Estimated Animal Populations in the Hiwassee River Basin (Source: NCDA Veterinary Division, February 1995)	2 - 22
2.13	Water Classification Statistics for Streams in the Hiwassee River Basin	2 - 22
2.14	Water Classification Statistics for Lakes in the Hiwassee River Basin	2 - 23
2.15	1992 and Projected Service Populations and Water Use for the Town of Murphy (Source: Division of Water Resources)	2 - 23
2.16	Hiwassee River Basin Water Withdrawals for 1990 (MGD) (Source: USGS)	2 - 25
3.1	Causes of Impairment and Sources of Water Pollution	*3* - 1

LIST OF TABLES (continued)

Table	Title	Page
3.2	Overall Erosion Trends in North Carolina	*3* - 3
3.3	USLE Erosion on Cultivated Cropland in North Carolina	*3* - 4
3.4	North Carolina Erosion in Blue Ridge Mountain Region	*3* - 4
3.5	North Carolina Erosion on Major Land Resource Areas (MLRA)	*3* - 4
3.6	Definitions of Categories of NPDES Permits	*3* - 11
3.7	Summary of NPDES Wastewater Permits in the Hiwassee River Basin	*3* - 12
3.8	Summary of Major/Minor NPDES Dischargers and Permitted and Actual Flows for the Hiwassee River Basin	*3* - 15
3.9	Summary of NPDES Stormwater Permits in the Hiwassee River Basin	*3* - 17
3.10	Timber Harvest Removal Trends (in Thousand Cubic Feet) by County for 1979 to 1994 (Division of Forest Resources)	*3* - 21
4.1	Ambient Monitoring System Parameters	*4* - 4
4.2	Ambient Monitoring System Stations within the Hiwassee Basin	*4* - 4
4.3	Summary of Ambient Monitoring System Station Data Excursions from the NC Water Quality Criteria by Parameter. January 1990 to December 1994	*4* - 5
4.4	Fecal Coliform summary data for the Hiwassee River Basin 1990 to 1995	*4* - 7
4.5	Basin Assessment Sites in Hiwassee River Subbasin 04-05-01, 1994, Taxa Richness Values and Bioclassifications	*4* - 11
4.6	Benthic Macroinvertebrate Special Studies, Hiwassee River Subbasin 04-05-01, 1983-1994	*4* - 13
4.7	High Quality Waters Investigation Results for the Hiwassee River Basin	*4* - 14
4.8	Basin Assessment Sites in Hiwassee River subbasin 04-05-02, 1994, Taxa Richness Values and Bioclassifications	*4* - 17
4.9	Benthic Macroinvertebrate Special Studies, Hiwassee Subbasin 04-05-02, 1983-1994	*4* - 17
4.10	Valley River above and below the Town of Andrews WWTP, 1985 - 1994	*4* - 18
4.11	Monitored Stream Sites in the Hiwassee River Basin	*4* - 26
4.12	Overall Use Support Status for Streams (Miles) by Subbasin for Hiwassee River Basin (1990 - 1994)	*4* - 28

LIST OF TABLES (continued)

Table	Title	Page
4.13	Monitored Lakes in the Hiwassee River Basin	*4* - 29
5.1	List of Nonpoint Source Programs	*5* - 9
5.2	Hiwassee River Basin Nonpoint Source Program Description and Contacts	*5* - 10
5.3	Program Initiatives in the Hiwassee River Basin	*5* - 13
5.4	Nonpoint Source (NPS) 319 Priority Rating for Non-Coastal Water	*5* - 25
5.5	Funding Agencies for Assistance with Point Sources	*5* - 26
5.6	Funding Agencies for Assistance with Nonpoint Sources	*5* - 27
6.1	Priority Issues Identified by Workshop Participants (Sheet 1 of 2)	*6* - 5
6.1	Priority Issues Identified by Workshop Participants (Sheet 2 of 2)	*6* - 6
6.2	Priority Issues and Actions Recommended by the NPS Team Members	*6* - 7
6.3	Partially Supporting or Not Supporting Waters in the Hiwassee River Basin	*6* - 8
6.4	Support-Threatened Waterbodies in the Hiwassee River Basin	*6* - 9
6.5	State and Federal Sediment Control-Related Programs	*6* - 16
6.6	Recommended Actions to Address Construction-Related Sediment Problems	*6* - 19
6.7	Recommended Actions to Address Sediment from Private Access Roads	*6* - 20
6.8	Recommended State Road Construction Measures	*6* - 21
6.9	Recommendations for Urban Stormwater Control	*6* - 23
6.10	How to Take Care of Your Lawn and Car and Protect Water Quality	*6* - 24
6.11	Substitutions for Household Hazardous Substances	*6* - 24
6.12	Recommended Actions for Proper Maintenance of Septic Tanks	*6* - 26
7.1	Hiwassee River Basin NPS Team Members	*7* - 2

EXECUTIVE SUMMARY

NORTH CAROLINA'S BASINWIDE APPROACH TO WATER QUALITY MANAGEMENT - PURPOSE OF HIWASSEE RIVER BASIN PLAN

Basinwide management is a watershed-based water quality management initiative being implemented by the North Carolina Division of Water Quality (previously Division of Environmental Management). The *Hiwassee River Basinwide Water Quality Management Plan* is the thirteenth basinwide water quality management plan prepared by the Division of Water Quality (DWQ) in a series of plans being prepared for all seventeen of the state's major river basins. DWQ uses the plans as guides in carrying out its water quality programs in each river basin.

The basinwide water quality management plans are not new regulatory documents. They are planning documents used to communicate the state's rationale, approaches and long-term water quality management strategies for each basin to policy makers, the regulated community and the general public. Each plan is completed and approved prior to the scheduled date for basinwide discharge permit renewals. The plans are then evaluated, based on follow-up water quality monitoring, and updated at five year intervals.

DWQ uses this approach as a means to report to the public on the current status of water quality in the basin, major water quality concerns and issues, projected trends in development and water quality, the long-range water quality goals for the basin, and recommended point and nonpoint source management options.

The *Hiwassee River Basinwide Water Quality Management Plan* was approved by the NC Environmental Management Commission in May 1997 and will be updated in 2002. Basinwide NPDES permitting is scheduled to commence in December 1997.

GOALS OF THE BASINWIDE APPROACH

The primary goals of DWQ's basinwide program are:

1) to identify and restore full use to impaired waters,
2) to identify and protect highly valued resource waters and biological communities of special importance, and
3) to manage the causes and sources of pollution so as to ensure the protection of those waters currently supporting their uses while allowing for reasonable economic growth.

PUBLIC WORKSHOPS

A public workshop was held in the Hiwassee River basin in Murphy on November 8, 1995. The workshop, which was attended by approximately 40 people, was co-sponsored by the North Carolina Cooperative Extension Service and DWQ. The purpose of the workshops was to familiarize stakeholders in the basin with DWQ's basinwide approach and to solicit comments for the basin plan. Workshop participants were asked to comment on what they saw as the priority issues in the basin and how these issues could be addressed. A summary of the comments received from the workshop participants is provided in Chapter 6.

Priority issues identified at the workshop included:

1. Need to respect private property
2. Emphasize non-regulatory and localized water quality protection efforts over regulations
3. Recognize and address government misrepresentation and unfair implementation of contradictory regulations
4. Clean up wastewater treatment plant discharges as needed
5. Balancing water uses and future planning
6. Need to sample all streams

HIWASSEE RIVER BASIN OVERVIEW

The Hiwassee River basin is located in the southwestern corner of North Carolina in the Appalachian Mountains (Figure 1). Water flow in the Hiwassee River is regulated by the Tennessee Valley Authority (TVA) for the production of hydroelectric power. The river is impounded three times in North Carolina to form Chatuge Lake, Hiwassee Lake and Apalachia Lake. The headwaters of the Hiwassee River originate in North Carolina and northern Georgia. The waters of the basin flow north to northwest into Tennessee. The Hiwassee River is one of the major rivers flowing into the Tennessee River. The Tennessee River in turn flows into the Mississippi River and eventually into the Gulf of Mexico. The largest rivers in the basin are the Hiwassee River and its tributaries, the Valley and Nottely Rivers. Many of the streams in the basin are located within the Nantahala National Forest. Overall water quality in this basin is good as most of the streams drain undisturbed and undeveloped mountain areas.

Based on 1990 census data, the population of the basin was 26,723 people. The percent population growth over the ten year period from 1980 to 1990 was 7.1% versus a statewide average of 12.7%. The overall population density is 43 persons per square mile versus a statewide average of 123 persons per square mile. While the resident population may be low, the basin experiences significant seasonal population fluctuations from recreation and tourism. There is the potential for a significant increase in tourism and second home development associated with the opening of the gambling casino on the Cherokee Indian Reservation. The casino is expected to draw 1.2 million persons per year to the Reservation.

The basin is characterized by steep slopes and erodible soils. These steep slopes limit the amount of land area suitable for development and crop production. Much of the watershed is undeveloped or lies within the Nantahala National Forest. While most of the land is forested (approximately 45.6% private forest lands and 33.5% public forest lands), many retirement and second home developments are being built in the area. Most development occurs in river valleys and near streams due to the more level ground found in valleys. Development in or near stream corridors increases the chances for sedimentation and erosion problems.

There are a number of high quality and outstanding resource waters in the basin. The Hiwassee River basin is well known for its trout fishery waters. The entire Fires Creek catchment has been designated as Outstanding Resource Waters and most of the Tusquitee Creek watershed is classified as High Quality Waters. The Fires Creek Wildlife Management Area is part of the Nantahala National Forest. Tributary streams in these watersheds that have received Excellent biological ratings include Big Tuni Creek, Johnson (Mill) Creek, Albone Creek, Coldspring Branch, Little Fires Creek and Leatherwood Branch.

There are eleven aquatic species in the Hiwassee River basin that are listed by North Carolina as either Endangered, Special Concern, or Significantly Rare.

Figure 1. General Map of the Hiwassee River Basin

The streams and rivers of the Hiwassee River basin are still generally of high water quality. However, there are signs of sedimentation problems occurring. Sources of sedimentation include agriculture, mining operations, development, and silviculture. The few water quality problems encountered in the Hiwassee River basin are due primarily to nonpoint source pollution and toxicity problems in Brasstown Creek and the Valley River. Further discussion on these waters can be found in the Recommended Management Strategies below.

ASSESSMENT OF WATER QUALITY IN THE HIWASSEE RIVER BASIN

An assessment of water quality information collected by DWQ and other agencies indicate that the Hiwassee River basin has generally good water quality. There are two streams that are impaired and three streams that are threatened. Below is a summary of some key monitoring data that reflect water quality in the basin. A more detailed presentation of this information can be found in Chapter 4.

Summary of DWQ Monitored Data

Benthic Macroinvertebrates - These are primarily bottom-dwelling aquatic insect larvae such as species of mayflies, stoneflies, and caddisflies that are used as biological indicators of water quality. Measurements of the number and diversity of these organisms at strategic sampling sites is an important means of assessing water quality.

Macroinvertebrate data were collected at 15 basin assessment sites during 1994 and a total of 37 sites (73 samples) have been rated since 1983. Water quality was Excellent at 9 sites, Good at 3 sites, Good-Fair at 2 sites, and Fair at 1 site (Brasstown Creek). Of the 73 samples collected since 1983, 66% were given an Excellent bioclassification.

Fish Tissue Analysis - Fish tissue samples were collected from Hiwassee River and Hiwassee Lake (13 observations) from 1981 to 1986. Fish tissue samples were analyzed for metals contaminants only. Results of fish tissue analyses indicated that mean levels of metals contaminants were non-detectable or present at levels below federal Food and Drug Administration (FDA) and Environmental Protection Agency (EPA) criteria.

Lakes Assessments - There were three lakes in the Hiwassee River Basin sampled as part of the North Carolina Lakes Assessment Program. These lakes are: Chatuge Lake, Apalachia Lake and Hiwassee Lake. Hiwassee Lake was the only lake intensively monitored during the growing seasons of 1991 through 1993 as part of a state reference lake program. Each lake is individually discussed in the appropriate subbasin section in Chapter 4. These lakes are classified oligotrophic and are currently meeting their intended uses.

Ambient Monitoring - There are two ambient monitoring stations in the Hiwassee River basin where water quality samples are collected monthly by DWQ. Water quality at these stations infrequently exceeded state criteria. The most notable finding of the water chemistry data is low pH levels starting in the winter of 1991 and extending through 1994. Present pH levels appear to be more normal. This situation occurred throughout the Little Tennessee and French Broad River basins as well and is not readily explained. Atmospheric deposition may have contributed to the low pH levels during this time. In addition, elevated levels of fecal coliform were detected on Brasstown Creek.

Use-Support Ratings

Use-support ratings are a method to analyze water quality information and to determine whether the quality is sufficient to support the uses for which the waterbody has been classified by the

state. The word *uses* refers to activities such as swimming, fishing and water supply. All surface waters in the state have been assigned a classification (Appendix I).

DWQ has collected chemical and biological water quality monitoring data throughout the basin, some of which is summarized above. Available data for a particular stream segment has been assessed to determine the overall *use support* rating; that is, whether the waters are *fully supporting, support-threatened, partially supporting,* or *not supporting* their uses. Streams referred to as *impaired* are those rated as either partially supporting or not supporting their uses. Use support ratings in the Hiwassee River basin, described more fully in Chapter 4, are summarized below.

Of the 989 miles of streams and rivers in the Hiwassee River basin, use support ratings were determined for 81% or 797 miles with the following breakdown:

SUPPORTING.....78%
- Fully supporting (64%)
- Support-threatened (14%)

IMPAIRED.....3%
- Partially supporting (3%)
- Not supporting (0%)

NOT EVALUATED.....19%

The majority of the streams have good to excellent bioclassifications and very few standards were violated at the ambient stations. In fact, as noted above, there are only two impaired waters in the basin (Brasstown Creek and Valley Creek). However, although water quality is high in this basin, nonpoint source pollutants such as increased sedimentation, were evident at some of the sampling sites. Also, point source discharges in Georgia pose potential water quality concerns in the headwaters of the Hiwassee River. Those waters considered impaired or support threatened based on monitoring data are discussed below by subbasin.

RECOMMENDED MANAGEMENT STRATEGIES FOR RESTORING IMPAIRED WATERS AND PROTECTING THREATENED WATERS

Chatuge Lake and Hiwassee River (Subbasin 04-05-01)

Overall water quality in the subbasin is considered Excellent based on evaluation of benthic macroinvertebrate data collected since 1985 (refer to Chapter 4 for map of sampling sites). However, Brasstown Creek, located within this subbasin, is impaired based on ambient water quality data collections. In addition, Town Creek at Hayesville and the Hiwassee River downstream from Chatuge Lake Dam are Support Threatened.

Brasstown Creek

Brasstown Creek is rated Partially Supporting its designated uses and is therefore considered impaired. The creek originates in north Georgia and flows parallel to NC 66 for most of its length. The creek is affected by nonpoint source runoff from the highway and various land use activities. Brasstown Creek is also affected by elevated levels of fecal coliform bacteria relating to the effluent from the Young Harris Water Pollution Control Plant in Georgia.

The Southeastern Natural Resources Leaders Group (SENRLG) has chosen Brasstown Creek as a potential waterbody for conducting a survey of land use activities and identifying potential restoration projects. The efforts of SENRLG could have very positive benefits for Brasstown Creek.

Recommendations:
The State of North Carolina and DWQ need to work more closely with Georgia's EPD to assure that proper NPDES limits are established and maintained for those dischargers in the upper Hiwassee River watershed in Georgia as these streams enter North Carolina.

Town Creek at the Town of Hayesville
The Hayesville WWTP has experienced chronic compliance problems over the years with its BOD5, fecal coliform, and flow permit limits. Operational problems and high waste flows were the primary cause. In January 1996, Clay County took over operation of the plant. In order to alleviate compliance problems, the county is planning to construct a new 0.3 MGD waste water treatment plant (WWTP) with an outfall to the Hiwassee River. The current plant discharges to Town Creek, which has limited assimilative capacity and is rated Support Threatened. The new WWTP is expected to produce a better quality effluent than the existing plant, in addition to providing capacity for future growth.

Recommendations:
With the additional wastewater treatment capacity, efforts should be made to identify failing septic tanks and connect them to the city/county sewer collection system.

Hiwassee River below Chatuge Dam
The Tennessee Valley Authority (TVA) operates Chatuge Dam on the Hiwassee River approximately 4.5 miles upstream of the proposed new Hayesville WWTP. The dam is used for flood control, recreation, and power generation. TVA has no minimum release requirement from the dam. A discontinued USGS gauging station located approximately 1.5 miles downstream of the dam repeatedly recorded monthly minimum stream flows of < 2.0 cfs over the last ten years of its operation (1965-1975). When water is being released from the dam maximum stream flows can be over 1000 cfs.

Since water used to generate electricity is drawn from near the bottom of Chatuge Lake, instream dissolved oxygen (DO) concentrations below the dam can be <1.0 mg/L. In order to minimize the wide fluctuations in streamflow as well as to increase the instream DO concentration, TVA constructed a reaeration weir approximately 0.8 mile downstream of the dam. The reaeration weir was put into service in November 1992. The weir is designed to maintain a minimum instream DO concentration of 5.0 mg/L and a minimum flow of 60 cfs from the weir pool.

Recommendations:
Given the potential for DO concentrations to be near the state standard of 5.0 mg/L immediately below the reaeration weir, it is recommended that Hayesville conduct instream DO monitoring once Clay County relocates the wastewater treatment outfall to the Hiwassee River.

Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)

While overall water quality in this subbasin is considered very good, the Valley River at Andrews is rated as impaired and other reaches of the river near Rhodo and Tomatla are rated as Support Threatened. Other Support Threatened waters include the Hiwassee River downstream of Murphy and Junaluska Creek near Andrews.

Valley River at the Town of Andrews
The Town of Andrews discharges to Valley River. A 1994 special study on the river by DWQ could not attribute the water quality problems in Valley River solely to the Andrews discharge since samples taken upstream of the discharge indicated water quality problems as well. The Andrews WWTP has had some compliance problems in the last four years with three toxicity

test failures in 1995. Since those three failures the town has passed its toxicity test the last four consecutive times.

Recommendations:
It is recommended that the Andrews municipal area be targeted for a nonpoint source survey to identify the sources of pollution that are contributing to water quality problems in the area.

Hiwassee River at the Town of Murphy
The Town of Murphy discharges to the Hiwassee River. The town has had no significant compliance problems nor has it failed any toxicity tests since 1992. However, the Asheville Regional Office has reported that the town has substantial inflow and infiltration (I&I) problems. The I&I problems have resulted in occasional raw wastewater discharges to the Hiwassee River. Currently the town is under a flow moratorium for additional sewer hookups. The Town of Murphy is working with an engineering consulting firm to alleviate the I&I problems as well as to investigate the possibility of an expansion. Long term instream dissolved oxygen problems are not anticipated as a result of this discharge.

Recommendations:
It is recommended that this facility continues to monitor its effluent for total phosphorus and total nitrogen in order to provide nutrient data for the future management of Hiwassee Lake.

Valley River
The Valley River is rated either Support Threatened or Partially Supporting its designated uses at the three DWQ sampling sites located 1) above Andrews, 2) near Rhodo and 3) near Tomatla.

Recommendations:
The Partially Supporting portion of the river is addressed above under discussion for the Town of Andrews. The entire length of the Valley River could become a focus of the Hiwassee NPS team in the future. A localized team effort will likely be needed to determine the sources of degradation to the Valley River and correct any problems.

Junaluska Creek
Junaluska Creek is bordered by SR 1505 from its headwaters to the Town of Andrews. It is likely that this road is contributing to its Support Threatened status.

Recommendations:
As a tributary of the Valley River, Junaluska Creek could also be investigated for potential sources of degradation by the Hiwassee NPS team.

POTENTIAL RECLASSIFICATIONS TO HIGH QUALITY WATERS OR OUTSTANDING RESOURCE WATERS

The Hiwassee River basin contains a large number of streams that have either ORW or HQW classifications, as well as trout (Tr) and water supply (WS) status. Britton Creek was reclassified to HQW in August 1992. Based on data collected from summer 1994 surveys, the following streams may qualify for ORW/HQW reclassification. However, there are no formal actions being undertaken at this time to reclassify these waters.

- Peachtree Creek
- Hanging Dog Creek
- Persimmon Creek
- Beaverdam Creek

MAJOR WATER QUALITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES

A. GROWTH AND DEVELOPMENT

Growth Trends and Water Quality

There has been limited growth in the Hiwassee River basin, with growth occurring primarily in Clay County and near Hayesville. This trend is expected to continue. Impacts to water quality from growth and development can include sedimentation, streambank erosion and degradation from a variety of fertilizers, chemicals, and road salts.

Traditionally, growth and development within the basin has occurred mostly along streams and rivers where lands are less steep. Growth along waterways can have a significant negative impact on water quality if construction activities are not undertaken with proper care. Recently, construction activities have also occurred on mountain ridges and slopes to obtain views of valleys and ridges. Building on slopes can be particularly harmful to water quality if appropriate erosion and sedimentation control measures are not used. Slopes tend to have soil types that are more shallow and unstable than those in valleys. Often, driveways to home sites on slopes are greater than 12% slope, the recommended slope for reducing erosion potential (Willett, pers. comm.).

In recent years, there has been a wave of development from Atlanta, Georgia to the North Carolina state line. Parcels of property have sold rapidly throughout areas of the Hiwassee River basin. Clay County has seen an approximate doubling of land parcels over the last ten years (Willett, pers. comm) as land is subdivided. Clay County is especially attractive to developers because of the beauty of the area, easy access due to new multi-lane highways, close proximity to Atlanta and recreation opportunities on Chatuge Lake. To date, most of the land has not been built upon. Approximately 61% of the land parcels in Clay County are held by out-of-state developers that intend to subdivide these large parcels when the market is most receptive (Mike Decker, pers. comm). When these developers perceive that the timing is right for building out these parcels, the rate of growth within this basin will accelerate quickly and may be too fast for local governments to keep pace with (Willett, pers. comm). The basin also receives a tremendous seasonal population fluctuation.

While increases in tourism and development can be seen as very positive for this portion of the state with some of the lowest average per capita incomes in the state, it is also very important for local governments and community leaders to look towards the future and balance economic growth with protection of the natural resources that draw people to the area.

Growth management requires planning for the needs of future population increases as well as maintaining a strong tourism base. These actions are critical to water quality management and the quality of life for the residents of the basin. Refer to section 6.6 for recommended management strategies relating to proper planning for growth and development.

Influence of the Cherokee Reservation Gambling Casino on Growth and Water Quality

The Cherokee Reservation gambling casino, the only legalized gambling casino in the Southeast, is geographically situated to become "...one of the primary gambling centers east of the Mississippi. It will be centrally located to many eastern cities and is within 500 miles of over half the U.S. population " (Willett and Eller, 1995). The development of the gambling casino on the Cherokee Indian Reservation is estimated to attract an additional 2 million visitors per year to the Reservation (Willett and Eller, 1995). It is expected that these visitors will tour surrounding areas.

A recent NC Division of Community Assistance study (Willett and Eller, 1995) suggests that western North Carolina will be permanently impacted by the development of the Cherokee Indian Reservation gambling casino. In addition to other effects not related to water quality, the region is likely to experience:

1) The need for additional state support for road improvements. Road improvements will entail construction and the potential for increased erosion and sedimentation, as well as the potential for increased effects of acid runoff to streams if Anakeesta rock formations are exposed (See Multi-Lane Highways discussion below);

2) Increased traffic which may result in increased water quality impacts through stormwater runoff and exhaust emissions that contribute to acid rain (See discussion on acid deposition below);

3) The need for higher taxes to pay for increased local government services (water and sewer improvements alone are estimated at $5.6 million); and

4) The diversion of dollars from existing businesses to gambling and displacement which occurs when non-gambling tourists travel to other areas to avoid increased traffic, lack of hotel accommodations, and avoidance of the gambling atmosphere (Willett and Eller, 1995).

The gambling casino may have effects on water quality as the outlying areas experience accelerated commercial activity due to displacement and spill-over. Commercial activity in these outlying areas will increase the demand for roads and services. In addition, strong economic activity may be viewed as an additional reason to build second homes or establish a new business by an outside entrepreneur. Construction of homes, commercial areas and roads increase stormwater runoff and sedimentation problems. This demand for goods, services and homes will need to be planned for and managed in order to reduce the potential for degradation of water resources. Refer to section 6.6 for recommended management strategies relating to proper planning for growth and development.

Multi-Lane Highways

The NC Division of Community Assistance report estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout western North Carolina. At present, there are six major corridors (See Chapter 2) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation and provide opportunities for easy access to rather remote areas of the state. Corridor 1, through the Hiwassee River basin, is expected to carry an additional 72,800 vehicles on US 19/129.

The development of the four-lane thoroughfare from Andrews to Almond (via Robbinsville) will provide access to Robbinsville and Graham county for economic development in the area (DOT 1996). This thoroughfare should also increase traffic flow across the mountains through the Hiwassee River basin, from Atlanta to the Great Smoky Mountains National Park and the Cherokee Indian Reservation gambling casino. Under the DOT Transportation Improvement Program, US Hwy 64 will be widened to a five lane highway from NC 69 to the Hiwassee River. NC Hwy 175 will be upgraded from the Georgia state line to the junction with US 64. The portion of US 64 from the Clay county line to Murphy is expected to be rerouted to a new location and developed to a two lane roadway, ultimately to become a four lane highway. NC 60 is planned to be developed to a four lane highway from the Georgia state line to US 64-74.

During road construction there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are sometimes found in this region of the state. These rock formations can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff.

Acid Rain/Deposition

The developments of thoroughfares will make it easier for tourists and developers to access and use the area. As traffic flow increases, the emission of nitrous oxides from vehicles to the atmosphere will increase. Nitrous oxides react with volatile organic compounds to create ozone. At times, ozone levels in the Great Smoky Mountains National Park can reach levels nearly double the average ozone level in Raleigh (News and Observer, Sept. 1, 1996). The man-made pollutants that trouble the peaks of the Smokies is creating more widespread problems throughout the Southern Appalachians, as noted by the Southern Appalachian Man and the Biosphere (SAMAB). The region of the GSMNP presently receives some of the most acidic deposition in the country. This high amount of deposition combined with low stream buffering ability and the fact that the capacity of the soils to absorb excess nutrients has been reached in many areas, has produced many low pH streams at higher elevations and higher stream nitrogen levels than in any other national park (News and Observer, Sept. 1, 1996). Refer to Chapter 4 for a more thorough discussion of the effects of acid deposition of high elevation streams in western North Carolina.

Recommendations for Addressing Growth Issues in Western North Carolina

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains the high water quality that is presently attracting people to the area. Local governments are responsible for the institution of programs and initiatives to balance economic growth with water quality protection. The following strategies are examples of a few of the initiatives local governments could pursue.

- Develop a Regional Organization. It has been suggested for western North Carolina that a regional organization be developed representative of the eight counties (covering the Hiwassee, Little Tennessee, Savannah and French Broad River basins) that will be affected the most by the gambling casino (Willett and Eller, 1995). While the focus of this group would primarily be aimed at economic development, a separate task force should be developed to conduct an analysis of the impacts of the casino on natural resources. Several economic development organizations are already in existence in the region.

- Develop a variety of land use management tools. Land use management issues will need to be addressed either by the local governments or by the natural resource task force of the regional organization. The lack of land use planning can have long-term negative impacts on water quality. Chapter 5, Section 5.6.3 presents information on local governments that have some land use planning in effect.

  Each of the 5 counties within the Little Tennessee River basin should have a Sedimentation and Erosion Control Ordinance, Pre-Development Ordinance (or subdivision ordinance) and a Land Use Plan in effect. The development of a Land Use Guidance System (LUGS) may be a feasible system to enact within these counties. LUGS is a systematic land use planning and management tool that allows for land use decisions to be made on a site specific basis.

The concept behind LUGS is that projects are heard case-by-case, often based on a pre-existing growth guidance assessment. A committee reviews the project for its compatibility with the growth guidance assessment. Anyone from the surrounding area that may be affected by the project is invited to attend review meetings. The Board of Commissioners typically makes a final decision on the project. This process is less generic in its approach than zoning and yet allows for protection of the integrity of the community.

- Pursue Funding for Local Water Quality Protection Projects. The Clean Water Management Trust Fund (see Chapter 5, Section 5.8) may be a source of funding to assist local governments in obtaining a balance between economic growth and protecting surface waters of the state. Local governments will need to take responsibility for planning for the additional tourists and growth and development. This region of the state typically has a lower tax base than other areas of the state. Problems with aging infrastructure are also typical, especially for the small towns in the region. The Clean Water Management Trust Fund can be used for many purposes including: acquiring land for conservation easements and riparian buffers, restoring degraded lands to protect water quality, repairing failing waste treatment systems and septic tank systems and improving stormwater management. Local governments and regional organizations should consider pursuing funding through the Clean Water Management Trust Fund as a means to upgrade infrastructure and manage land to protect water quality. Contact the Executive Director, Dave McNaught at 919-974-5497 for more information.

- Support Local Initiatives for Water Quality Protection. Local governments and regional organizations can also support local efforts to protect areas by developing greenways, bikeways and monitoring efforts conducted by citizen volunteers and protection of lands near surface waters and wetlands.

- Encourage participation in the Straight Pipe Elimination Amnesty Program. This program is described further in Appendix VI.

At the state level, it may be possible to develop an incentive program for local governments to encourage the development and implementation of land use plans. This incentive policy has been applied in other states. The premise of an incentive program is to provide partial funding to staff the program if a local government develops a land use plan and then enforces its plan. If the land use plan is not developed or enforced, no funding would be available. Such a program has not yet been developed in North Carolina.

B. URBAN AND INDUSTRIAL STORMWATER CONTROL

Urban stormwater runoff can be a significant contributor to water quality problems. In the Hiwassee River basin, urban development is relatively limited at present. As land is converted to impervious surfaces with construction of housing developments and commercial areas, careful attention to stormwater control will be more important. Stormwater problems are likely to be centered around the Towns of Andrews, Murphy and Hayesville, and any high density developments that may arise. There are no municipalities in the Hiwassee River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

Recommendations

The best time to address urban stormwater impacts are when it is most effective and least costly to do so -- before development occurs. Numerous studies have demonstrated a serious decline in the health of receiving waters when 10 to 15 percent of a watershed is turned into impervious surfaces (Schueler, 1995).

The entire community plays a role in controlling the quality and quantity of urban stormwater. The following is a list of recommendations for local governments, citizens, businesses, developers, and state agencies.

- Mapping of the municipal storm sewer systems and outfall points, and developing procedures to update this information.
- Evaluating existing land uses in the local government's jurisdictional area to determine where sources of stormwater pollution may exist. In addition, local government activities and programs could be evaluated to determine where existing activities address stormwater management in some way, or could be modified to do so.
- Developing educational programs to inform citizens of activities that may contribute pollutants to stormwater runoff (dumping oil, paint or chemicals down storm drains) and offering ways of carrying out such activities in an environmentally sound manner. Storm drain stenciling is a good example of a low cost educational tool.
- Developing programs to locate and remove illicit connections (illegal discharge of non-stormwater materials) to the storm sewer system. These often occur in the form of floor drains and similar connections.
- Reviewing local ordinances pertaining to parking, curb and gutter and open space requirements. Many of these local ordinances could be modified to enhance water quality protection from urban stormwater runoff impacts. Maintaining riparian buffer strips along streams is an example.
- Creating wetlands along streams in urbanized areas of the watershed to receive stormwater runoff can be an effective way to remove pollutants by burial, chemical breakdown, and/or assimilation into plant tissue. Careful design of these systems is needed in order to adequately handle the altered hydraulics of urban areas.

Throughout the Hiwassee River basin, various types of industrial activities with point source discharges of stormwater are required to be permitted under the federally mandated National Pollutant Discharge Elimination System (NPDES) stormwater program. These include activities related to manufacturing, processing, materials storage areas and construction activities with greater than five acres of disturbance. These dischargers must develop Stormwater Pollution Prevention Plans (SWPPP) to minimize and control pollutants discharged from their stormwater systems. These SWPPPs are subject to review and modification by the permitted facilities and DWQ to assure that management measures are appropriate.

C. EROSION AND SEDIMENTATION

Sedimentation has been identified as a source of water quality degradation in streams in the basin. Sedimentation is a widespread nonpoint source-related water quality problem that results from erosion of disurbed lands. land-disturbing activities include land clearing, agriculture and development (e.g., highways, shopping centers, and residential subdivisions). Construction activities can be especially harmful in the mountains where slopes are steep and rainfall is frequent.

Since the mountain counties are increasingly popular areas for home, commercial and golf course construction, there is the potential for greater sediment loads to enter streams during land clearing and construction activities. Improperly designed, constructed, and maintained private access roads are a significant source of sediment in the mountains. After construction is complete, poorly designed roads, trails, and driveways may continue to erode into water bodies. Also, the increased impervious surface areas in developed watersheds increases the rate and volume of runoff after storms which can increase erosion of stream banks.

The degree of sedimentation affects both the habitat of aquatic macroinvertebrates and the quality and amount of fish spawning and rearing habitat. Sedimentation is one of the main factors limiting trout production in western North Carolina. Inorganic sediments can affect trout productivity in three ways: direct effects - impairment of respiration, feeding habits, and migration patterns; reduced egg hatching and emergence due to decreased water velocity and dissolved oxygen; and, trophic effects - reduction in prey (macroinvertebrates). As fine suspended solids increase in the waters, the dissolved oxygen, permeability, and apparent velocity decrease (West, date unknown). Erosion and sedimentation resulted in lower hatching and emergence success of trout embryos, reduced trout biomass and growth rates when comparing two streams in western North Carolina (West et. al, 1982).

Sedimentation impacts streams in several other ways. Eroded sediments may gradually fill lakes and navigable waters and may increase drinking water treatment costs. Sediment also serves as a carrier for other pollutants including nutrients (especially phosphorus), toxic metals, pesticides, and road salts.

Recommendations:

For each of the major types of land-disturbing activities, there are programs being implemented by various government agencies at the state, federal and/or local level to minimize soil loss and protect water quality. Some of these programs are listed in Table 6.5 and are briefly described in Appendix VI.

It is also important to note that non-government interests such property owners, developers and contractors need to accept responsibility for controlling erosion. Chapter 6 contains numerous recommendations for minimizing erosion and sedimentation from construction activities, private access roads, and state road construction. The responsibility for controlling sediment from these activities falls on many shoulders as shown in Table 1, below. The parties with the greatest responsibility include: homeowners, developers/contractors, local governments, the NC Division of Land Resources and the NC Department of Transportation.

Table 1. Sediment Related Activities and Groups with Greatest Responsibility

Activity	Responsibility Groups	Chapter 6 Table Reference (with Recommended Measures)
Construction	Homeowners Developers Contractors Local Governments NC Division of Land Resources	Table 6.6
Private Roads	Homeowners Local Governments State/Federal Agencies	Table 6.7
State Roads	NC Department of Transportation	Table 6.8

D. FECAL COLIFORM BACTERIA

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals and are widely used as an indicator of the potential presence of disease-causing bacteria and viruses. They enter surface waters from a number of sources including failing onsite wastewater systems, broken sewer lines, improperly treated discharges of domestic wastewater, pump station overflows, straight piping and runoff carrying livestock and wildlife wastes.

There are no monitored waterbodies in the Hiwassee River basin where fecal coliform bacteria standards have been exceeded in at least 25% of the samples taken by DWQ. However, Brasstown Creek has had some problems with elevated fecal coliform bacteria due to effluent form the Young Harris Water Pollution Control Plant. The Hiwassee River and the Valley River have had occasional elevated levels of fecal coliform bacteria.

Recommendations:
Several general management strategies for addressing fecal coliform contamination include:

- Proper maintenance and periodic inspections of onsite waste disposal systems such as septic tanks.
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Elimination of direct unpermitted discharges of domestic waste (also known as "straight piping").
- Proper management of livestock to keep wastes from reaching surface waters.
- Encouragement of local health departments to routinely monitor waters known to be used for body contact recreation (e.g., swimming and tubing).

The 1996 General Assembly established a program designed to eliminate domestic sewage or wastewater discharges from both direct (straight pipe) and from overland flow of failing septic systems. The focus of the program contains three components:

1) the identification and elimination of domestic sewage discharges into streams proposed or currently used for public water supplies,
2) an amnesty period to end December 31, 1997 during which time violations for identification of domestic dischargers will not be incurred, and
3) a public education program about the amnesty period will be implemented. The majority of the funds allocated to this program are recurring funds.

Septic tanks are used widely throughout this basin, particularly since many citizens live outside of the service area of a regional wastewater treatment plant. Unfortunately, many citizens are not aware of how to care for their septic tanks. Some of the actions that homeowners, local governments, and state and federal agencies can take to reduce pollution from septic tanks are listed in Table 6.12.

E. TOXIC SUBSTANCES

Toxic substances, or toxicants, routinely regulated by DWQ include metals, organics, chlorine, and ammonia, as described in Chapter 3.

The waters of the Hiwassee River basin need to be protected from immediate acute effects and the residual chronic effects of toxic substances. Toxic limitations for point source discharges are based on the volume of the effluent released and the 7Q10 flow condition of the receiving stream. In the Hiwassee River basin, four point source discharges are required to conduct whole effluent toxicity testing (The Towns of Hayesville, Andrews, and Murphy and Clifton Precision South Division). Violations have occurred for the Towns of Hayesville and Andrews, as well as Clifton Precision. Refer to Section 6.3 for recommended control strategies for these NPDES permit holders.

Toxics from nonpoint sources of pollution typically enter streams during storm events through runoff from roads, parking lots, agricultural lands or golf courses. In the Little Tennessee River basin, low pH levels have been observed in many high elevation streams. These low pH levels have been attributed to chronic acid deposition and the low buffering capacity of high elevation

streams in the basin. With continued chronic input of acid deposition over the mountain region, there is potential for surface water degradation to occur in the Hiwassee River basin. This issue is discussed further in Chapter 4.

Recommendations:
Continued research and monitoring will be important to fully understand the relationship between acid deposition and water quality and for furthering the development of policies to reduce impacts to surface waters from the chronic introduction of atmospheric pollution.

For wastewater treatment plants, DWQ will continue to require toxicity testing at qualifying facilities and to correct problems as necessary.

Chapter 6 also includes recommendations for residents to play their part in keeping toxic substances out of streams and lakes. Tables 6.10 and 6.11 in Chapter 6 contain environmentally-friendly recommendations for lawn, automobile and home care.

FUTURE INITIATIVES IN THE HIWASSEE RIVER BASIN

Nonpoint Source Control Strategies and Priorities/Nutrient Reduction Efforts

Improving our knowledge of and controlling nonpoint source pollution will be a high priority over the next five years. Nonpoint source pollution accounts for some of the threatened waters in the Hiwassee River Basin. The following initiatives are underway to address the protection of surface waters from nonpoint sources of pollution.

- Establishment of nonpoint source basin teams in each basin. DWQ has begun to establish a nonpoint source team in each of the state's 17 major river basins. A nonpoint source team has been established in the Hiwassee River basin. Refer to Chapter 7 for further description.
- Interagency Water Quality Monitoring. DWQ has begun the process of coordinating with other natural resource agencies on the idea of interagency water quality monitoring across the state. Refer to Section 7.2.3 of Chapter 7 for more information.
- Development of a Use Restoration Waters (URW) Program. DWQ is developing a Use Restoration Waters (URW) Program. If approved, this program would include voluntary and regulatory management strategies to control the specific parameters of concern in selected impaired watersheds. Refer to Chapter 7 for more details.

National Pollutant Discharge Elimination System (NPDES) Program

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

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

Longer-term objectives will include refining overall management strategies after obtaining feedback on current management efforts during the next round of water quality monitoring. Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling byproducts of the

treatment process (including nonpotable reuse of treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

Use of Discharger Self-Monitoring Data

DWQ will continue to explore the possibilities of using discharger self-monitoring data to a greater degree to augment the data it collects through the programs described in Chapter 4. Quality assurance, timing and consistency of data from plant to plant would have to be addressed. Also, a system would need to be developed to enter the data into a computerized database for later analysis. One method of data collection that is currently being explored includes developing a comprehensive list of monitoring sites for the basin that would be monitored by an association of NPDES dischargers with data input to STORET. A basinwide sampling program has been established for dischargers in the Neuse River Basin and to date appears to be successful.

Coordinating Basinwide Management With the Construction Grants and Loans Program

The potential exists to use the basinwide planning process to identify and prioritize wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. Completed basin documents are provided to this office for its use.

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, effluent limits, compliance information, water quality data and stream classifications, will be put in a central data center which will be made accessible to most staff at desktop computer stations. Much of this information is also being entered into the state's GIS computer system. As all this information is made available to the GIS system, including land use data from satellite or air photo interpretation, and as the system becomes more user friendly, the potential to graphically display the results of water quality data analysis will be tremendous.

CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

The purpose of this Basinwide Water Quality Management Plan is to report to citizens, policy makers and the regulated community on:

- the current status of surface water quality in the basin,
- major water quality concerns and issues,
- projected trends in development and water quality,
- the long-range water quality goals for the basin, and
- recommended point and nonpoint source management options.

This Plan presents strategies for management of both point and nonpoint sources of pollution. The Division of Water Quality (previously Division of Environmental Managment) is preparing a basinwide water quality management plan for each of the state's 17 major river basins, as shown in Figure 1.1

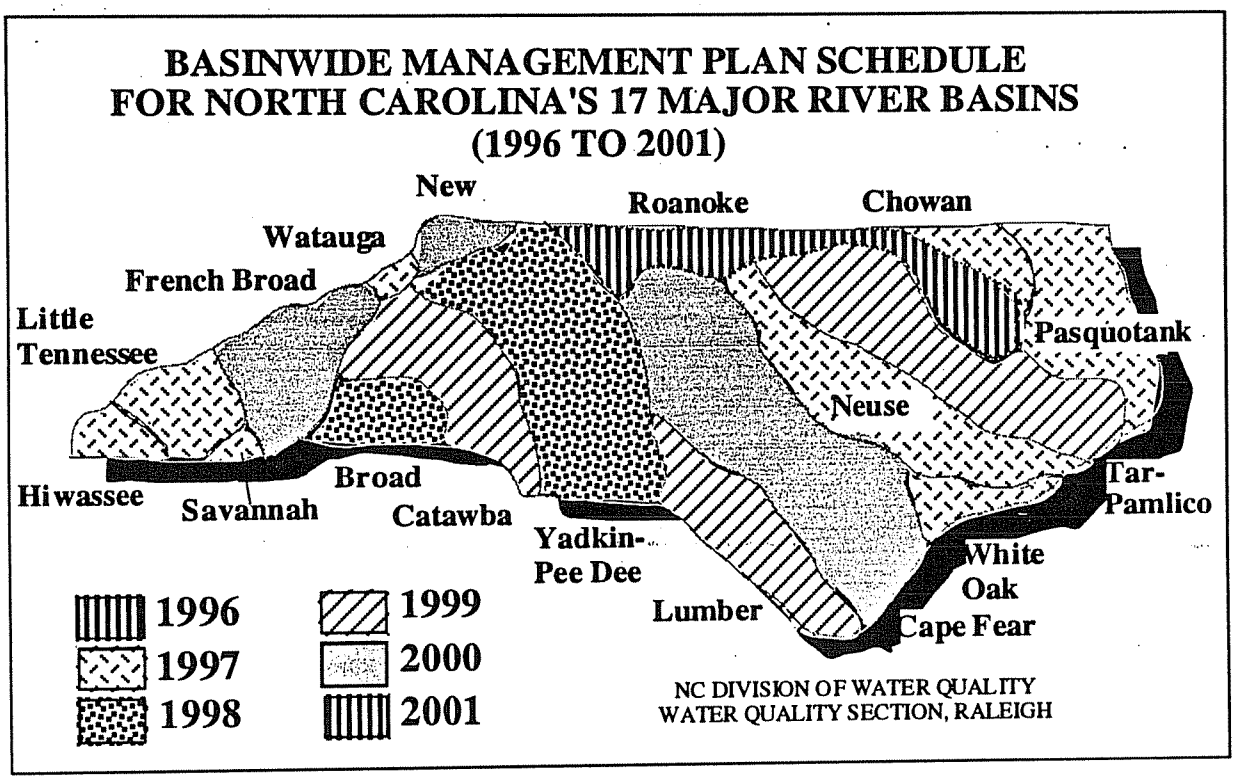


Figure 1.1 Basinwide Management Plan Schedule (1996 to 2001)

1.2 GUIDE TO USE OF THIS DOCUMENT

CHAPTER 1: Introduction - This chapter provides a non-technical description of the purpose of this plan, the basinwide water quality management approach and how this approach will be administered. The description of the basinwide management approach is based primarily on a 54-page framework document entitled *North Carolina's Basinwide Approach to Water Quality Management: Program Description - Final Report/August 1991* (Creager and Baker, 1991).

CHAPTER 2: General Basin Description - Some of the specific topics covered in this chapter include:

- an overview of the major features such as location, rainfall, population, physiography, etc.
- hydrology of the basin and its subbasins
- a summary of land cover within the basin based on results of a 1982 and 1992 Nationwide Resources Inventory (NRI) conducted by the US Department of Agriculture Natural Resources Conservation Service.
- population growth trends and densities by subbasin using 1970, '80 and '90 census data.
- major water uses in the basin and DWQ's program of water quality classifications and standards.

CHAPTER 3: Causes of Impairment and Sources of Water Pollution - This chapter describes both point and nonpoint sources of pollution. It also describes a number of important causes of water quality impacts including sediment, biochemical oxygen demand (BOD), toxic substances, nutrients, color, fecal coliform bacteria and others. Pollutant loading in the basin and general water quality problem areas are discussed.

CHAPTER 4: Water Quality and Use Support Ratings - This chapter describes the various types of water quality monitoring conducted by DWQ, summarizes water quality in each of the subbasins in the basin and presents a summary of use support ratings for those surface waters that have been monitored or evaluated.

CHAPTER 5: Water Quality Programs and Program Initiatives in the Basin - Chapter 5 summarizes the existing point and nonpoint source control programs available to address water quality problems. These programs are management tools available for addressing the priority water quality concerns and issues that are identified in Chapter 6. Chapter 5 also describes the concept of Total Maximum Daily Loads (TMDLs). TMDLs represent management strategies aimed at controlling point and nonpoint source pollutants. This chapter also describes various program initiatives being implemented in the basin to address water quality problems.

CHAPTER 6: Major Water Quality Concerns and Recommended Management Strategies - Water quality issues identified in Chapters 2, 3 and 4 are evaluated and prioritized based on use-support ratings, degree of impairment, and the sensitivity of the aquatic resources being affected. Recommended management strategies, or TMDLs, are presented that describe how the available water quality management tools and strategies described in Chapter 5 will be applied in the basin. This includes generalized wasteload allocations for dischargers and recommended programs and best management practices for controlling nonpoint sources.

CHAPTER 7: Future Initiatives - This chapter presents future initiatives for protecting or improving water quality in the basin. These may include both programatic initiatives such as improving permit compliance, or basin-specific initiatives such as developing strategies for restoring impaired waters.

1.3 NORTH CAROLINA'S BASINWIDE MANAGEMENT APPROACH

Introduction - Basinwide water quality management is a watershed-based management approach being implemented by DWQ which features basinwide permitting, integrating existing point and nonpoint source control programs, and preparing basinwide management plans. DWQ is applying this approach to each of the seventeen major river basins in the state as a means of better identifying water quality problems, developing appropriate management strategies, maintaining and protecting water quality and aquatic habitat, and assuring equitable distribution of waste assimilative capacity for dischargers.

After conducting public workshops to identify areas of concern and major issues, a basinwide management plan is prepared for each basin. The plans are circulated for public review and are presented at public meetings in each river basin. The management plan for a given basin is completed and approved preceding the scheduled date for basinwide discharge permit renewals in that basin. The plans are then evaluated, based on followup water quality monitoring, and updated at five year intervals.

DWQ began formulating the idea of basinwide management in the late 1980s, established a basin permitting schedule in 1990, began basinwide monitoring activities in 1990, and published a basinwide program description in August 1991. Basinwide management entails coordinating and integrating, by major river basin, DWQ's water quality program activities. These activities, which are discussed further in Section 1.4, include permitting, monitoring, modeling, nonpoint source assessments, and planning.

Water Quality Program Benefits - Several benefits of basinwide planning and management to North Carolina's Water quality program include:

- ***Improved program efficiency.*** By reducing the area of the state covered each year, monitoring, modeling, and permitting efforts can be focused. As a result, *increased fficiency* can be achieved for a given level of funding and resource allocation.
- ***Increased effectiveness.*** The basinwide approach is in consonance with basic ecological watershed management principles, leading to *more effective* water quality assessment and management. Linkages between aquatic and terrestrial systems are addressed (e.g., contributions from nonpoint sources). All inputs to aquatic systems and potential interactive, synergistic and cumulative effects are considered.
- ***Better consistency and equitability*** . By clearly defining the program's long-term goals and approaches, basinwide plans will encourage *consistent* decision-making on permits and water quality improvement strategies. Consistency and greater attention to long-range planning will promote a *more equitable* distribution of assimilative capacity, explicitly addressing the trade-offs among pollutant sources and allowances for economic growth.
- ***Increased public awareness of the state's water quality protection programs.*** The basinwide plans are an educational tool for increasing public awareness on water quality issues within the basin.
- ***Basinwide management promotes 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 prevent overloading of the receiving waters and to allow for a reasonable margin of safety to ensure compliance with water quality standards.

Basinwide Planning Schedule - The following table presents the overall basin schedule for all 17 major river basins in the state. Included are the dates for permit reissuance and the dates by which management plans are to be completed for each basin.

Table 1.1 Basinwide Permitting and Planning Schedule for North Carolina's 17 Major River Basins (1993 through 1998).

Basin	Target Date for Basin Plan Approval	Discharge Permits to be Issued	Basin	Target Date for Basin Plan Approval	Discharge Permits to be Issued
Neuse	2/93(approved)	4/93	Roanoke	9/96(approved)	1/97
			White Oak	1/97(approved)	6/97
Lumber	5/94(approved)	11/94	Savannah	4/97(approved)	8/97
			Watauga	4/97(approved)	9/97
Tar-Pamlico	12/94(approved)	1/95	Little Tennessee	5/97(approved)	10/97
Catawba	2/95(approved)	4/95	Hiwassee	5/97(approved)	12/97
French Broad	5/95(approved)	8/95			
New	7/95(approved)	11/95	Chowan	8/97	1/98
			Pasquotank	8/97	1/98
Cape Fear	9/95(approved)	1/96	Neuse (2nd cycle)	11/97	4/98
			Yadkin-Pee Dee	1/98	7/98
			Broad	6/98	11/98

The number of plans to be developed each year varies from one to six and is based on the total number of permits to be issued each year. For example, the Cape Fear basin, the state's largest, has about as many dischargers as all six of the small basins in 1997. This has been done in order to balance the permit processing workload from year to year. In years where more than one basin is scheduled to be evaluated, an effort has been made to group at least some of the basins geographically in order to minimize travel time and cost for field studies and public meetings.

Plans to be updated every five years - The earliest basin plans will likely not achieve all of the long-term objectives for basinwide management outlined above. However, plans are updated every 5 years. Updated plans will incorporate additional data and new assessment tools (e.g., basinwide water quality modeling) and management strategies (e.g., for reducing nonpoint source contributions) as they become available.

Basinwide Plan Preparation, Review and Public Involvement - Preparation of an individual basinwide management plan is a five year process which is broken down into four phases as described below.

Year	Activity
Year 1 to 3	Water Quality Data Collection/Identification of Goals and Issues: Year 1 entails identifying sampling needs and canvassing for information. It also entails coordinating with other agencies, the academic community and local interest groups to begin establishing goals and objectives and identifying and prioritizing problems and issues. Biomonitoring, fish community and tissue analyses, special studies and other water quality sampling activities are conducted in Years 2 and 3 by DWQ's Environmental Sciences Branch (ESB). These studies provide information for assessing water quality status and trends throughout the basin and provide data for computer modeling.

Year 3 to 4 — Data Assessment and Model Preparation: Modeling priorities are identified early in this phase and are refined through assessment of water quality data from the ESB. Data from special studies are then used by DWQ's Technical Support Branch (TSB) to prepare models for estimating potential impacts of waste loading from point and nonpoint sources using the TMDL approach. Preliminary water quality control strategies are developed based on modeling, with input from local governments, the regulated community and citizen groups during this period.

Year 4 — Preparation of Draft Basinwide Plan: The draft plan, which is prepared by DWQ's Planning Branch, is due for completion by the end of year 4. It is based on support documents prepared by DWQ's Environmental Sciences Branch (water quality data) and the Technical Support Branch (modeling data and recommended pollution control strategies). Preliminary findings are presented at informal meetings through the year with local governments and interested groups, and comments are incorporated into the draft.

Year 5 — Public Review and Approval of Plan: At the beginning of year 5, the draft plan, after approval of the Environmental Management Commission (EMC), is circulated for review and public meetings are held. Revisions are made to the document, based on public comments, and the final document is submitted to the EMC for approval midway through year 5. Basinwide permitting begins at the end of year 5.

Implementation - The implementation of basinwide planning and management will occur in phases. Permitting activities and associated routine support activities (field sampling, modeling, wasteload allocation calculations, etc.) have already been rescheduled by major river basin. All National Pollutant Discharge Elimination System (NPDES) permit renewals within a basin occur within a prescribed time period after completion of the final basin plan, and will be repeated at five year intervals.

Nonpoint source management proposals will be implemented by several different avenues. The Water Quality Section is setting up nonpoint source (NPS) teams for each basin. These teams are made up of representatives of nonpoint source agencies, resource agencies, and special interest groups. The NPS teams are responsible for prioritizing specific watersheds for follow-up investigations, educational efforts, and best management practice (BMP) implementation. Funding for BMP implementation will be sought from sources such as existing cost-share monies or from federal Section 319 grants. In addition to projects in specific watersheds, the NPS team will develop programmatic action plans for each category of nonpoint source pollution. The action plans detail voluntary actions that agencies and groups have committed to complete to protect and improve water quality in the basin. Many of the action plan items involve increased educational efforts or enforcement of existing programs.

1.4 BASINWIDE RESPONSIBILITIES WITHIN THE DWQ WATER QUALITY SECTION

The Division of Water Quality is the lead state agency for the regulation and protection of the state's surface waters. The Division is comprised of four sections: Water Quality, Groundwater, Construction Grants and Loans and the Water Quality Laboratory.

The primary responsibilities of the Division of Water Quality are to maintain or restore an aquatic environment to sufficient quality to protect the existing and best intended uses of North Carolina's surface waters and to ensure compliance with state and federal water quality standards. The Division receives both state and federal allocations as well as funding through permit fee collections. Policy guidance is provided by the Environmental Management Commission. The major areas of responsibility are water quality monitoring, permitting, planning, modeling (wasteload allocations) and compliance oversight.

The Central office is divided into four branches, each branch is subdivided into two units (Figure 1.2 and Appendix A). The Planning Branch is responsible for developing surface water quality standards and classifications, nonpoint source program planning, administering the basinwide management program, modeling nonpoint pollution sources, developing use support ratings and improving the section's GIS capabilities. It also coordinates EPA water quality planning grants, state environmental policy act responsibilities and the implementation of the Comprehensive Conservation and Management Plan (CCMP) that resulted from the Albemarle-Pamlico Estuarine Study (APES).

The Operations Branch is responsible for permit compliance tracking, the pretreatment program, water supply watershed protection/local government technical support, and the operator training and certification program.

The Technical Support Branch is responsible for reviews and processing of discharge and nondischarge permits, coordinating development of TMDLs and wasteload allocations for dischargers, and providing primary computer modeling support.

The Environmental Sciences Branch is responsible for all biological and chemical water quality monitoring and evaluation including benthic macroinvertebrate monitoring (biomonitoring), fish tissue and fish communities studies, and the wetlands 401 Water Quality Certification program. The Branch is also responsible for effluent toxicity testing and evaluations, algal analyses, long term biochemical and sediment oxygen demand, and lakes assessments.

The seven Regional Offices carry out activities such as wetland reviews, compliance evaluations, permit reviews and facility inspections for both discharging and nondischarging systems, ambient water quality monitoring, state environmental policy act reviews, stream reclassification reviews, pretreatment program support and operator training and certification assistance. In addition, they respond to water quality emergencies such as oil spills and fish kills, investigate complaints and provide information to the public. Figure 1.3 shows the location of the regional offices and the counties that they serve.

REFERENCES CITED: CHAPTER 1

Creager, C.S., and J. P. Baker, 1991, North Carolina's Basinwide Approach to Water Quality Management: Program Description, DWQ Water Quality Section, Raleigh, NC.

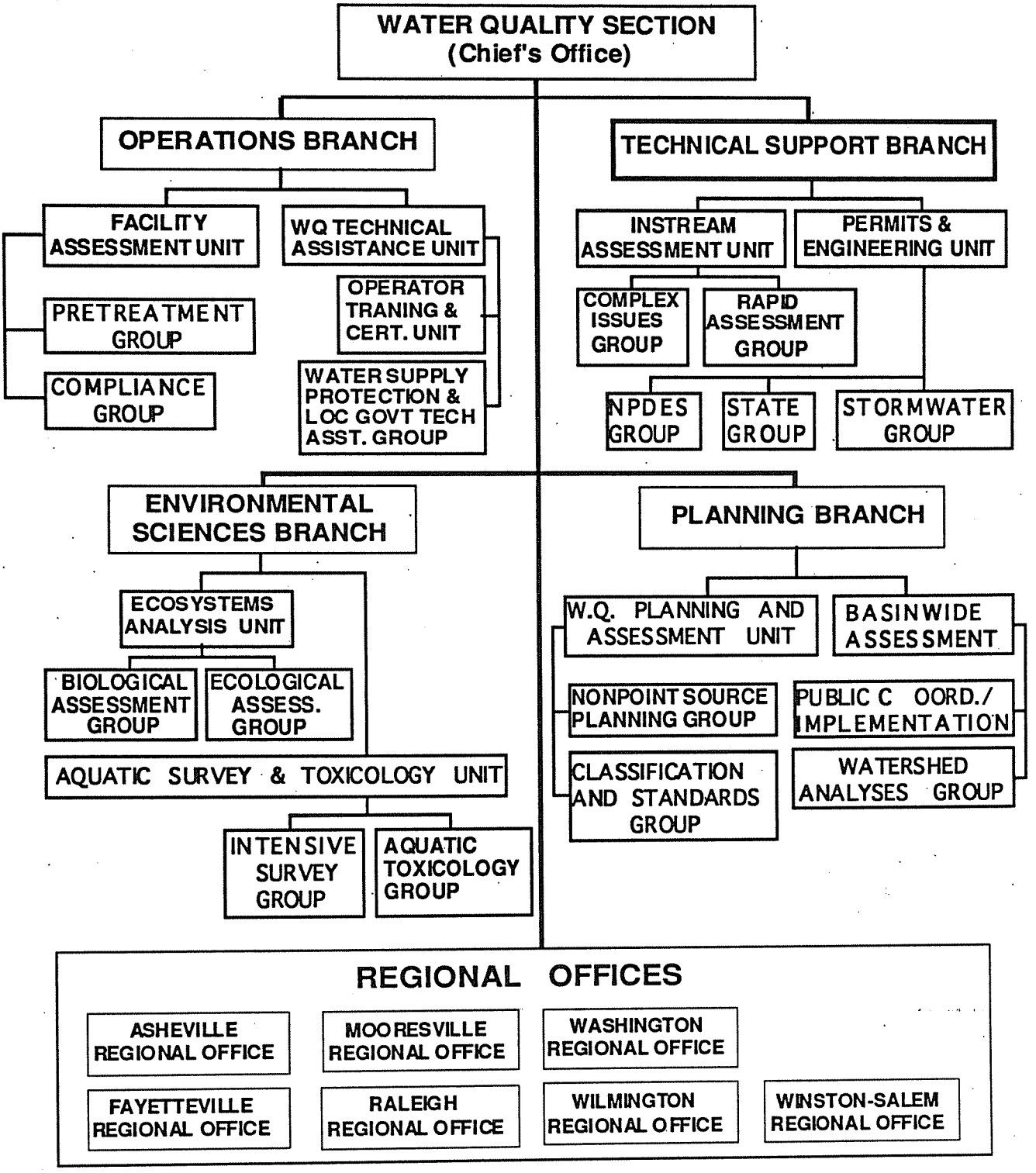
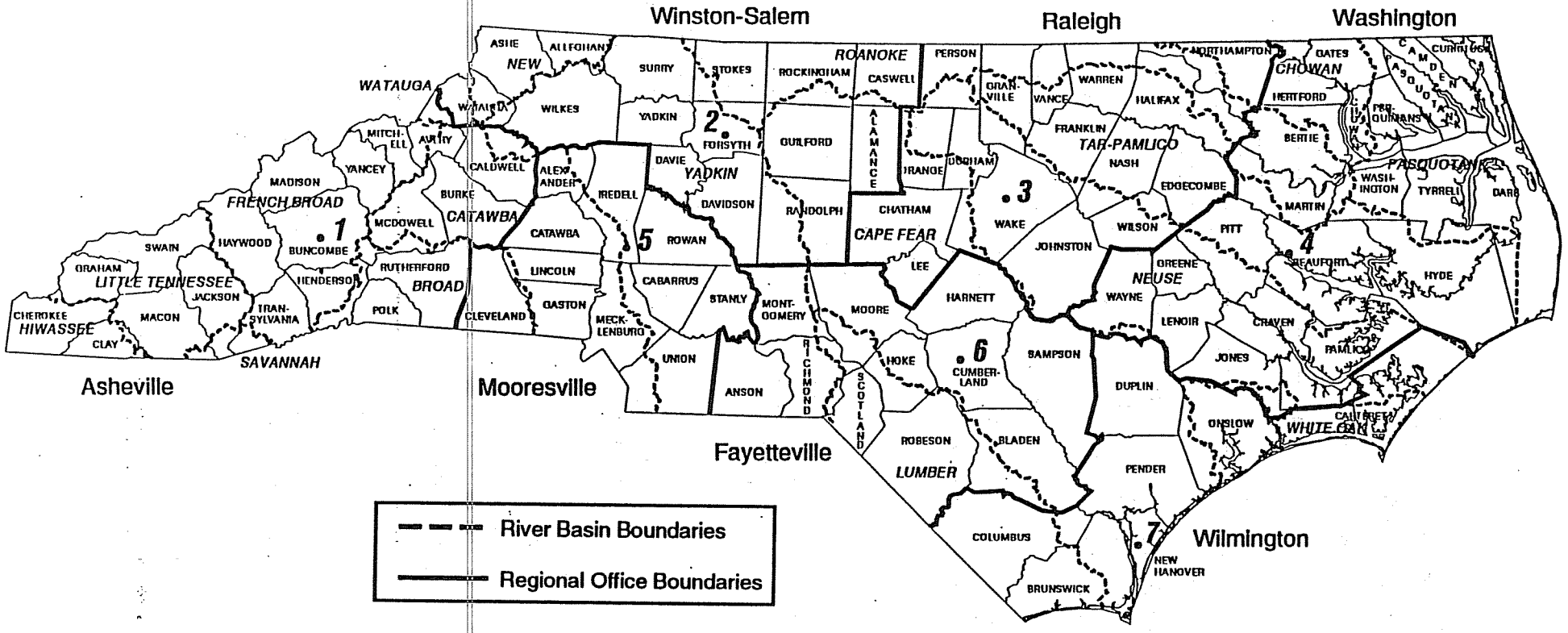


Figure 1.2 Organizational Structure of the DWQ Water Quality Section

DWQ CENTRAL AND REGIONAL OFFICES (WITH RIVERS BASINS)

N.C. Department of Environment, Health, and Natural Resources



1 - ARO

Mr. Roy Davis
Regional Supervisor
59 Woodfin Place
Asheville, NC 28801
(704)251-6208
Fax (704)251-6098

2 - WSRO

Mr. Larry Coble
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3 - CENTRAL OFFICE

DEHNR, DEM
Water Quality Section
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3 - RRO

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4 - WaRO

Mr. Jim Mulligan
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(919)946-6481
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5 - MRO

Mr. Keith Overcash
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6 - FRO

Mr. Tommy Stevens
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7 - WIRO

Mr. Rick Shiver
Regional Supervisor
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Wilmington, NC 28405-3845
(910)395-3900
Fax (910)350-2004

Figure 1.3 Location of Division of Water Quality Regional Offices

CHAPTER 2

GENERAL BASIN DESCRIPTION

2.1 HIWASSEE RIVER BASIN OVERVIEW

The Hiwassee River basin is located in the southwestern corner of North Carolina's Blue Ridge Province of the Appalachian Mountains, west of the Eastern Continental Divide (Figure 2.1). The headwaters of the Hiwassee River originate in North Carolina and northern Georgia (Figure 2.2). The waters of the basin flow north to northwest into Tennessee. The Hiwassee River is one of the major rivers flowing into the Tennessee River. The Tennessee River in turn flows into the Mississippi River and eventually into the Gulf of Mexico. The largest rivers in the basin are the Hiwassee River and its tributaries, the Valley and Nottely Rivers. Many of the streams in the basin are located within the Nantahala National Forest. Overall water quality in this basin is excellent as most of the streams drain undisturbed and undeveloped mountain areas.

The Hiwassee River basin encompasses 640 square miles in portions of Clay and Cherokee Counties. The largest town in the upper watershed, where land use is mainly forest and agricultural, is Hayesville. Based on 1990 census data, the population of the basin was 26,723 people. The percent population growth over the ten year period from 1980 to 1990 was 7.1% versus a statewide average of 12.7%. The overall population density is 43 persons per square mile versus a statewide average of 123 persons per square mile. While the resident population may be low, the basin experiences significant seasonal population fluctuations from recreation and tourism.

The basin contains approximately 986 miles of freshwater streams and rivers. Figure 2.3 provides a general view of the North Carolina portion of the basin and the basin's relationship to the Little Tennessee and Savannah River basins.

The Hiwassee River is completely regulated by the Tennessee Valley Authority (TVA) for the production of hydroelectric power. The river is impounded three times in North Carolina to form Chatuge Lake, Hiwassee Lake and Apalachia Lake. Mission Dam on the Hiwassee River near the Clay/Cherokee County line below Chatuge Lake, is the only dam that does not form an impoundment. Chatuge Lake is a large reservoir straddling the North Carolina/Georgia state line. Hiwassee Lake is one of sixteen lakes selected throughout the state as representative of minimally impacted lakes. Apalachia Lake, located immediately downstream of Hiwassee Lake, is a run-of-the-river reservoir located within the Nantahala National Forest. It is considered oligotrophic and fully supporting its designated uses.

The first major tributaries of the Hiwassee River downstream of Chatuge Lake (subbasin 04-05-01), are Tusquitee Creek and Fires Creek. Both the Town of Andrews and the Town of Murphy are located in this subbasin. The entire Fires Creek catchment has been designated as Outstanding Resource Waters and most of the Tusquitee Creek watershed is classified as High Quality Waters. The Fires Creek Wildlife Management Area is part of the Nantahala National Forest. Tributary streams in these watersheds that have received Excellent biological ratings include Big Tuni Creek, Johnson (Mill) Creek, Albone Creek, Coldspring Branch, Little Fires Creek and Leatherwood Branch.

The few water quality problems encountered in the upper Hiwassee River subbasin are due primarily to nonpoint source run off. These problems are seen on Brasstown Creek below Mission dam. This creek originates in north Georgia and is impacted by nonpoint source run off,

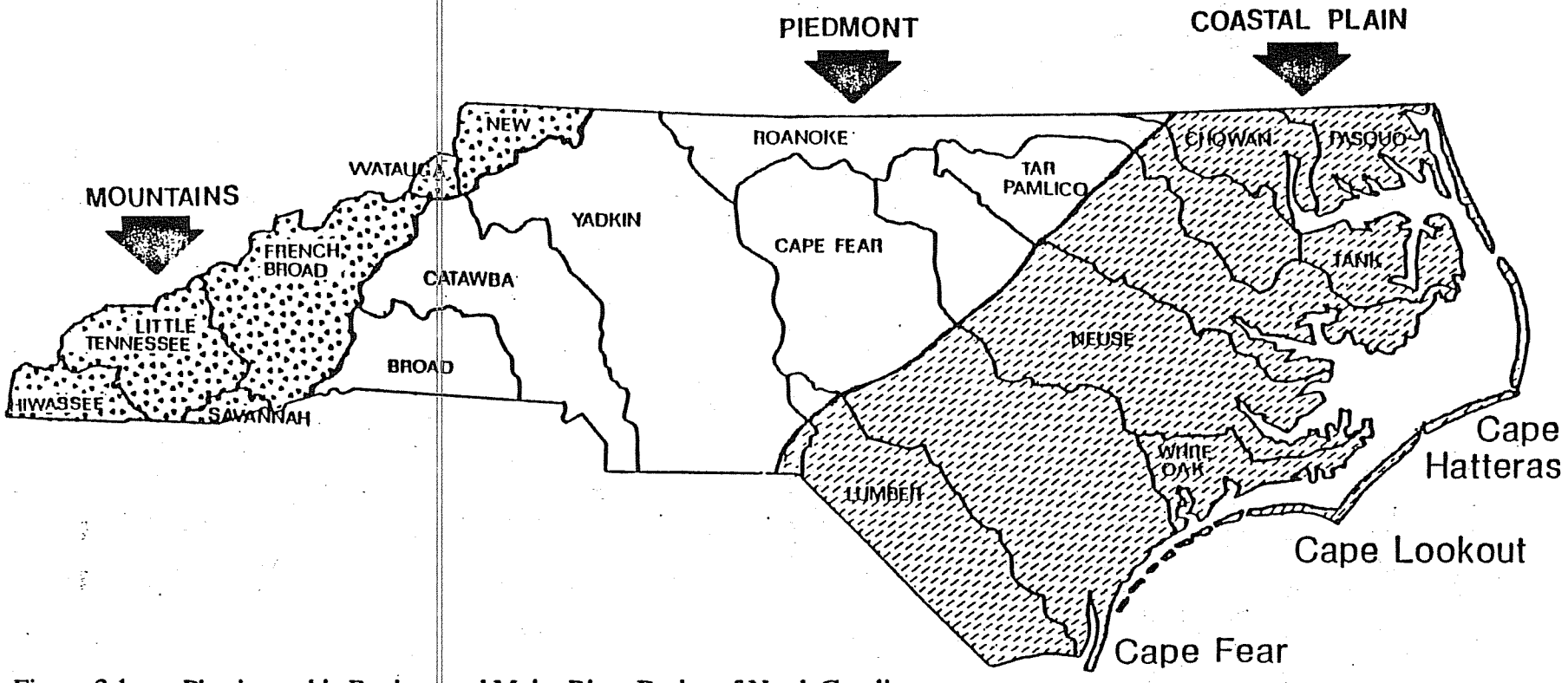

Figure 2.1 Physiographic Regions and Major River Basins of North Carolina

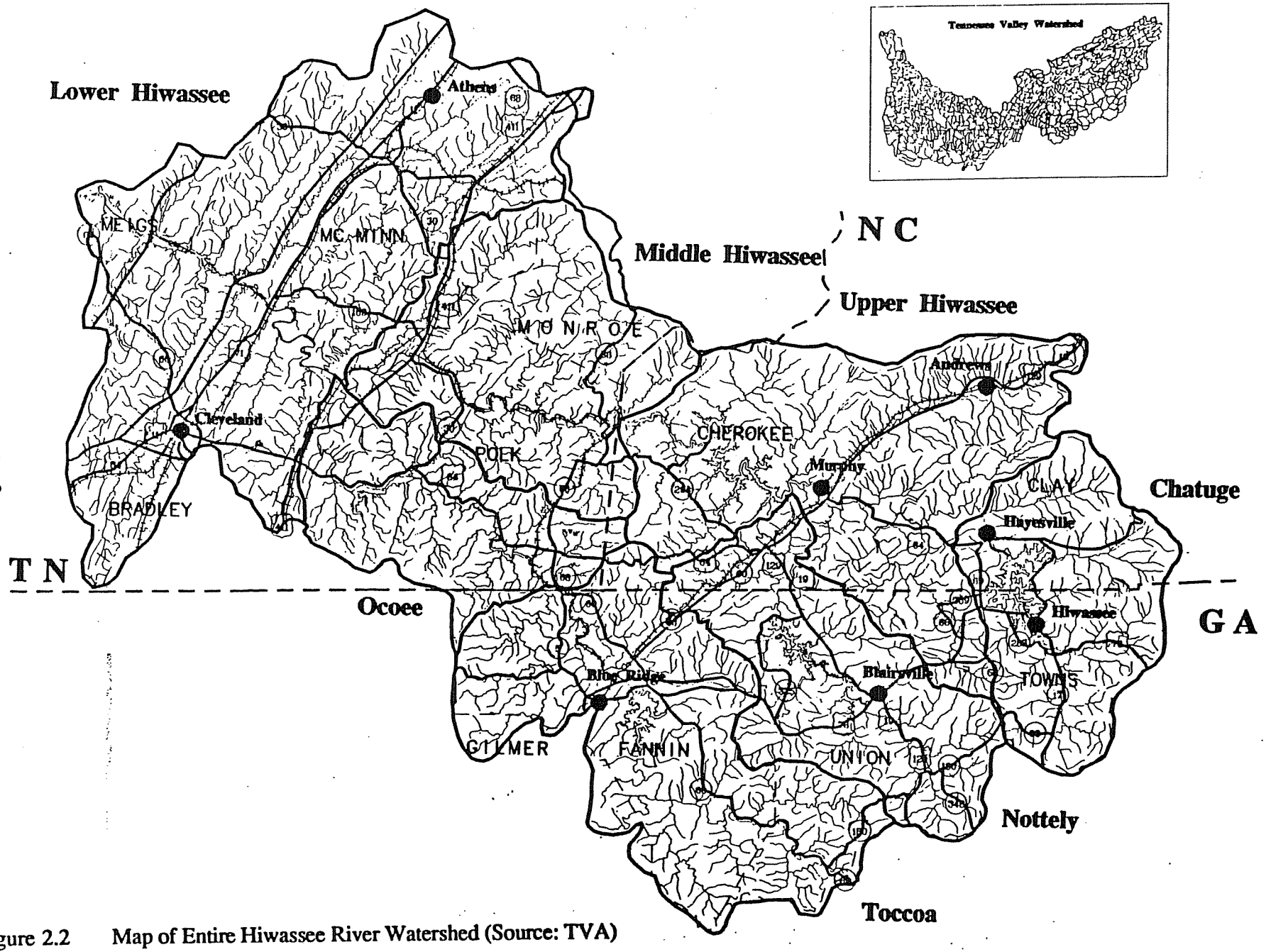

Figure 2.2 Map of Entire Hiwassee River Watershed (Source: TVA)

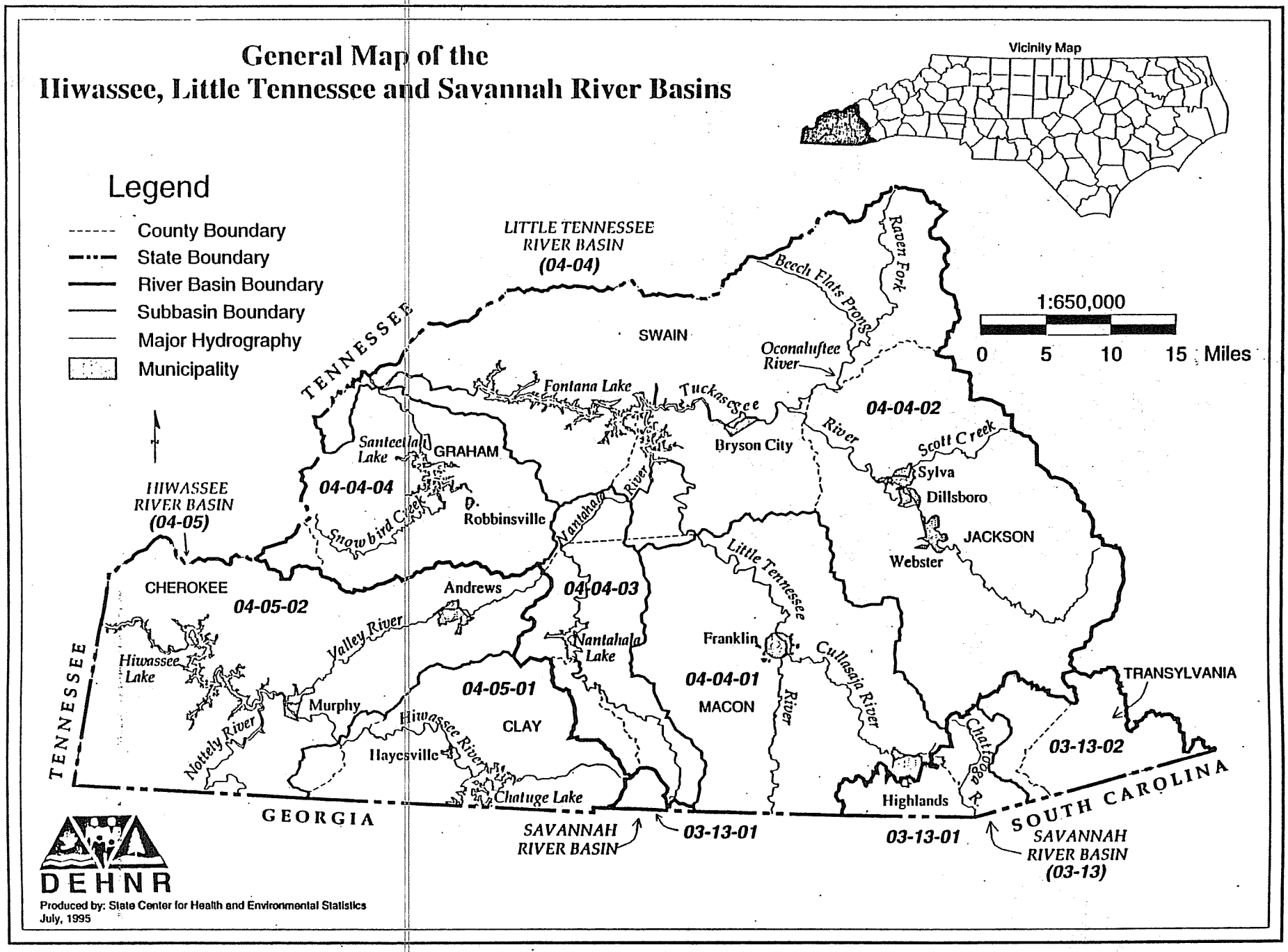

Figure 2.3 General Map of the Hiwassee River Basin in Relation to Neighboring River Basins

as it flows along NC 66 for most of its length. It also receives effluent from the Young Harris Water Pollution Control Plant in Georgia. The next downstream major tributary of the Hiwassee is Peachtree Creek, which was given an Excellent biological rating.

The Valley River (subbasin 04-05-02) is the largest tributary to the Hiwassee River. The Valley River flows in a southwesterly direction from Topton through Andrews, Marble, and Tomatla to its confluence with the Hiwassee River just below Murphy. Land use here is primarily agricultural and forest, with some urban areas in the Valley River watershed between Andrews and Murphy, along US 19/129. A special study of the upper Valley River in 1994 revealed unexpected water quality problems in the Valley River near Andrews. There was evidence of sediment problems in the headwater areas, which includes Junaluska Creek. There was also evidence of toxicity problems on the Valley River between Stewart Road and a site about 3 miles below Andrews. There was no evidence that the Andrews WWTP (the largest discharger in the area) contributed to these problems. In fact, the site above the WWTP showed the most severe water quality problems. There are no permitted dischargers upstream of the Andrews WWTP. There are two small tributaries of the Valley River that are classified as HQW (Britton Creek) or ORW (Gipp Creek).

There are a number of high quality and outstanding resource waters in the basin, as discussed later in this chapter. The Hiwassee River basin is well known for its trout fishery waters. In the Hiwassee River basin, there are eleven aquatic species that are listed by North Carolina as either Endangered, Special Concern, or Significantly Rare.

The basin is characterized by steep slopes and erodible soils. These steep slopes limit the amount of land area suitable for development and crop production. Much of the watershed is undeveloped or lies within the Nantahala National Forest. While most of the land is forested (approximately 45.6% private forest lands and 33.5% public forest lands), many retirement and second home developments are being built in the area. Most development occurs in river valleys and near streams due to the more level ground found in valleys. Development in or near stream corridors increases the chances for the sedimentation and erosion problems.

Slopes of less than 12% are desirable for development purposes and, in the absence of public sewer lines, soil depth of three feet or more over bedrock is desirable for construction of onsite septic systems. It is estimated that just 18% of lands in North Carolina's mountains meet these desirable characteristics (Clay et. al., 1975). Statistics provided by the US Department of Agriculture's Natural Resources Conservation Service indicate that cultivated cropland is shrinking as developed lands are increasing. Major industries in the basin include silviculture and tourism.

2.2 BASIN HYDROLOGY

The watershed is divided into 2 major hydrologic areas (*8-digit hydrologic units*) by the U.S. Water Resources Council and the U.S. Geological Survey (USGS). These major hydrologic areas are further subdivided by DWQ for management purposes into 2 subbasins denoted by 6-digit numbers (04-05-01 and 04-05-02). Table 2.1 presents the USGS hydrologic units and DWQ's corresponding subbasins.

Table 2.1 Hydrologic Divisions in the Hiwassee River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ Subbasin 6-digit codes Figure 2.3
Chatuge Lake, Hiwassee River, Valley River, Nottely River, Hiwassee Lake, Apalachia Lake	06020002	04-05-01, 04-05-02
Ocoee Drainage	06020003	04-05-02

2.3 LOCAL GOVERNMENT AND PLANNING JURISDICTIONS

The basin encompasses three municipalities and all or portions of Clay and Cherokee counties as presented in Table 2.2. Both counties are included in the planning region of the Southwestern North Carolina Planning and Economic Development Commission.

Table 2.2 Local Governments and Local Planning Units within the Hiwassee River Basin

County	% of County in Basin	Municipality
Cherokee	100%	Murphy Andrews
Clay	90%	Hayesville

2.4 LAND COVER, POPULATION AND GROWTH TRENDS

2.4.1 General Land Cover

Land cover information in this section is from the US Department of Agriculture (USDA), Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) of 1992 and 1982 (USDA, 1994). The NRI is a multi-resource national inventory based on soils and other resource data collected at scientifically selected random sample sites. It is considered accurate to the 8-digit hydrologic unit scale established by the US Geological Survey (NRCS, 1993). A 1992 update of this data was recently released.

Table 2.3 summarizes acreage and percentage of land cover from the 1982 and 1992 NRI for the Hiwassee River basin. Land cover in the basin is dominated by non-federal forest land (approximately 45.6%) and federal land (33.5%). Federal lands are primarily in the Nantahala National Forest and are therefore mostly forested lands. These two categories combined suggest that close to 80% of the basin is forested. The most dramatic land cover changes exhibited between 1982 and 1992 (Figure 2.4) were in the increase of urban/built-up lands (approximately 59% increase) and pasture lands (approximately 30% increase). Cultivated croplands decreased by approximately 81%. Descriptions of these land covers can be found in Table 2.4.

Land cover types in the Hiwassee River basin identified in a National Resources Inventory (NRI) conducted by USDA Natural Resource Conservation Service include cultivated and uncultivated croplands, pastureland, forest land, federal lands, urban and built-up lands, and other (rural transportation, small water areas and census waters).

Table 2.3 Estimated Acreage by Broad Land Use for the Hiwassee River Basin - 1982 versus 1992

(Source: USDA Natural Resource Conservation Service, 1992 NRI)

	Hiwassee River 06020002		Ocoee River 06020003			
LAND COVER	Acres	%	Acres	%	Total Acres	% of Total
Cult. Crop	2,200	0.5	0.0	0.0	2,200	0.5
Uncult. Crop	4,700	1.1	0.0	0.0	4,700	1.1
Pasture	32,100	7.8	1,400	15.6	33,500	8.0
Forest	184,800	44.8	7,400	82.2	192,200	45.6
Urban/Built-up	24,800	6.0	200	2.2	25,000	5.9
Federal Lands	141,300	34.4	0.0	0.0	141,300	33.5
Other	22,300	5.4	0.0	0.0	22,300	5.4
Totals	412,200	100.0	9000	100.0	421,200	100.0
% of Basin		97.9		2.1		100.0

(Source: USDA Natural Resource Conservation Service, 1982 NRI)

	Hiwassee River 06020002		Ocoee River 06020003			
LAND COVER	Acres	%	Acres	%	Total Acres	% of Total
Cult. Crop	9,900	2.2	1,400	15.6	11,300	2.9
Uncult. Crop	5,100	1.2	0.0	0.0	5,100	1.2
Pasture	24,700	6.0	0.0	0.0	24,700	5.9
Forest	195,400	47.4	7,600	84.4	203,000	48.2
Urban/Built-up	15,700	3.8	0.0	0.0	15,700	3.7
Federal Lands	139,000	33.8	0.0	0.0	139,800	33.1
Other	22,400	5.6	0.0	0.0	22,400	5.0
Totals	412,200	100.0	9000	100.0	421,200	100.0
% of Basin		97.9		2.1		100.0

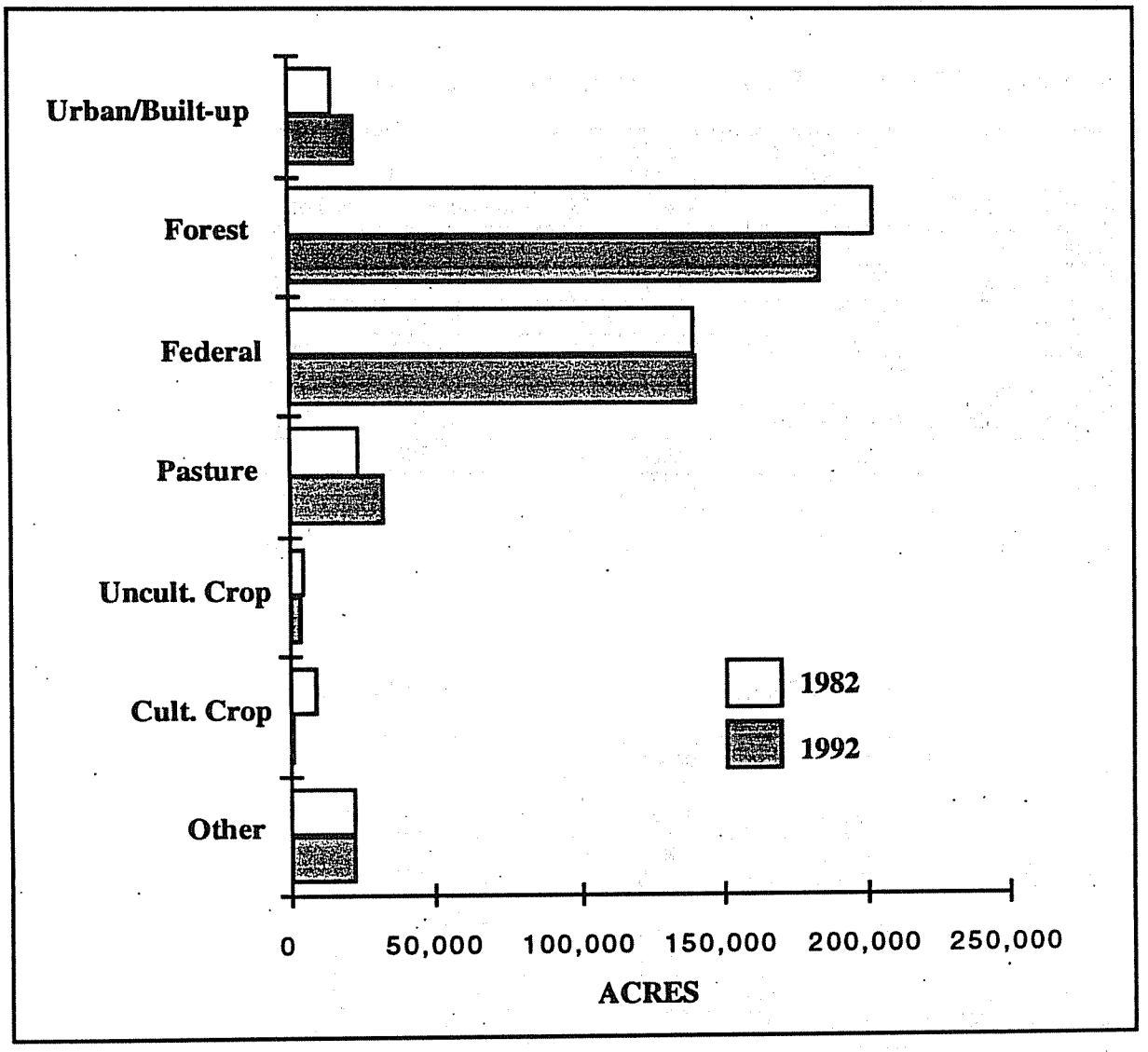

Figure 2.4 Summary of Land Cover for the Hiwassee River Basin

Table 2.4 Description of Land Cover Types (1992 NRI - USDA SCS)

Land Cover Type (No.)	Land Cover Description
1) Cultivated Cropland	Land used for the production of adapted crops for harvest, including row crops, small-grain crops, hay crops, nursery crops, orchard crops, and other specialty crops. The land may be used continuously for these crops or they may be grown in rotation with grasses and legumes.
2) Uncultivated Cropland	Summer fallow, aquaculture in crop rotation, or other cropland not planted (may include cropland in USDA set-aside or similar short-term program).
3) Pastureland	Land used primarily for production of introduced or native forage plants for livestock grazing. This category includes land that has a vegetative cover of grasses, legumes, and /or forbs, regardless of whether or not it is being grazed by livestock.
4) Forest Land	Land at least 10 percent stocked 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 and not currently developed for non-forest use. Ten percent stocked, when viewed from a vertical direction, is a canopy cover of leaves and branches of 25 percent or greater. The minimum area for classification of forest land is 1 acre, and the area must be at least 1,000 feet wide.
5) 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. Highways, railroads, and other transportation facilities are considered part of this category if surrounded by other urban and built-up areas. Tracts of less than 10 acres that do not meet this category's definitions (e.g., small parks or water bodies) but are completely surrounded by urban and built-up lands are placed in this category.
6) Federal Lands	All publicly owned federal land areas including National Forests.
7) 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). Includes the following three categories Small Water Areas: Water bodies less than 40 acres in size and streams less than one-half mile wide. Census Water: Large water bodies 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.

Several state agencies including the NC Department of Transportation and the Department of Environment, Health and Natural Resources are working with the state's Center for Geographic Information and Analysis (CGIA) to develop statewide land cover information based on recent satellite imagery. However, until these other land coverages become available, the 1992 NRI data is the most recent comprehensive data for the basin as a whole.

More recent land cover information is available in the Southern Appalachian Assessment Report (unpublished at time of printing). This land cover analysis was conducted by remotely sensed Landsat scenes into 17 classes of land cover. Hydrologic areas and watersheds were defined by the 8-digit Hydrologic Unit Code areas and ecological regions as defined by Omernik's Ecoregions of the Continental United States. The 17 classes were aggregated into 9 cover types (Table 2.5). Landsat image data was acquired between June 1990 and September 1994.

The Landsat data shows the majority of land cover in the basin to be in forest lands (Table 2.6). The SAA land cover data was obtained using different methodology than the NRCS land cover data, so comparisons cannot be made between the two datasets. The data was obtained to look at the entire Appalachian Mountain region, rather than at a statewide scale or river basin scale. However, the data is useful for showing breakdown of cover types by Landsat image data taken at a regional scale and applied to a river basin.

Table 2.5 Description of Southern Appalachian Assessment Landsat Land Cover Types

Cover Type	Description
Forest	Represents all forest types including: hardwood, coniferous, and mixed.
Herbaceous	Represents all areas that are vegetated and contain a crown closure of less than 25% (not forested), and are not classified by USGS land use data as agricultural (cropland or pasture).
Barren	Represents all areas that are greater than 75% non-vegetated, and contain less than 50% synthetic surfaces. Exposed rock surfaces (quarries) fall into this land cover type.
Pasture	Represents all areas defined as agricultural pasture lands.
Cropland	Represents all areas defined as agricultural crop lands.
Wetlands	Represents all areas that are coded as lacrustine or palustrine in the National Wetlands Inventory data, but are not subclassified as open water or forested with bottomland hardwood species.
Developed	Represents all areas that are greater than 75% non-vegetated and contain greater than 50% synthetic surfaces from USGS land use data. Urban land cover falls into this type.
Water	Represents all areas in water.
Indeterminate	Represents all other categories that could not be determined during analysis and includes clouds, shadows, etc.

Table 2.6 Land Cover for the Hiwassee River Basin based on Southern Appalachian Assessment (1990 to 1994) Landsat Data.

Cover Type	Acres	% of Total
Forest	356,425	86
Herbaceous	5,594	1
Barren	86	<1
Pasture	31,208	8
Cropland	5,172	<1
Wetlands	228	<1
Developed	3,030	<1
Water	9,952	2
Indeterminate	0	0
Total	411,597	100

Table 2.7 shows, by county, the estimated percentage of lands within the basin that are within the Nantahala National Forest.

Table 2.7 Acreage and Percent of Counties Within National Forest Lands (USDA Forest Service).

County	Total Acres in County	Forest Land (acres)	% of County
Clay	136,902	65,716	48
Cherokee	289,171	93,163	32
Total	426,073	158,879	

According to land use information from TVA (unpublished), most of the land cover within the Hiwassee River basin that lies in northern Georgia (Towns and Union counties) is forested.

2.4.2 Population, Growth Trends and Tourism in the Basin

Population

There are two counties and three municipalities (Murphy, Andrews, and Hayesville) located in whole or in part in the basin. Based on 1990 census data, the population of the basin was 26, 723 people. Table 2.8 presents census data for 1970, 1980, and 1990 for both of the subbasins and the percent growth within each subbasin. It also includes land and water areas and population densities (persons/square mile) by subbasin based on the land area for that subbasin.

Figure 2.5 shows 1990 population densities by census block group for the Hiwassee River Basin. The overall population density is 43 persons per square mile versus a statewide average of 123 persons per square mile. Census block group boundaries do not generally coincide with subbasin boundaries so population figures are estimated. The census data are collected within boundaries such as counties and municipalities. By contrast, the subbasin lines are drawn along natural drainage divides separating watersheds. Therefore, where a census block group straddles a subbasin line, an estimate has been made on the population percentage located in the subbasin. This is done by determining the percentage of the census block group area within the subbasin and then taking that same percentage of the total census block group population and assigning it to the subbasin. This method assumes 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 each ten years so comparisons between years are considered approximate.

Growth Trends

Figure 2.6 presents the percent population growth by subbasin. The percent population growth over the last ten year census period (1980 - 1990) was 7.1% versus a statewide average of 12.7%. During the last decade there has been an increase in the amount of urban and built-up lands (US Department of Agriculture, Natural Resources Conservation Service). While population in the basin is low, the population has grown significantly (27.7%) between 1970 and 1990.

Growth rates between 1980 and 1994 for the municipalities within the Hiwassee River basin show little growth (Figure 2.7). However, only approximately 15% of the population of Cherokee county was living in a municipality in 1994. Clay county had only 5.0% of its population located within a municipality (Office of State Planning). Much of the growth occurring within the basin is occurring along stream and river corridors in rural areas, which can have a more significant impact on water quality due to a lack of municipal regulations and a dependence on septic systems. As noted earlier, increases in population tend to offset land cover previously held in forest lands.

Table 2.9 shows projected population growth between 1990 and 2020 for the two counties within the basin. Both counties are projected to show a population increase. The municipalities within the basin are expected to continue to grow at a significant rate (Office of State Planning 1995).

Tourism

There are population fluctuations within the basin due to the influence of seasonal tourism. Second home development surrounding the municipalities within the basin, as well as development in the outlying areas has the potential to result in significant water quality impacts in the basin.

The development of a gambling casino on Reservation Lands within the Qualla boundary is expected to dramatically increase tourism not only on the reservation, but throughout the outlying areas as well. It is estimated that approximately 2 million additional visitors will be visiting the area as a result of the gambling casino (Willett and Eller 1995).

The NC Division of Community Assistance report (Willett and Eller 1995) estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout the region. At present, there are six major thoroughfares (referred to as Corridor 1 through 6, see Figure 2.8) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation. The projected increase in traffic on each of Corridor 1 through 6 can be found in Table 2.10.

Corridor 1 through Cherokee County will carry travelers through the Hiwassee River basin along US Hwy. 19/129, which parallels much of the Valley River. The development of the four-lane thoroughfare from Andrews to Almond (via Robbinsville) will provide access to Robbinsville and Graham County for economic development in the area (DOT 1996). Corridor 6 (US Hwy. 23/441) through Macon County will carry travelers through the upper Little Tennessee River basin along the upper Little Tennessee River to Dillsboro. Both of these Corridors are expected to drastically increase traffic flow (approximately 309,400 vehicles annually) over the mountains from the region of Atlanta, Georgia.

Table 2.8 Hiwassee River Basin Population (1970, 1980, and 1990), Percent Population Change and Land Area Summaries

SUBBASIN	POPULATION (Number of Persons)			POPULATION DENSITY (Persons/Square Mile)			LAND AND WATER AREAS			
							Total Land and Water Area		Water Area	Land Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
04-05-01	5,236	6,839	7,445	26	35	38	128,717	201	6	195
04-05-02	15,694	18,102	19,278	36	41	44	282,981	442	11	431
Totals	20,930	24,941	26,723	33	40	43	400,896	643	17	626

Note: Population, land area and water area were derived from 1970, 1980 and 1990 census data.

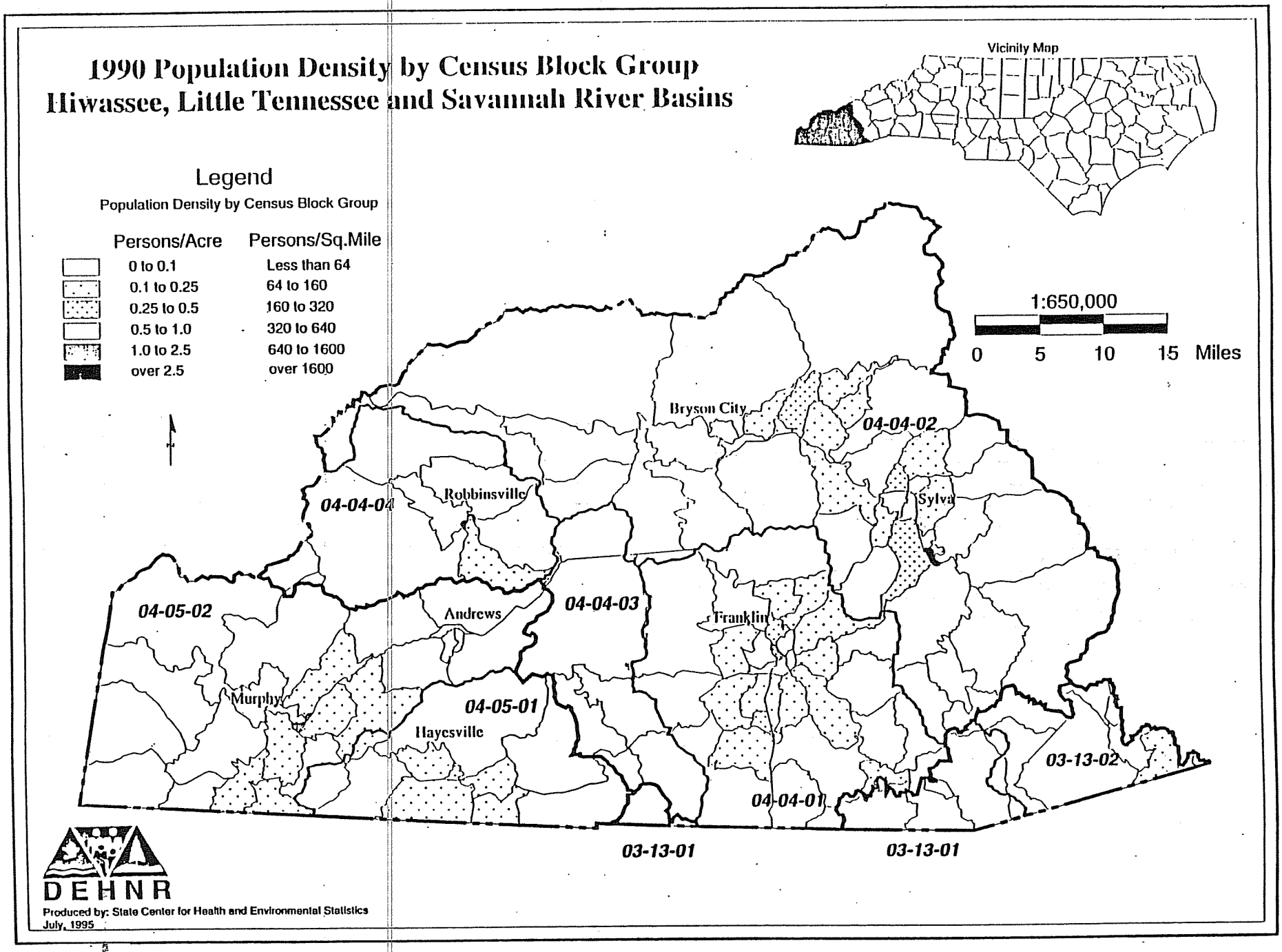

Figure 2.5 1990 Population Density by Census Block Group for the Hiwassee River Basin

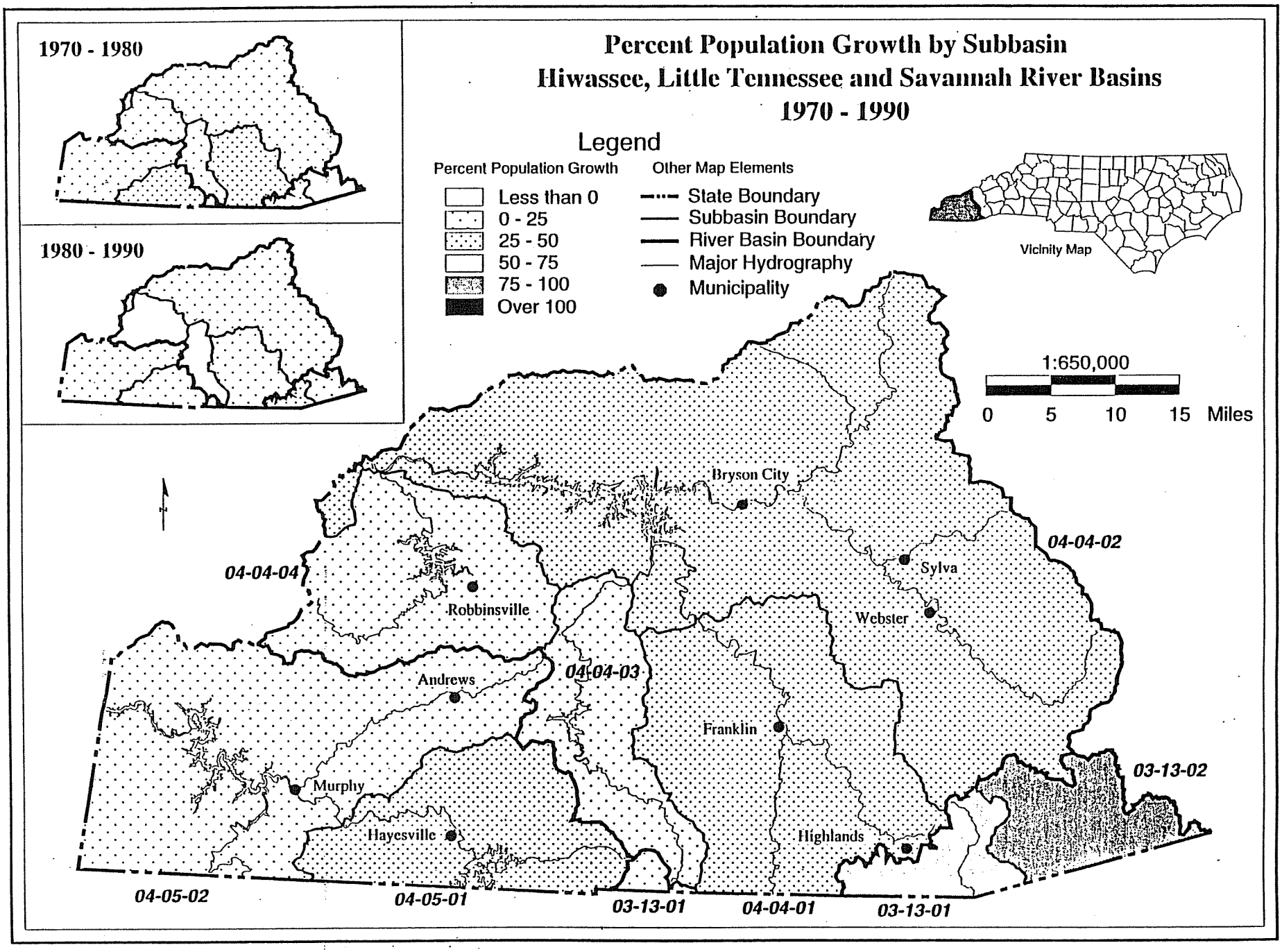

Figure 2.6. Percent Population Growth by Subbasin

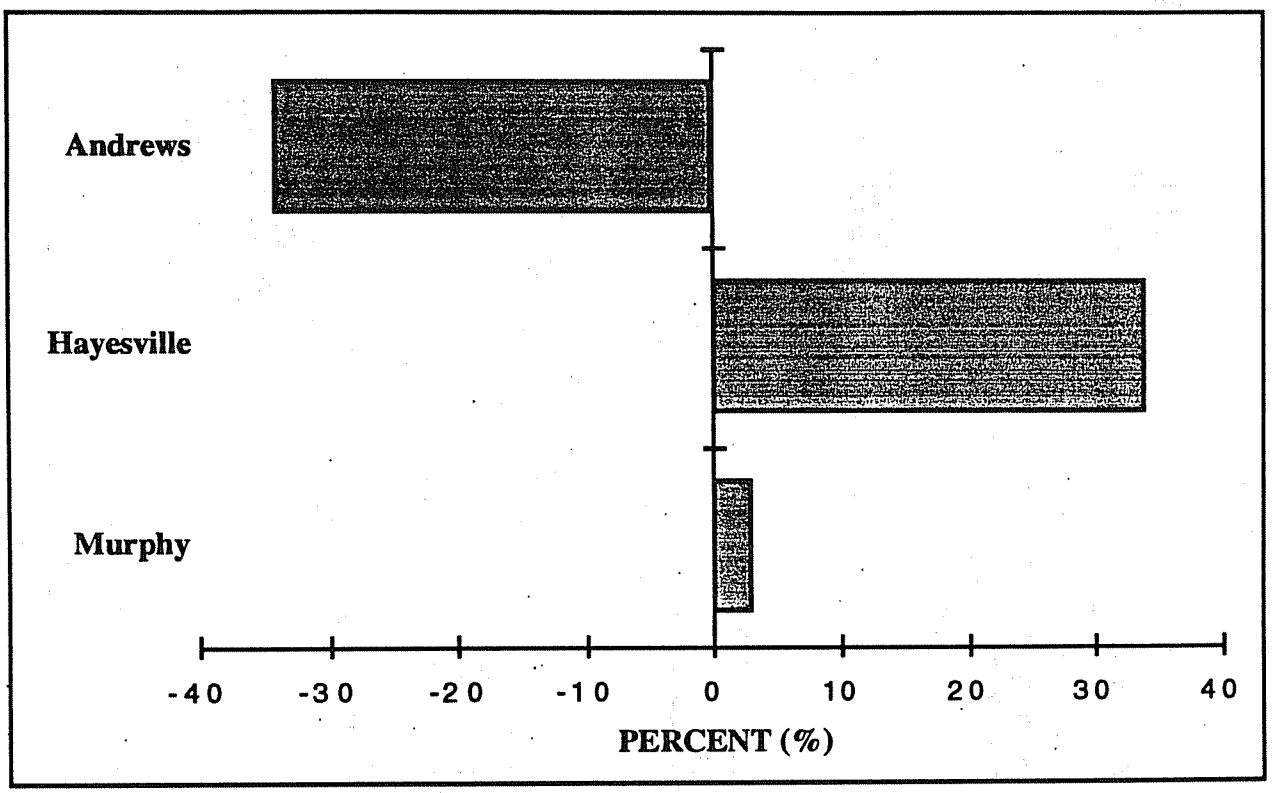

Figure 2.7 Percent Population Change for Municipalities in the Hiwassee River Basin - 1980 - 1994.

Table 2.9 Projected Population Changes by County for Counties in the Hiwassee River Basin (NC Dept. of Administration)

County	1990 Population	2020 Population	% Change (1990 - 2020)
Clay	6,658	7,111	7%
Cherokee	19,767	20,956	6%

Corridor 2 (US Hwy. 441) allows travelers access to the Cherokee Indian Reservation from Gatlinburg and eastern Tennessee. US Hwy. 441 is the route through the Great Smoky Mountains National Park and provides access to the Blue Ridge Parkway (already the most visited National Park and the most traveled national parkway in the U.S.). It is anticipated that an additional 119,080 vehicles will annually travel through the Great Smoky Mountains National Park.

Corridors 3 and 4 are anticipated to increase annual vehicular traffic by 583,440 vehicles from Haywood and Jackson Counties and beyond. Corridor 3 (US Hwy. 19) is a narrow, curving and, in places, steep road from Maggie Valley, Waynesville, and I-40. This route is already congested in peak tourist seasons and accidents are frequent. Corridor 4 (US Hwy. 23/74) will serve as a main route for travelers from Waynesville, Asheville and I-40.

Corridor 5 is expected to bring an additional 28,080 vehicles on US107 through the Savannah River basin and the community of Cashiers.

US Hwy. 19 is expected to be improved to a multi-lane road through the Cherokee Indian Reservation and to 4 - 5 miles on either side of the Reservation. In addition, due to the increased traffic flow expected as a result of the gambling casino, Business 441 on Reservation lands may be widened. The feasibility study is now being conducted on the US Hwy. 19 improvements (DOT 1996).

Improved, multi-lane roads provide opportunities for quicker and easier access to rather remote areas of the state. However, during construction of these roads there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are frequently found in this region of the state. These rock formations can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff from roads.

2.5 IMPORTANT NATURAL RESOURCES

2.5.1 Waterfalls

The Hiwassee River basin has only two significant waterfalls (Adams 1994). These are the Leatherwood Falls (located on the Fires Creek Wildlife Management Area of the Nantahala National Forest in Clay county) and the Falls on the Tellico River (located in the Nantahala National Forest in Cherokee county). Because the Hiwassee River basin is located near an area of the state that receives the highest amount of annual rainfall it is somewhat surprising that there are not more waterfalls. The low number of large waterfalls can be explained by the rock type and topography within the basin. Although the mountain slopes are steep, the river valleys are broad. When the flow of these streams is great enough to create waterfalls, the water has already fanned out into the valley below (Adams 1994).

2.5.2 Lakes

The North Carolina portion of the Hiwassee River basin has three notable lakes: Chatuge Lake, Hiwassee Lake, and Apalachia Lake. The Tennessee Valley Authority (TVA) regulates water releases from these lakes for the production of hydroelectric power. These lakes offer opportunities for camping, hiking, swimming and boating. Discussion on water quality of these lakes are included in Chapter 4.

2.5.3 Rare Aquatic Faunal Species

In the Hiwassee River Basin, there are eleven aquatic animal species that are listed by North Carolina as either Endangered, Threatened, Special Concern, or Significantly Rare (Table 2.11). One species, the Littlewing Pearlymussel, is listed as endangered under federal listings. Endangered species are those species that are in danger of becoming extinct. Threatened species are considered likely to become endangered within the foreseeable future. Species of Special Concern have limited numbers and vulnerable populations and are in need of monitoring. Significantly Rare species are those whose numbers are small and whose populations need monitoring (NC DEHNR, 1996).

The knotty elimia (*Goniobasis interrupta*)is a mollusk that is endemic to the Hiwassee River basin. Little is known about the life history or ecology of this rare freshwater gastropod, but it has been observed in streams with rocky substrates and medium to fast flowing water. The knotty elimia has an olive-colored conical shell.

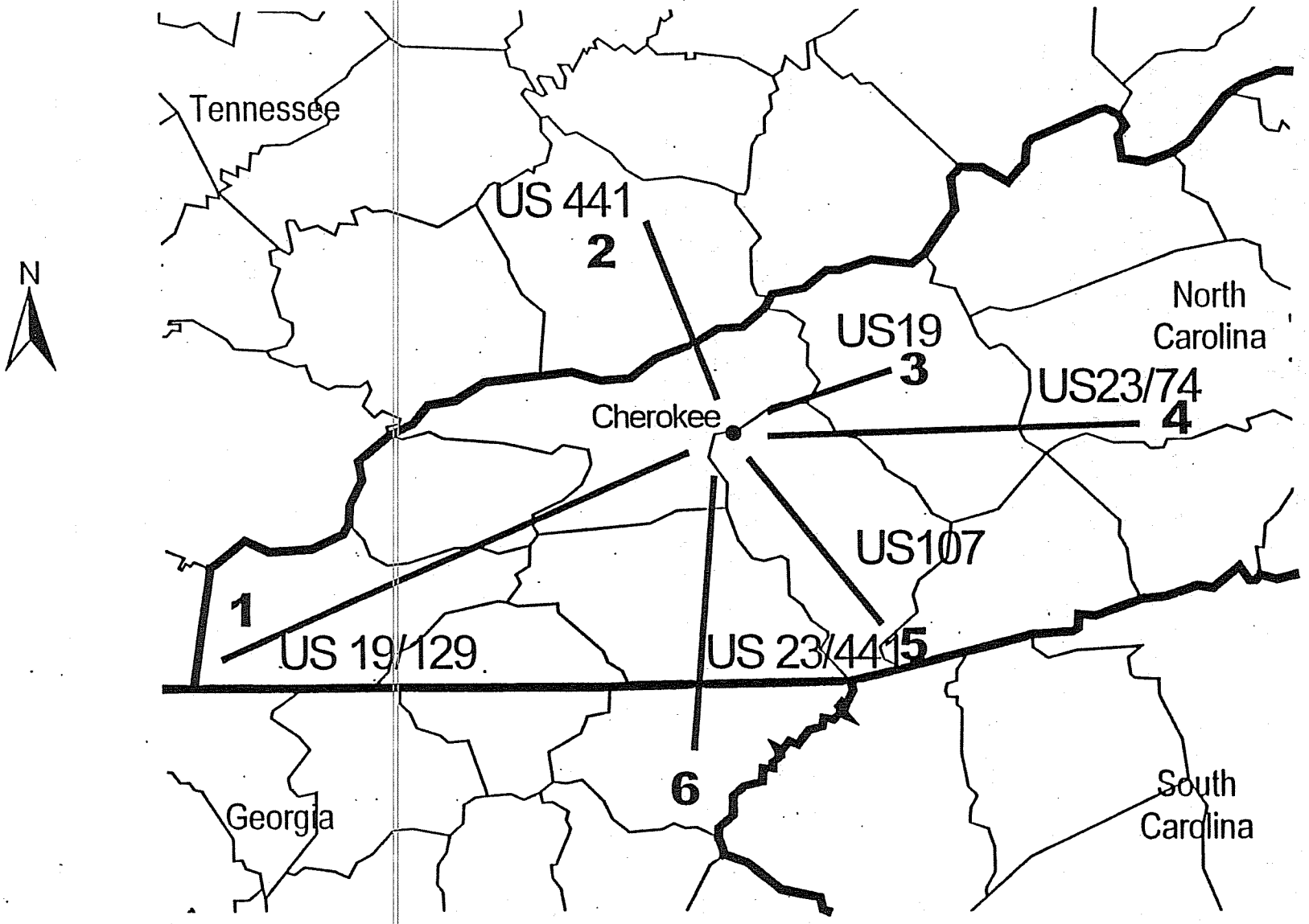

Figure 2.8 Major Traffic Routes to the Cherokee Indian Reservation Casino

Table 2.10 Projected Increase in Traffic along Major Corridors as a Result of the Cherokee Indian Reservation Gambling Casino

Month	Volume Increase							
	Percentage	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6	Total
January	3.7	2,694	4,406	5,445	16,142	1,039	8,754	38,480
February	3.7	2,694	4,406	5,445	16,142	1,039	8,754	38,480
March	4.9	3,567	5,835	7,211	21,378	1,376	11,593	50,960
April	6.2	4,514	7,383	9,124	27,049	1,741	14,669	64,480
May	8.6	6,261	10,241	12,656	37,520	2,415	20,348	89,441
June	11.1	8,081	13,218	16,335	48,427	3,117	26,263	115,441
July	13.6	9,901	16,195	20,014	59,334	3,819	32,178	141,441
August	13.6	9,901	16,195	20,014	59,334	3,819	32,178	141,441
September	11.1	8,081	13,218	16,335	48,427	3,117	26,263	115,441
October	13.6	9,901	16,195	20,014	59,334	3,819	32,178	141,441
November	6.2	4,514	7,383	9,124	27,049	1,741	14,669	64,480
December	3.7	2,694	4,406	5,445	16,142	1,039	8,754	38,480
Totals	100.0	72,800	119,080	147,160	436,280	28,080	236,600	1,040,000

Source: DCA study, September, 1995.

Table 2.11 Rare Aquatic Species Recorded in the Hiwassee River Basin (Source: NC Natural Heritage Program)

Common Name	Scientific Name	Listing Status: State	Federal
Tangerine Darter	*Percina aurantiaca*	SR	
Olive Darter	*Percina squamata*	SC	
Hellbender	*Cryptobranchus alleganiensis*	SC	
Loggerhead Musk Turtle	*Sternotherus minor*	SC	
Sauger	*Stizostedion canadense*	SR	
Spike	*Elliptio dilatata*	SC	
Hiwassee Crayfish	*Cambarus hiwasseensis*	SR	
Parrish Crayfish	*Cambarus parrishi*	SR	
Knotty Elimia*	*Goniobasis interrupta*	E	
Tennessee Heelsplitter	*Lasmigona holstonia*	E	
Littlewing Pearlymussel*	*Pegias fabula*	E	E

Listing abbreviations - E = Endangered, SC = Special Concern, SR = Significantly Rare
* - Signifies historic record; species has not been recorded in many years

Three rare freshwater mussels have been recorded in the Hiwassee River basin, and each of the species occupies different habitats. The littlewing pearlymussel (*Pegias fabula*), a small, chalky-white mussel, prefers to live in transition zones between riffles and pools in small to medium streams with low turbidity. The Tennessee heelsplitter (*Lasmigona holstonia*) generally prefers small streams. And the spike (*Elliptio dilatata*) is found in a range of habitats, from small streams to large rivers and in substrates from sand to gravel and cobble.

Despite habitat differences, freshwater mussels have similarities which may contribute to their declining populations across North Carolina. For example, they depend on a common diet of detritus, diatoms, phytoplankton, and zooplankton. In addition, they have similar life histories which involve parasitizing host fish for larval development. Mussels attach their larvae to the gills or fins of a specific fish species for two to six weeks. After the larvae have developed, they drop from the fish and metamorphose into juveniles. The survival of mollusk populations is directly linked to the health and presence of certain fish species.

The long-term survival of these Hiwassee mussel populations is questionable. The littlewing pearlymussel has not been observed in the Hiwassee River basin for many years. The Tennessee heelsplitter was last observed in the Hiwassee River basin in 1991, but there are few previous records of the species. And although populations of spikes are still found in the basin, they are susceptible to pollution -- especially from coal mines or sedimentation -- which has a major impact on their populations.

The two rare crustaceans recorded in the Hiwassee River basin are Hiwassee crayfish (*Cambarus hiwasseensis*) and Parrish crayfish (*Cambarus parrishi*). Although they both exist in swiftly flowing, well-oxygenated rivers and are endemic to the Upper Hiwassee basin, they rarely occupy the same habitat. These rare crayfish are vulnerable to habitat destruction from sedimentation, water pollution (including acid rain), and impoundments.

Three rare freshwater fishes in the Hiwassee basin are the sauger (*Stizostedion canadense*), tangerine darter (*Percina aurantiaca*), and olive darter (*Percina squamata*). Sauger is a big-stream species that prefers deeper, slower water than either of the darters. The adult tangerine darter prefers swiftly flowing streams, but juvenile darters prefer shallow, silty, edge-of-stream environments. The olive darter exists primarily in fast riffle areas with boulder or rubble substrates.

The loggerhead (or stripeneck) musk turtle (*Sternotherus minor*) is a small turtle with a gray-brown shell. It spends most of its time in streams and rivers, and it feeds on aquatic insects and snails. The stripeneck musk turtle's limited range in North Carolina makes it vulnerable to even minor habitat destruction.

The hellbender (*Cryptobranchus alleganiensis*) is a very large aquatic salamander (often 18 to 20 inches long) with wrinkled, fleshy folds of skin on either side of its body. The hellbender feeds on crayfish in large streams with cool, clean and fast-flowing water, which it needs for cutaneous respiration. It is a myth that hellbenders are poisonous. Pollution and siltation have damaged much of the hellbender's habitat, making this amphibian species rare in North Carolina.

Other non-aquatic threatened and endangered species of amphibians, mammals, and plants occur along the streambanks. These non-aquatic species may be affected by water quality degradation in the basin.

The Hiwassee River basin contains natural communities of high quality and rarity. High-quality wetland communities that exist in the Hiwassee River basin include: high elevation seeps, southern Appalachian bogs, swamp forest-bog complex, floodplain pools, and piedmont/low mountain alluvial forests. Of particular importance are the mountain bogs, which are disappearing due to nutrient input, plant succession, drainage for agriculture, groundwater pumping, impounding for ponds, and other development pressures. Mountain bogs often contain rare plants and animals, including the state Threatened bog turtle (*Clemmys muhlenbergii*) and the federally Endangered green pitcher plant (*Sarracenia oreophila*).

2.5 ANIMAL OPERATIONS

2.5.1 Registered and Certified Operations

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H. 0217) to establish procedures for managing and reusing animal wastes from intensive livestock operations (See Appendix II for additional information on rule requirements). The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve more than or equal to the following animal populations: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. The deadline for submittal of registrations to DWQ for existing facilities was December 31, 1993.

In the Hiwassee River basin there are a total of 25 registered livestock operations. None of these are yet certified. They must develop an approved waste management plan before the end of 1997. The majority of these operations are located in the area of Hayesville and Murphy. All operations are for cattle (includes dairy) with the exception of three operations (one swine, one horse, and one poultry operation).

Table 2.12 summarizes the estimated total capacity of animals for livestock operations as of February 1995. This includes both registered and unregistered facilities. Figures are presented for each subbasin. These numbers are small compared to state totals (<1% for swine and dairy populations and 6% for poultry capacity). However, if animal operations are not managed properly there is the potential for localized water quality problems due to animal waste.

Table 2.12 Estimated Animal Populations in the Hiwassee River Basin (Source: NCDA Veterinary Division, February 1995)

Subbasin	Swine 1994	Swine 1990	Swine Change(%)	Dairy 1994	Poultry Capacity
Upper Hiwassee River (04-05-01)	516	493	5%	546	86,105
Lower Hiwassee River (04-05-02)	214	435	-51%	736	1,056,739
Totals	730	928		1,282	1,142,844

2.7 SURFACE WATER CLASSIFICATIONS AND STANDARDS IN THE HIWASSEE RIVER BASIN

All surface waters in the state are assigned a primary water classification, and they may also be assigned one or more supplemental classifications. Classifications are assigned to protect the various uses of the waters, such as swimming, aquatic life propagation or water supplies. For each classification, there is a set of water quality standards that must be met in order to protect the uses. Chapter 5 provides a brief description of the Surface Waters Classifications and Standards Program. Appendix II provides a more detailed summary of the state's primary and supplemental classifications including, for each classification, the best usage, water quality standards, stormwater controls and other protection requirements as appropriate. This information is derived from 15A NCAC 2B .0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina.

The waters of the Hiwassee River basin have a variety of surface water quality classifications applied to them (Table 2.13). The majority of the waters are classified as C (77%) or WS-IV (22%). The supplemental classification of Tr applies to many of the waters in the basin. There are currently 28 waters in the Hiwassee River basin supplementally classified as HQW and 31 waters supplementally classified as ORW. There are 100 waters (3=WS-I, 11=WS-II, 85=WS-IV, 1=WS-V) designated as water supply watersheds in the Hiwassee River Basin. The location of HQW's, ORW's and Water Supply Watersheds can be found in Figure 2.9.

Table 2.13 Water Classification Statistics for Streams in the Hiwassee River Basin

	HQW	ORW	B	C	Tr	WS-I	WS-II	WS-IV
Length (miles)	49	57	.12	855	385	2.6	6.3	244
% of Total	4.5%	5.2%	.01%	77.1%	35	.23%	.57%	22.0%

The above stream length summaries were calculated by first identifying the blue lines (referred to as arcs) representing stream segments, and subsequently attributing them by their class. This was an iterative process as many of the arcs were redundantly attributed (e.g. 'HQW' and 'C'), and therefore measured twice. This explains why the sum of the percentages for the various classes is greater than 100 percent.

Stream length summaries do not include the length of arcs representing pond and/or lake shorelines. Therefore, the measurement of the length of a particular stream will stop when entering an impounded area (lake), and begin again where the stream flows out of the impoundment. The total number of acres and percent of total per category for the lakes of the Hiwassee River basin are presented in Table 2.14.

Table 2.14 Water Classification Statistics for Lakes in the Hiwassee River Basin

Water Classification	B	C	WS-IV
Acres	4,552	5,504	86
% of Total	44.9%	54.3%	.85%

A complete listing of classifications for all surface waters in the basin can be found in a DWQ publication entitled "Classifications and Water Quality Standards Assigned to the Waters of the Hiwassee River Basin". This has been reprinted in Appendix II. Pending reclassifications are discussed in Chapter 6.

2.8 WATER USE IN THE HIWASSEE RIVER BASIN

2.8.1 Local Government Water Supply Plans and General Water Use

The Division of Water Resources is compiling a State Water Supply Plan (SWSP) Database that contains information from Local Water Supply Plans pursuant to GS 143-355 (l) and (m). Currently (May 21, 1996) there are four water systems in the study area that are subject to GS 143-355 (l). Only one of these systems, the Town of Murphy, has submitted an approved plan that has been entered into the SWSP database. The following summary of current and future population and water use is based on this water system.

Table 2.15 presents the 1992 and projected serviced population and water use for Murphy through to the year 2020. Based on this table it may be expected that the population serviced by this system will increase by 5 percent over the next few decades.

Table 2.15 1992 and Projected Service Populations and Water Use for the Town of Murphy
(Source: Division of Water Resources)

	1992	2000	2010	2020
Water Use (in mgd)	0.687	0.687	0.778	0.993
Population	2,800	2,800	2,850	2,950

DWR's data for this water system indicates an average daily use of 0.687 MGD and a maximum daily usage of 0.946. It is important to note that Murphy uses a surface water source. In 1992 the average daily discharge for this water system was 0.50 MGD with a high monthly discharge of 0.573 MGD occurring in February and a low monthly discharge of 0.445 MGD occurring in April.

A 45 percent increase in water use is forecasted by the year 2020. The Town of Murphy reports an available water supply of 80.25 million gallons per day (MGD). The Town is not projecting a 2020 water supply deficit based on their current water supply sources.

USGS Water Use information for the Hiwassee River Basin (HUC# 06020002) indicates that the total water withdrawals for the basin was 10.14 MGD. Ground water sources supplied 1.66 MGD of this and the remaining 8.84 MGD was withdrawn from surface water sources. The water withdrawal profile for the basin is presented in Table 2.16.

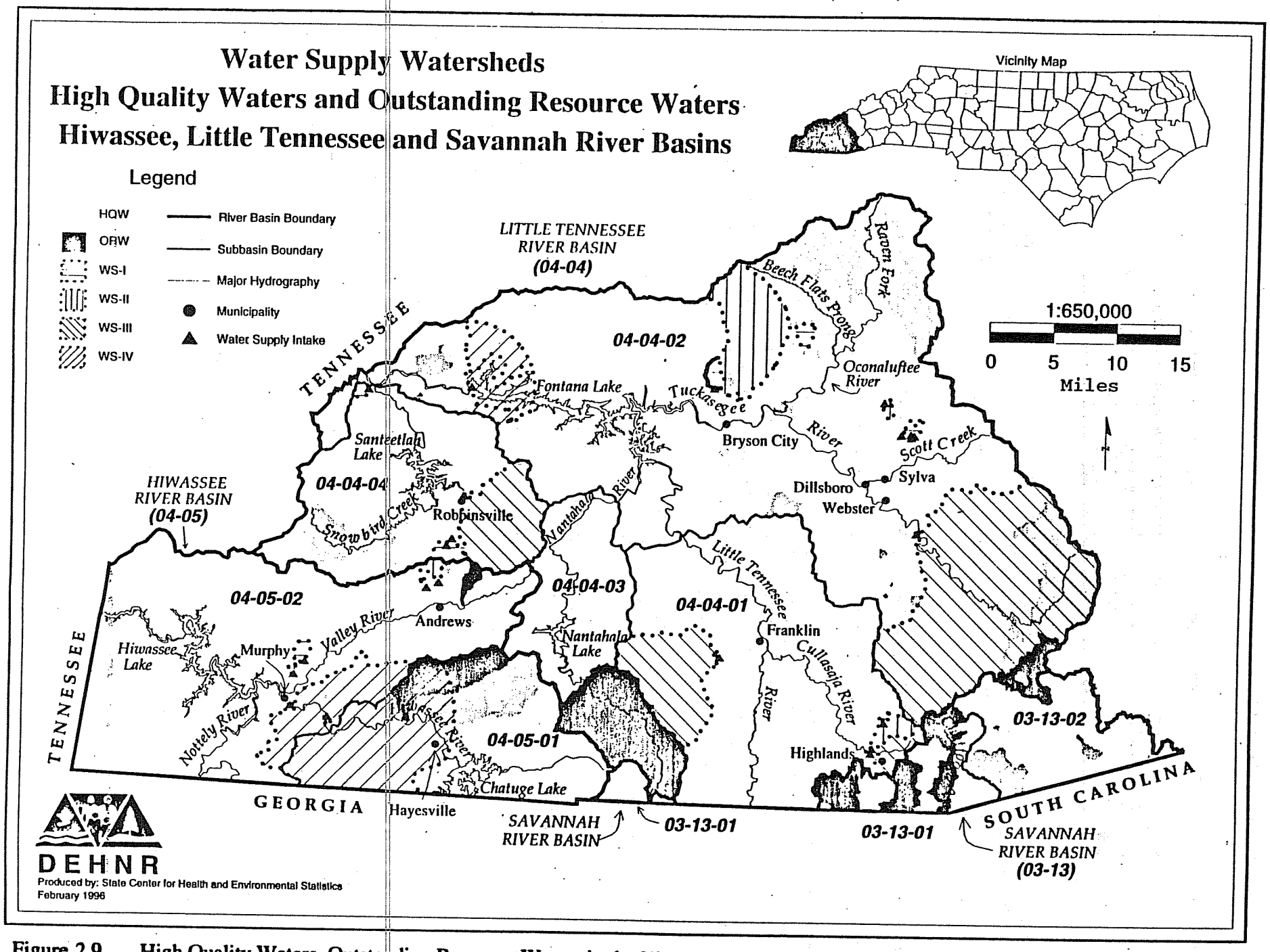

Figure 2.9 High Quality Waters, Outstanding Resource Waters in the Hiwassee River Drainage Area in North Carolina

Table 2.16 Hiwassee River Basin Water Withdrawals for 1990 (MGD) (Source: USGS)

Withdrawal Category	Ground Water	Surface Water	Total Water
Public Water Supply	0.31	1.12	1.43
Commercial Self Supply	0.04	0.00	0.04
Domestic Self Supply	1.07	0.00	1.07
Industrial Self Supply	0.05	0.02	0.07
Electric Power Self Supply	0.00	0.00	0.00
Mining Self Supply	0.00	0.00	0.00
Livestock Self Supply	0.19	7.22	7.41
Irrigation Self Supply	0.00	0.12	0.12
TOTAL	1.66	8.48	10.14

2.8.2 Water Withdrawal and Transfer Registration

DWR's Water Withdrawal and Transfer Registration Database for 1991 contains six surface water withdrawals. Four of these are operated by the Town of Murphy (Cherokee County). Murphy's water use was addressed in the preceding SWSP database section. The remaining two withdrawals were registered by the Town of Andrews from Dan Holland Lake and the Beaver Creek Impoundment. In 1990 the average (and maximum) withdrawal for this public water supply was 0.60 MGD. There are no 1993 Water Withdrawal and Transfer Registrations, pursuant to G.S. 143-215.22H, in the Hiwassee River Basin

2.9 MINIMUM STREAMFLOW REQUIREMENTS

DWR's Instream Flow Unit's activities involved the Hiwassee and Nottely Rivers in the Hiwassee River Basin. The Instream Flow Unit operates under the rules applied to the Dam Safety Law that require dams to release minimum stream flows to adequately maintain aquatic habitat (G.S. 143-215.24.0500).

Hiwassee River

The Division of Water Resources (DWR) conducted an Instream Flow Incremental Methodology (IFIM) study below Chatuge Lake on the Hiwassee River. The study's recommendations were provided as comments to the Tennessee Valley Authority (TVA) on their Lake Improvement Plan. The TVA's Lake Improvement Plan is a $50 million dollar program for improving dissolved oxygen and minimum releases at 16 hydropower dams. Eighty-three cubic feet per second (cfs) was selected by TVA as the daily average minimum flow target at the Chatuge Dam. An infuser weir is in place below the dam to improve low dissolved oxygen concentrations and to maintain a minimum flow when the hydropower facility is not generating.

Nottely River

DWR also conducted an IFIM study on the Nottely River in North Carolina downstream of Nottely Lake which is located just across the state line in Georgia. The study recommendations were provided as comments on the Environmental Impact Statement (EIS) for the TVA's Lake Improvement Plan. TVA installed a minimum flow turbine at the dam to release a constant 50 cfs.

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CHAPTER 3

CAUSES OF IMPAIRMENT AND SOURCES OF POLLUTION

3.1 INTRODUCTION

Water pollution is caused by a number of substances including sediment, nutrients, bacteria, oxygen-demanding wastes, metals, color and toxic substances. *Sources* of these pollution-causing substances are divided into broad categories called *point* sources and *nonpoint* sources. Point sources are typically piped discharges from wastewater treatment plants and large urban and industrial stormwater systems. Nonpoint sources can include stormwater runoff from urban areas, forestry, mining, agricultural lands and others. **Section 3.2** identifies and describes the major causes of pollution in the Hiwassee River basin. **Sections 3.3** and **3.4** describe point and nonpoint source pollution in the basin.

3.2 CAUSES OF IMPAIRMENT

Causes of impairment refers to the substances which enter surface waters from point and nonpoint sources and result in water quality degradation. The major causes of water quality impairment include biochemical oxygen demand (BOD), sediment, nutrients, toxicants (such as heavy metals, chlorine, pH and ammonia) and fecal coliform bacteria (Table 3.1). Each of these causes of impairment is discussed in the following sections.

Table 3.1 Causes of Impairment and Sources of Water Pollution

Cause of Impairment	Source of Pollution
Sediment	Construction and mining sites, disturbed land areas, streambank erosion and alterations, cultivated farmland
Nutrients	Fertilizer on agricultural, residential, commercial and recreational lawns, animal wastes, trout farm effluent, leaky sewers and septic tanks, atmospheric deposition, municipal wastewater
Toxic and Synthetic Chemicals	Pesticide applications, disinfectants (chlorine), automobile fluids, accidental spills, illegal dumping, urban stormwater runoff
Oxygen-Consuming Substances	Wastewater effluent, organic matter, leaking sewers and septic tanks, animal waste
Fecal Coliform Bacteria	Failing septic tanks, animal waste, runoff from livestock operations, wildlife, improperly disinfected wastewater effluent
Road Salt	Applications to snow and ice
Oil and Grease	Leaky automobiles, industrial areas, illegal dumping
Thermal Impacts	Heated landscape areas, runoff from impervious areas, tree removal along streams, wet detention ponds

3.2.1 Sedimentation

Sedimentation is the most widespread cause of nonpoint source pollution in the state and results from land-disturbing activities including agriculture, building and highway construction, uncontrolled urban runoff which erodes streambanks, mining and timber harvesting. Unpaved roads and driveways on steep slopes are also significant sources of sediment. While no waters in the Hiwassee River basin have been identified through DWQ sampling efforts as impaired due to sedimentation, several waters in the basin do have sedimentation problems during rainfall events and high flows. Most sediment-related impacts are associated with nonpoint source pollution. Recommendations aimed at addressing sedimentation are listed in Section 6.3 of Chapter 6 and programs are briefly described under nonpoint source pollution controls in Chapter 5.

Effects of Sedimentation

Sedimentation is often divided into two categories: *suspended load* and *bed load*. Suspended load is composed of small particles that remain in suspension in the water. Bed load is composed of larger particles that slide or roll along the stream bottom. Suspension of load types depends on water velocity and stream characteristics. Indirect effects of increased sediment loads may include increased stream temperatures and decreased intergravel dissolved oxygen. Biologists are often primarily concerned with the *concentration* of the suspended sediments and the *degree of sedimentation* on the streambed (Waters 1995).

The concentration of suspended sediments affects the availability of light for photosynthesis, as well as the ability of aquatic animals to see their prey. Several researchers have reported reduced feeding and growth rates by fish in waters with high suspended solids. In some cases it was noted that young fish left those stream segments with turbid conditions. Suspended sediments can clog the gills of fish and reduce their respiratory abilities. These forms of stress may reduce the tolerance level of fish to disease, toxicants and chronic turbid conditions. Suspended solids are reported as Total Suspended Solids or as Turbidity. They are measured in parts per million or milligrams per liter (Waters 1995).

The degree of sedimentation affects both the habitat of aquatic macroinvertebrates and the quality and amount of fish spawning and rearing habitat. Degree of sedimentation can be estimated by observing the amount of streambed covered, the depth of sedimentation, and the percent saturation of interstitial space or embeddedness. Eggs and fry in interstitial spaces may be suffocated by the sediments thereby reducing reproductive success (Waters 1995).

The findings of academic research have noted the potential impact of sedimentation on fisheries, in particular on wild trout populations. This topic is also discussed in Chapter 4 of this plan. Sedimentation is one of the main factors limiting trout production in western North Carolina. Inorganic sediments can affect trout productivity in three ways: direct effects - impairment of respiration, feeding habits, and migration patterns; reduced egg hatching and emergence due to decreased water velocity and dissolved oxygen; and, trophic effects - reduction in prey (macroinvertebrates). As fine suspended solids increase in the waters, the dissolved oxygen, permeability, and apparent velocity decrease (West, date unknown). Erosion and sedimentation resulted in lower hatching and emergence success of trout embryos, reduced trout biomass and growth rates when comparing two streams in western North Carolina (West et. al, 1982).

The impact of sedimentation on fish populations depends on both concentration and degree of sedimentation, but impact severity can also be affected by the duration (or dose) of sedimentation. Suspended sediments may occur at high concentrations for short periods of time, or at low concentrations for extended periods of time. The greatest impacts to fish populations will be seen at high concentrations for extended time periods. The use of a dose-response matrix in

combination with field investigations can help predict the impact of suspended sediments on various life stages of fish populations (Newcombe 1996).

Sedimentation impacts streams in several other ways. The amount of sediment can affect channel shape, pattern, and the relative balance between pools and riffles. Eroded sediments may gradually fill lakes and navigable waters and may increase drinking water treatment costs. Sediment also serves as a carrier for other pollutants including nutrients (especially phosphorus), toxic metals, pesticides, and road salts.

Measuring Sediment Loads

Suspended sediment is a very useful indicator of active erosion in a particular basin. Suspended sediment concentrations are very sensitive to landscape disturbance, and its conceptual simplicity as a measurement tool gives it broad appeal. The primary problem with using suspended sediment as a monitoring tool is its inherent variability. Representative samples are difficult to obtain, and suspended sediment samples vary tremendously over time and space. Most sampling schemes take individual or composite samples at regular time intervals (e.g. daily). Since high flows are relatively rare, a sampling system based on equal time intervals will result in a large number of samples at relatively low flows, when suspended sediment concentrations are low, and very few samples at high flows, which is when most of the suspended sediment transport takes place. This is both inefficient and results in a high level of uncertainty with regard to the total sediment load. For a clear picture of sediment dynamics in a particular watershed, sediment sampling programs should be carefully designed using staged, point integrated, or depth integrated samplers to include measurements at relatively high flows.

Statistics compiled by the US Department of Agriculture, Natural Resource Conservation Service (formerly known as the Soil Conservation Service) indicate a statewide decline in erosion from 1982 to 1992 (USDA, NRCS, 1992) as shown in Table 3.2.

Table 3.2 Overall Erosion Trends in North Carolina

	1982	1987	1992
Area (1,000 acres)	33,708.2	33,708.2	33,708.2
Gross Erosion (1,000 tons/yr)	46,039.5	43,264.6	36,512.9
Erosion Rate (Tons/Yr/Ac)	1.1	1.4	1.3

The most widely used tool to evaluate erosion at the landscape level is the Universal Soil Loss Equation (USLE). The NRCS statistics also indicate a statewide reduction per acre on cropland erosion using the Universal Soil Loss Equation (Table 3.3). However, the USLE produces results which are difficult to interpret for the NC mountains. Although tons/acre/year is a standard unit of measurement for erosion, it does not reflect the high spatial and temporal variability of erosion. Sediment impacts do not in generally originate from a county wide "average" area; the majority of sediment comes from localized high impact areas. It is very easy to average out a sediment impact over a whole watershed or county or state area and thereby give the impression that the problem is less significant than it actually is in the immediate area. It makes much more sense from a management perspective to reduce sediment from 40 tons/acre to 2 tons/acres in a high impact area than to reduce erosion from cropland from 6.5 to 6.3 tons/acre. This points to the need for targeted management efforts coupled with a monitoring strategy which effectively measures sediment transport under both average and extreme conditions.

Table 3.3 USLE Erosion on Cultivated Cropland in North Carolina

	1982	1987	1992
Cropland Area (1,000 acres)	6,318.7	5956.8	5538.0
Gross Erosion (1,000 tons/yr)	40,921.4	37475.3	30,908.3
Erosion Rate (Tons/Yr/Ac)	6.5	6.3	5.6

In the Blue Ridge Mountains region, which encompasses the entire Little Tennessee River basin and several others, the overall erosion picture is not very clear. Table 3.4 shows a significant decline in cultivated cropland acreage and a corresponding decline in gross erosion over the past ten years, but the erosion rate per acre increased from 12.7 tons/acre/year in 1982 to 20.8 tons/acre/year in 1987 and then dropped to 18.3 tons/acre/year in 1992. Non-cultivated cropland erosion rates also increased over the ten year period from 1.4 tons/acre/year in 1982 to 1.7 tons/acre/year although pasture land rates dropped from 2.6 to 2.2 tons/acre/year over the same period.

According to the Raleigh NRCS office, several factors may explain the large erosion rate increase from 1982 to 1987. The mountains were the last region of the state to be accurately soil-mapped, and so more recent data may reflect an improved knowledge of soil loss. Secondly, there have been some revisions in soil loss coefficients for individual soil types. And third, Christmas tree farms have been included in the cropland acreage figures. Many farms are located on extremely steep lands and the large increase in the Christmas tree industry could play an important role in these numbers.

Table 3.4 North Carolina Erosion in Blue Ridge Mountain Region

	1982	1987	1992
Cropland Area (1,000 acres)	122.9	97.9	76.2
Gross Erosion (1,000 tons/yr)	1555.6	2035.2	1397.5
Erosion Rate (Tons/Yr/Ac)	12.7	20.8	18.3

Compared to other regions of the state, the overall erosion rate per acre for cultivated cropland in the mountains is very high although it is noted that the rate has dropped since 1987 (Table 3.5).

Much of this data relates to cropland and the need to continue to improve cropland erosion controls in the mountains. It also carries a broader message of the high erosion potential in the mountains, not only from agricultural activities, but for all land-disturbing activities on the steep slopes which are so prevalent in this region. Of particular concern are potential sediment losses from logging operations that do not follow forestry best management practices, streambank erosion, second home development and highway construction.

Table 3.5 North Carolina Erosion on Major Land Resource Areas (MLRA)

	1982	1987	1992
Blue Ridge Mountains	12.7	20.8	18.3
Southern Piedmont	12.3	12.0	10.5
Carolina and Georgia Sand Hills	6.0	5.6	5.1
Southern Coastal Plain	3.9	3.9	4.0
Atlantic Coast Flatwoods	3.2	3.1	3.2
Tidewater Area	1.4	1.5	1.6

Sediment and Streamflow

Peak flows have important effects on stream channel morphology and bed material particle size. Specifically, since higher flows move larger particles, peak flows determine the stable particle size in the bed material. Large stable particles provide important habitat niches for invertebrates and small fish. The size of peak flows is also important in determining the stability of large woody debris and the rate of bank erosion. Increased bank erosion and channel migration will affect the riparian vegetation and alter the amount of active sediment in the stream channel. Periods of high flow are periods of bank modification and deposition on active floodplains, especially in areas with dense riparian vegetation.

The vast majority of the sediment transport occurs during peak flows, as sediment transport capacity increases exponentially with discharge. The ability of a stream to transport the incoming sediment will help determine whether there is deposition or erosion within the active stream channel. The relationship between sediment load and sediment transport capacity will affect the distribution of habitat types, channel morphology, and bed material particle size. Increased size of peak flows due to urbanization have been shown to cause rapid channel incision and severe decline in fish habitat quality.

In developing areas, the erosive forces brought by increased flood flows must be addressed at the source—increased runoff—for instream fixes to be successful. Recent studies underscore the importance of overall watershed imperviousness in determining stream water and habitat quality. Increased impervious cover in a watershed has many direct impacts on streams in the watershed. Streams broaden or deepen to accommodate larger flushes of water, specialized habitats such as pool and riffle structures and overhanging vegetation are lost, instream water quality declines, stream temperatures rise and stream biodiversity, from aquatic insects to anadromous fish declines. Each of these impacts has been shown to increase with higher levels of watershed imperviousness.

A change in the size of peak flows can also have important consequences for human life and property. Structures such as bridges, dams, and levees are designed according to a presumed distribution of peak flows. If the size of the peak flows is increased, this could reduce the factor of safety and lead to more frequent and severe damage.

Sediment and Streambank Erosion

Streambank erosion, which can contribute sediment loads to a stream, has many potential causes, such as clearing of instream obstacles or streamside vegetation, livestock trampling of stream banks, or higher than normal floods resulting from increased impervious cover. In alluvial channels, the stream and river banks tend towards a dynamic equilibrium with the discharge and sediment load. The bank material, vegetation type, and vegetation density also affect the stability and form of the streambanks. Change in any one of these factors is likely to be reflected in the size and shape of the stream channel, including the banks.

Streambank stability is a term which refers to the propensity of the stream bank to change in form or location over time. Streambank stability can be an important indicator of watershed condition and can directly affect several designated uses of streams. A higher incidence of bank instability can be initiated by natural events that disrupt the quasi-equilibrium of the stream, or by human disturbance. Unstable banks contribute sediment to the stream channel by slumps and surface erosion. Because all the material from an eroding streambank is delivered directly to the stream channel, the adverse impact of bank instability can be much greater than the adverse effects of a comparable area of eroding hillslope.

Even in undisturbed streams some streambank instability usually occurs. In valleys with a defined floodplain there is often lateral migration through bank erosion and point bar accretion. In V-

shaped valleys there is less opportunity for lateral migration and bank instability may steam from the input and eventual removal of obstructions emanating from fallen trees, landslides, or debris flows.

Although in some cases the erosion of one bank will be matched by deposition on the opposite bank, streambank erosion caused by human activities generally will increase stream width. The corresponding increase in stream surface area allows more direct solar radiation to reach the stream surface, and this will raise maximum summer water temperatures. In most cases an eroding streambank will provide little or no cover for fish.

Actively eroding streambanks also support little or no riparian vegetation, and the loss of this vegetation adversely affects a wide range of wildlife species, reduces available forage for domestic livestock, and reduces the long-term input of organic matter into the aquatic ecosystem. Both the increase in summer water temperatures and the loss of fish cover along an eroding stream bank will be exacerbated by the reduction in riparian cover.

Historic practices of disturbing the stream channel and removing large woody debris have been shown to increase the amount of fine sediment in the steam channel. Removal of, or a reduction in, the riparian vegetation is another mechanism by which management activities can increase the amount of fine sediments. Grazing often exacerbates the effect of reducing the vegetative cover by simultaneously trampling the vegetation, compacting the soil, and trampling the streambanks. The use of structural techniques such as: bank sloping, use of tree roots for stabilization, buffer strips, and fencing cattle out of streams can greatly reduce streambank erosion. Average annual soil loss has been shown to be decreased by 40% after cattle were fenced away from streams. This decrease resulted in nearly a 60% reduction in average sediment concentration during stormflow events (Owens, et al 1996). Stormwater management measures for urban development areas can also lessen the potential for streambank erosion.

Stream Modification

Natural streams around the world have certain physical characteristics in common, regardless of location and geologic conditions. One of the most important of these characteristics is known as bankfull stage. The bankfull stage corresponds to the flow at which channel maintenance is most effective, that is, the discharge that results in the average size and shape of channels.

Almost all natural streams have a bankfull discharge with a recurrence interval of 1-1.5 years. In other words, natural stream channels do not form with the capacity to carry a 50 year, 25 year, or even 2 year storm without overflow. Natural channels on average can carry the flow from an annual storm without overflow. In streams that have not been channelized or manipulated by human activities, streamflows larger than a typical annual event are generally carried in both the channel and a floodplain.

Humans have modified many natural streams by increasing the capacity of the stream channel to carry high flows, sometimes to carry even the flow from a 50 or 100 year storm. Such modifications are conceived in the name of flood control and are often used to justify development of floodplains for human occupance and other activities which constrict or encroach upon the floodplain.

Most engineering channel designs give a great deal of attention to conveyance of floodwaters. Very few channel designs include close attention to sediment conveyance. Given that the equilibrium channel size tends toward a bankfull discharge with a 1-1.5 year recurrence interval, larger stream channels will naturally initiate disequilibrium erosional processes. For example, a channel that has been straightened and enlarged to carry a 50 year storm, will begin building a smaller channel, point bars, floodplains, meanders, etc. as a result of the natural physical behavior

of sediment and the frequency distribution of streamflows. As a result, we have created streams which are unstable; they lose their equilibrium shape and slope and erode, degrade, and aggrade rapidly. Such unstable channel conditions can ultimately lead to degraded water quality as result of excessive sediment loads.

Sedimentation and Erosion in the Hiwassee River Basin
Sedimentation is a problem parameter on Shooting Creek and Little Fires Creek, although both of these creeks are currently fully supporting their uses. Shooting Creek was first sampled in 1994 and it was noted during sampling that the stream bottom showed signs of sedimentation from nonpoint sources. Sampling in Little Fires Creek, Junaluska Creek and South Shoal Creek have also noted sedimentation and bank erosion.

3.2.2 Fecal Coliform Bacteria

Fecal coliform bacteria are bacteria typically associated with the intestinal tract of warm-blooded animals. These bacteria are widely used as an indicator of the potential presence of pathogenic, or disease-causing, bacteria and viruses. Common sources of fecal coliform bacteria include leaking or failing septic systems, leaking sewer lines or pump station overflows, runoff from livestock operations and wildlife, and improperly disinfected wastewater effluent.

Fecal coliform bacteria are widely used as indicators of the potential presence of waterborne pathogenic organisms (which cause such diseases as typhoid fever, dysentery, and cholera). Fecal coliform bacteria in treatment plant effluent are controlled through disinfection methods including chlorination (sometimes followed by dechlorination), ozonation or ultraviolet light radiation.

Fecal Coliform Bacteria in the Hiwassee River Basin
Elevated levels of fecal coliform bacteria have caused use-impairment in Brasstown Creek (Partially Supporting) due to effluent from the Young Harris Water Pollution Control Plant in Georgia. Fecal coliform bacteria has not caused use-support impairment in the Hiwassee River basin at either ambient monitoring station, however elevated levels of fecal coliform in the Hiwassee River above Murphy and the Valley River at Tomotla have been noted.

Due to the low number of farm animal operations and limited development in the basin, the chances of bacterial contamination in streams is low. However, failing septic systems, straight piping and animal operations without appropriate best management practices in place can cause elevated bacterial levels in any of the many unmonitored streams.

3.2.3 Toxic Substances

Regulation 15A NCAC 2B. 0202(36) defines a toxicant as "any substance or combination of substances ... which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, has the potential to cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions or suppression in reproduction or growth) or physical deformities in such organisms or their offspring or other adverse health effects". Toxic substances frequently encountered in water quality management include chlorine, ammonia, organics (hydrocarbons and pesticides) heavy metals and pH. These materials are toxic to different organisms in varying amounts, and the effects may be evident immediately or may only be manifested after long-term exposure or accumulation in living tissue.

North Carolina has adopted standards and *action levels* for several toxic substances. These are contained in 15A NCAC 2B .0200. Usually, limits are not assigned for parameters which have action levels unless 1) monitoring indicates that the parameter may be causing toxicity or, 2) federal guidelines exist for a given discharger for an action level substance. This process of

determining action levels exists because these toxic substances are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility, stream characteristics and/or associated waste characteristics. Water quality based limits may also be assigned to a given NPDES permit if data indicate that a substance is present for which there is a federal criterion but no water quality standard.

Whole effluent toxicity (WET) testing is required on a quarterly basis for major NPDES dischargers (≥ 1 MGD) and any discharger containing complex (industrial) wastewater. This test shows whether the effluent from a treatment plant is toxic, but it does not identify the specific cause of toxicity. If the effluent is found to be toxic, further testing is done to determine the specific cause. This follow-up testing is called a toxicity reduction evaluation (TRE). WET testing is discussed in Sections 4.2.4 and 5.2.5 of Chapters 4 and 5 respectively. Other testing, or monitoring, done to detect aquatic toxicity problems include fish tissue analyses, chemical water quality sampling and assessment of fish community and bottom-dwelling organisms such as aquatic insect larvae. These monitoring programs are discussed in Chapter 4.

Each of the substances below can be toxic in sufficient quantity or concentration.

pH

Changes in pH to surface waters is primarily through point source discharges. However, changes can also occur with the introduction of substances in the form of spills to a waterbody and through acid deposition. Refer to Section 4.2.8 in Chapter 4 for more information on acid deposition and how it may affect the waters of the Hiwassee River basin. As the pH of a water decreases, metals are more bioavailable within the water column and are therefore more toxic to the aquatic organisms. As the pH increases, metals are precipitated out of the water column and less toxic to aquatic organisms. If a surface water has had chronic introductions of metals and the pH gradually or dramatically decreases, the metals in the substrate will become more soluble and be readily available in the water column. While lower pH values may not be toxic to the aquatic organisms, the lower values can have chronic effects on the community structure of macroinvertebrates, fish, and phytoplankton. Macroinvertebrates will show a shift from tolerant species to intolerant species and have less community diversity.

The NC standard for pH in surface waters is 6.0 to 9.0. Trout will not survive in waters with pH values below 5.5.

Metals

Municipal and industrial dischargers and urban runoff are the main sources of metals contamination in surface water. North Carolina has stream standards for many heavy metals, but the most common ones in municipal permits are cadmium, chromium, copper, nickel, lead, mercury, silver and zinc. Standards are listed in Appendix I. Each of these, with the exception of silver, is also monitored through the ambient network along with aluminum and arsenic. Point source discharges of metals are controlled through the NPDES permit process. Mass balance models are employed to determine allowable concentrations for a permit limit. Municipalities with significant industrial users discharging wastes to their treatment facilities limit the heavy metals from these industries through a *pretreatment program.* Source reduction and wastewater recycling at WWTPs also reduces the amount of metals being discharged to a stream. Nonpoint sources of pollution are controlled through best management practices.

Chlorine

Chlorine is a commonly used disinfectant at NPDES discharge facilities which have a domestic (i.e., human) waste component. These discharges are a major source of chlorine in the State's surface waters. Chlorine dissipates fairly rapidly once it enters the water, but its toxic effects can have a significant impact on sensitive aquatic life such as trout and mussels. At this time, no standard exists for chlorine in waters supplementally classified as trout waters and an action level

has been established for all other waters. A standard for all waters may be adopted in the future. In the meantime, all new and expanding dischargers are required to dechlorinate their effluent if chlorine is used for disinfection. If a chlorine standard is developed for North Carolina, chlorine limits may be assigned to all dischargers in the State that use chlorine for disinfection.

Ammonia (NH_3)

Point source dischargers are one of the major sources of ammonia. In addition, decaying organisms which may come from nonpoint source runoff and bacterial decomposition of animal waste also contribute to the level of ammonia in a waterbody. At this time, there is no numeric standard for ammonia in North Carolina. However, DWQ has developed an interim set of instream criteria of 1.0 mg/l in the summer (April - October) and 1.8 mg/l in the winter (November - March). These interim criteria are under review, and the State may adopt a standard in the near future.

Toxic substances in the Hiwassee River Basin

The Valley River monitoring site between Stewart Road and a site about 3 miles below Andrews was given a Partially Supporting rating due to toxicity and is therefore use-impaired. It was determined that the sampling site above the Andrews WWTP showed the most severe water quality problems, although there are no permitted dischargers in this area. Further investigations may determine the source of toxicity.

3.2.4 Oxygen-Consuming Wastes

Oxygen-consuming wastes include decomposing organic matter or chemicals which reduce dissolved oxygen in the water column through chemical reactions or biological activity. Raw domestic wastewater contains high concentrations of oxygen-consuming wastes that need to be removed from the wastewater before it can be discharged into a waterway. Maintaining a sufficient level of dissolved oxygen in the water is critical to most forms of aquatic life.

The concentration of dissolved oxygen (DO) in a water body is one indicator of the general health of an aquatic ecosystem. Dissolved oxygen concentrations are affected by a number of factors. Higher dissolved oxygen is produced by turbulent actions, such as waves, rapids and water falls, which mix air and water. Lower water temperatures also generally allows for retention of higher dissolved oxygen concentrations. Therefore, the cool swift-flowing streams of the mountains are generally high in dissolved oxygen. Low dissolved oxygen levels tend to occur more often in warm, slow-moving waters that receive a high input of effluent from wastewater treatment plants during low flow conditions. In general, the lowest dissolved oxygen concentrations occur during the warmest summer months and particularly during low flow periods. Water depth is also a factor. In deep slow-moving waters, such as reservoirs or estuaries, dissolved oxygen concentrations may be very high near the surface due to wind action and plant (algae) photosynthesis but may be entirely depleted (anoxic) at the bottom.

Sources of dissolved oxygen depletion include wastewater treatment plant effluent, the decomposition of organic matter (such as leaves, dead plants and animals) and organic waste matter that is washed or discharged into the water. Sewage from human and household wastes is high in organic waste matter, as is waste from trout farms. Bacterial decomposition can rapidly deplete dissolved oxygen levels unless these wastes are adequately treated at a wastewater treatment plant. In addition, some chemicals may react with and bind up dissolved oxygen. Industrial discharges with oxygen consuming wasteflow may be resilient instream and continue to use oxygen for a long distance downstream.

Oxygen-Consuming Waste in the Hiwassee River Basin

There are no waters known to be impaired by oxygen-consuming wastes in the Hiwassee River basin.

3.2.5 Nutrients

The term *nutrients* in this document refers to two major plant nutrients, phosphorus and nitrogen. These are common components of fertilizers, animal and human wastes, vegetation, trout farms and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources. Nutrients are beneficial to aquatic life in small amounts. However, in overabundance and under favorable conditions, they can stimulate the occurrence of algal blooms and excessive plant growth in quiet waters such as ponds, lakes, reservoirs and estuaries.

Nutrients in the Hiwassee River Basin

Nutrients have not been identified as a significant source of water quality impairment in the Hiwassee River Basin.

3.3 POINT SOURCES OF POLLUTION

3.3.1 Defining Point Sources

Point sources refers to discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge. The term applies to wastewater and stormwater discharges from a variety of sources. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems that may serve schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for medium and large municipalities which serve populations greater than 100,000 and stormwater discharges associated with industrial activity as defined in the Code of Federal Regulations [40 CFR 122.26(a)(14)]. The primary pollutants associated with point source discharges are oxygen-demanding wastes, nutrients, sediment, color and toxic substances including chlorine, ammonia and metals. Definitions and examples of the various categories can be found in Table 3.6.

Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state. Discharge permits are issued under the NPDES program which is delegated to North Carolina by the EPA. See Chapter 5 for a description of the NPDES program and permitting strategies.

3.3.2 Wastewater Point Source Discharges in the Hiwassee River Basin

There are 16 permitted NPDES wastewater dischargers in the Hiwassee River basin. There are twelve dischargers covered under individual permits and four dischargers covered under general permits. Table 3.7 lists the wastewater dischargers in the Hiwassee River basin along with a summary of general information. The locations of these permitted facilities are shown in Figure 3.1 and 3.2. Permit renewals are conducted at five year intervals. Permits for the Hiwassee River basin are scheduled to be renewed in December 1997.

Total permitted flow for all facilities is 2.94 million gallons per day (MGD). The average actual flow from all facilities is 1.70 MGD. Table 3.8 provides the total and average discharge for each category of permitted facility.

There is one permitted NPDES wastewater discharge from a trout farm in the Hiwassee River basin. Craig's Trout Farm is located on Owl Creek in Cherokee County and is covered under a

Table 3.6 Definitions of Categories of NPDES Permits

CATEGORY	DEFINITION	EXAMPLES
Major vs. Minor discharges (NCOO Facilities)	For publicly owned treatment works, any facility discharging over 1 MGD is defined as a Major discharge. For industrial facilities, the EPA provides evaluation criteria including daily discharge, toxic pollutant potential, public health impact and water quality factors. Any facilities which do not meet the criteria for Major status are defined as Minor discharges.	There are no major dischargers in the Hiwassee River basin.
General Permits (NCG Permit Facilities)	Permits for dishcargers in categories which all have similar discharges, operations and monitoring, and limits. Generally minor effluent on receiving stream individually.	Trout farms and most stormwater permits.
100% Domestic	A system which treats wastewater containing household-type wastes (bathrooms, sinks, washers, etc.).	Housing subdivision WWTPs, schools, Mobile Home Parks,
Municipal	A system which serves a municipality of any size.	NC0020800 - Town of Andrews WWTP
Process Industrial	Water used in an industrial process which must be treated prior to discharge.	There are no Process Industrial facilities in the Hiwassee River basin.
Nonprocess Industrial	Wastewater which requires no treatment prior to discharging[1].	NCG500006 - Coats American (Non-contact cooling water and cooling tower blowdown)
Stormwater Facilities	Discharges of runoff from rainfall or snow melt. NPDES permits are required for "stormwater discharges associated with industrial activity" and from municipal stormwater systems for towns over 100,000 in population.	"Stormwater discharges associated with industrial activity" include most types of manufacturing plants. Landfills, mines, junkyards, steam electric plants, transportation terminals and any construction activity which disturbs 5 acres or more during construction.

1: Non-contact cooling water may contain biocides; however, the biocides must be approved by our Aquatic Survey and Toxicology Unit. The approval process verifies that the chemicals involved have no detrimental effect on the stream when discharged with the non-contact cooling water.

general permit. At present there are no sampling sites on Owl Creek to determine the effect of the trout farm on water quality. No water quality problems resulting from the farm have been reported. Trout farms can be a source of nutrients to surface waters if the farms are not managed properly. The impacts from trout farms are typically found within a short stream length from the farm. In this way, impacts from trout production are localized and can result in lower macroinvertebrate ratings. Changes caused by trout farms can be in the form of algal production and higher than normal nutrients. The effects from trout farms are more often seen during low flows and high water temperatures. Trout farms can also cause water quality problems if there is more than one farm on a stream reach. See Appendix IV for the requirements of a general permit.

The Town of Andrews operates a 1.5 million gallon per day (MGD) wastewater treatment plant. This plant consistently meets its permit limits, but regularly experiences equipment problems.

Table 3.7 Summary of NPDES Wastewater Permits in the Hiwassee River Basin

Map #	Permit #	Facility	Receiving Stream	County
Subbasin 04-05-01				
1	NC0026697	Hayesville WWTP	Town Creek	Clay
3	NC0021148	USDAFS/Jack Rabbit Mtn Recreation Area	Chatuge Lake	Clay
4	NC0027332	TVA/Chatuge Hydro Plant	Hiwassee River	Clay
5	NCG550427	J. Davenport Residence	Tusquitee Creek	Clay
-	NCG500128	Nantahala P&L/Mission Hydro Plant	Hiwassee River	Clay
Subbasin 04-05-02				
1	NC0079031	Industrial Opportunities, Inc.	Hyatt Creek	Cherokee
2	NC0020800	Town of Andrews WWTP	Valley River	Cherokee
3	NC0023001	CWS/Bear Paw WWTP	Hiwassee River	Cherokee
3	NC0027359	TVA/Hiwassee Hydro Plant	Hiwassee River	Cherokee
4	NC0080683	Litton Systems/Clifton Precision	Slow Creek	Cherokee
5	NC0020940	Murphy WWTP	Hiwassee River	Cherokee
7	NC0063088	Riverside Bar-B-Que	Nottely River	Cherokee
10	NC0035386	Hiwassee Dam School	Thompson Branch	Cherokee
12	NCG530068	Craig's Trout Farm	Owl Creek	Cherokee
-	NC0069892	Town of Andrews WTP	Dan Holland Creek	Cherokee
-	NCG50006	Coats American	Hyatt Creek	Cherokee

These problems have been linked to significant inflow and infiltration resulting from an antiquated collection system. The collection system is primarily constructed from clay pipe which is subject to failure resulting in excessive inflow and infiltration. A sewer line study is currently under way to identify problem lines and target priority areas for renovation.

The Clay County Water and Sewer District (CCWSD) presently owns and operates a 0.097 MGD wastewater treatment plant (WWTP) for Hayesville. The WWTP discharges to Town Creek which is classified as WS-IV waters. This facility has been in continuous violation of permit limits for BOD and TSS in the past year due to increases in wastewater flows and inadequately designed treatment units.

The CCWSD is proposing to construct a new 300,000 gallons per day (GPD) WWTP on property owned by Clay County located off of Jarrett Road just outside of the Hayesville Town Limits. The proposed discharge for the new WWTP is directly into the Hiwassee River approximately 1000 linear feet upstream of the Tusquitee Road Bridge. Construction of a new facility will remedy the permit violation problems while allowing additional growth in the area. Relocation of the treatment plant discharge to the Hiwassee River will allow for greater assimilation of wastewater, relieving much of the stress that has been placed on the much smaller Town Creek.

The existing Hayesville WWTP serves 379 customers, located both inside and outside of the town limits. Based on the historical demographics and wastewater flow data, the 300,000 GPD WWTP is projected to handle maximum daily flow beyond the year 2015.

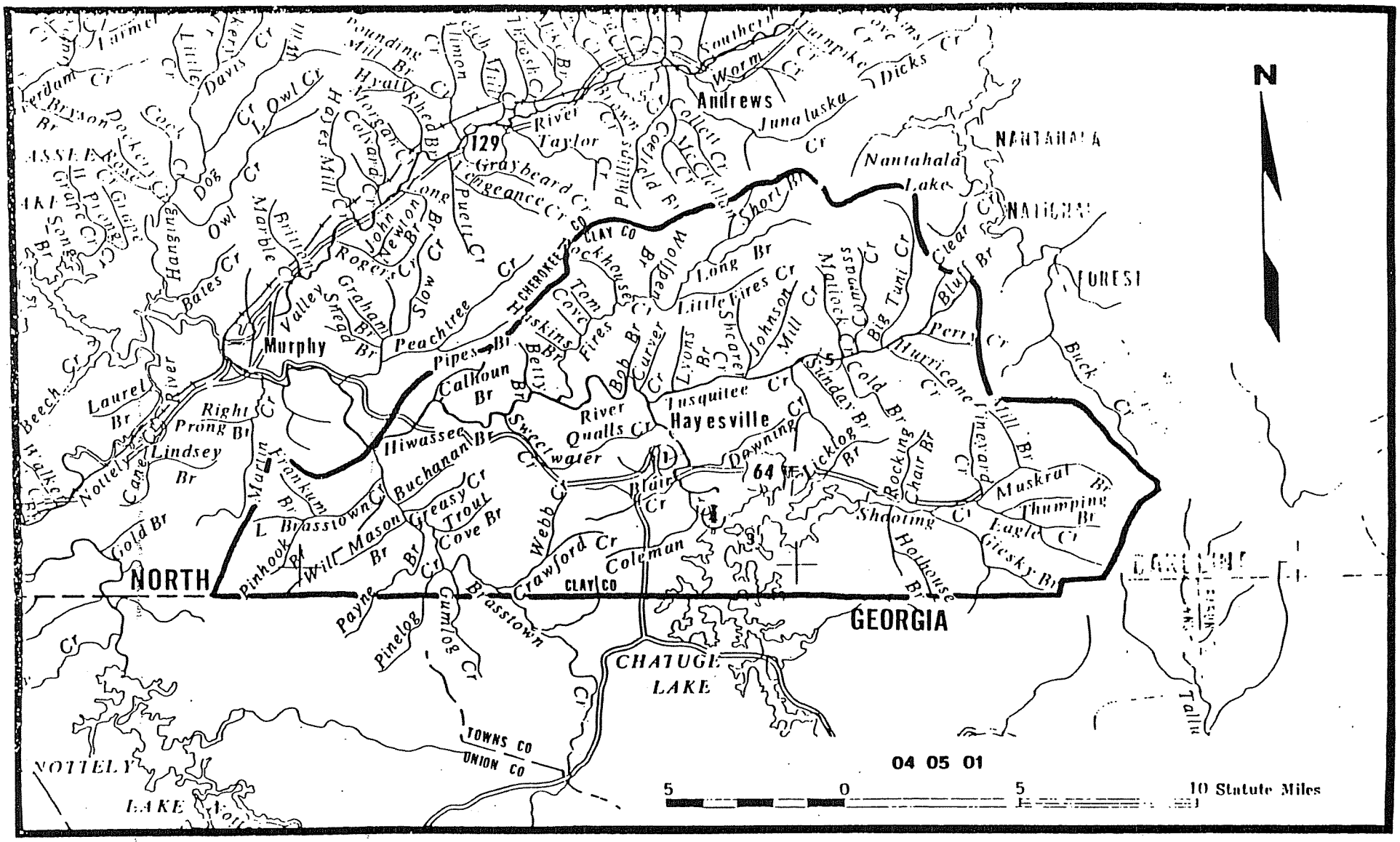


Figure 3.1 Map of NPDES Dischargers in the Chatuge Lake and Hiwassee River (Subbasin 04-05-01)

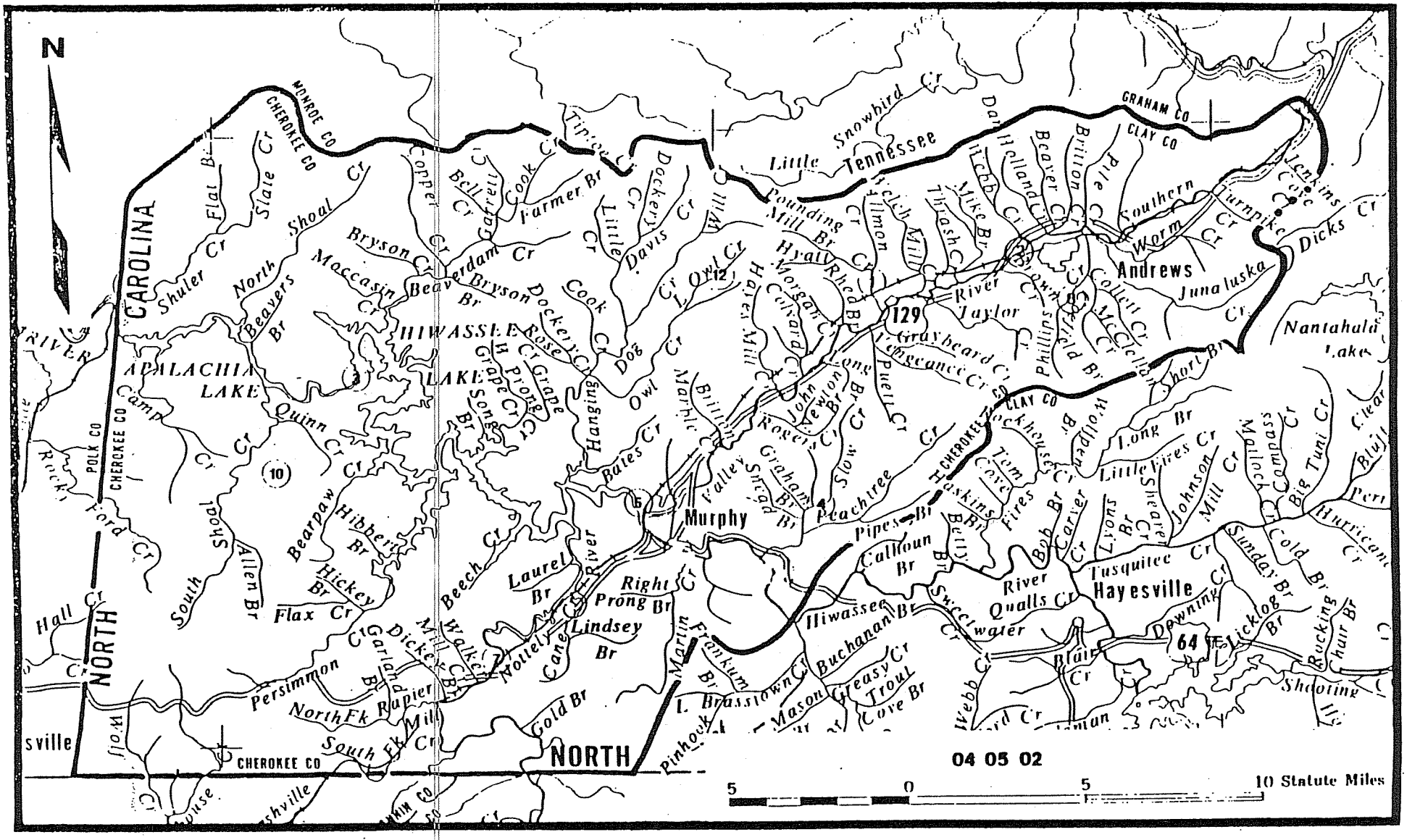

N
CAROLINA
NORTH
NORTH
MONROE CO
CHEROKEE CO
POLK CO
CHEROKEE CO
CLAY CO
GRAHAM CO
CLAY CO
CHEROKEE CO
Little Tennessee
Snowbird Cr
Tuni Cr
Cooper Cr
Bell Cr
Gabrell Cr
Cook Cr
Farmer Br
Dockery Cr
Davis Cr
Will Cr
Pounding Mill Br
Hyatt Mill Cr
Morgan Cr
Conard Cr
Long Br
Puett Cr
Hanging Dog Cr
Owl Cr
L Owl Cr
Cook Cr
Dockery Cr
Rose Cr
Grape Cr
Prone Cr
Song Br
Bryson Cr
Beaverdam Cr
Bryson Br
Maccasin Cr
Beavers Br
North Shoal Cr
Shuler Cr
Slate Cr
Flat Br
Camp Cr
Quinn Cr
Rocky Ford Cr
Apalachia Lake
Hiwassee Lake
Hiwassee River
Murphy
Bates Cr
Marble Cr
Valley Br
Graham Br
Spread Br
Billings Br
Roger Cr
John Lewton Br
Slow Cr
Peachtree Cr
Pipes Br
Calhoun Br
Beech Cr
Laurel Br
Right Prong Br
Hiwassee
Buchanan Br
Frankum Br
Martin Br
Lindsey Br
Cane Cr
Nottely
Walker Br
Dickey Br
Garland Br
Mill Cr
Flax Cr
Hickey Br
Hibbert Br
Bearpaw Br
Allen Br
South Shoal Cr
Hall Cr
Persimmon Cr
North Fk Rupier Cr
South Fk Cr
Gold Br
L Brasstown Cr
Mason Br
Greasy Cr
Troul Cove Br
Pinhook Cr
Webb Cr
Blair Cr
Swetwater Cr
Qualls Cr
Tusquitee Cr
Hayesville
River
Andrews
Junaluska
Nantahala Lake
Taylor River
Graybeard Cr
Tuscarora Cr
Phillips Br
Brown Br
Collett Cr
McClellan Br
Short Br
Long Br
Little Fires Cr
Johnson Mill Cr
Mallock Cr
Camp Br
Big Tuni Cr
Clear Br
Perry Br
Hurricane Cr
Sunday Br
Cold Br
Rocking Chair Br
Shooting Cr
Licklog Br
Downing Cr
Lyons Br
Sheares Cr
Bob Br
Carver Br
Tom Fires Cove
Skeenah Cr
Haskins Cr
Wolfpen Br
Southern Worm Cr
Turnpike Cr
Jenkins Cr
Dicks Cr
Pile Cr
Beaver Cr
Holland Cr
Hubb Cr
Mike Br
Thrash Cr
Fillmon Mill Cr

Table 3.8 Summary of Major/Minor NPDES Dischargers and Permitted and Actual Flows by Subbasin for the Hiwassee River Basin

FACILITY CATEGORIES	SUBBASIN		
	0 1	0 2	TOTALS
NC00 Individual Facilities	3	9	12
Stormwater Facilities	3	13	16
NCG General Permit Facilities	2	2	4
Total Facilities	8	24	32
Total Permitted Flow (MGD)	0.11	2.83	2.94
# of Facilities Reporting	2	7	9
Total Avg. Flow (MGD)	0.09	1.61	1.70
***Major Discharges**	0	1	1
Total Permitted Flow (MGD)	0	1.5	1.5
# of Facilities Reporting	0	1	1
Total Avg. Flow (MGD)	0.00	0.72	0.72
***Minor Discharges**	3	8	11
Total Permitted Flow (MGD)	0.11	1.33	1.44
# of Facilities Reporting	2	7	9
Total Avg. Flow (MGD)	0.09	0.89	0.98
100% Domestic Wastewater	1	4	5
Total Permitted Flow (MGD)	0.01	0.11	0.12
# of Facilities Reporting	1	4	5
Total Avg. Flow (MGD)	0.00	0.01	0.01
Municipal Facilities	1	1	2
Total Permitted Flow (MGD)	0.48	1.50	1.98
# of Facilities Reporting	1	1	2
Total Avg. Flow (MGD)	0.24	0.72	0.96
Major Process Industrial	0	0	0
Total Permitted Flow (MGD)	0	0	0
# of Facilities Reporting	0	0	0
Total Avg. Flow (MGD)	0.00	0.00	0.00
Minor Process Industrial	0	0	0
Total Permitted Flow (MGD)	0.00	0.00	0.00
# of Facilities Reporting	0	0	0
Total Avg. Flow (MGD)	0.00	0.00	0.00
Nonprocess Industrial	0	2	2
Total Permitted Flow (MGD)	0.00	0.30	0.30
# of Facilities Reporting	0	2	2
Total Avg. Flow (MGD)	0.00	0.01	0.01
* NC00 Individual permit facilities			

The Murphy WWTP is currently operating near its permitted capacity of 0.925 MGD. This facility is under moratorium for the addition of new sewer lines and an evaluation of the existing infrastructure is underway. The results of this evaluation will determine if the facility will have to expand or can reduce flow through the facility by renovating the existing infrastructure to address inflow and infiltration .

3.3.3 Stormwater Point Source Discharges in the Hiwassee River Basin

In the Hiwassee River basin, stormwater permitted industrial activities include the manufacture of ready mixed concrete, asphalt, metal products and equipment, textiles, timber products, furniture, stone, clay, and glass products, and mining activities. A complete list of permitted stormwater dischargers in the Hiwassee River basin is provided in Table 3.9. Figure 3.3 shows the locations of all permitted stormwater discharges.

The primary source of concern from these facilities is the contamination of stormwater from contact with exposed materials. In addition, poor housekeeping can lead to significant contributions of sediment and other pollutants to receiving streams. Water quality problems caused by excessive sediment loading have been reported in association with a ready mixed concrete facility on Whitaker Lane near Andrews. However, under new management this facility has installed best management practices to reduce the discharge of sediment from the site. The sediment basin installed has proven to be effective at resolving the water quality concerns identified. No other water quality concerns have been raised with regard to NPDES stormwater permitted dischargers.

3.4 NONPOINT SOURCES OF POLLUTION

Nonpoint source (NPS) pollution refers to runoff that enters surface waters through stormwater, snowmelt or atmospheric deposition (e.g., acid rain). There are many types of land use activities that can serve as sources of nonpoint source pollution including land development, construction, mining operations, crop production, animal feeding lots, failing septic systems, landfills, roads and parking lots. As noted earlier, stormwater from large urban areas (>100,000 people) and from certain industrial sites is technically considered a point source since NPDES permits are required for piped discharges of stormwater from these areas. However, a discussion of urban runoff will be included in this section.

Sediment and nutrients are major pollution-causing substances associated with nonpoint source pollution. Others include fecal coliform bacteria, heavy metals, oil and grease, and any other substance that may be washed off the ground or removed from the atmosphere and carried into surface waters. Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur at random time intervals depending on rainfall events. Below is a brief description of major areas of nonpoint sources of pollution in the Hiwassee River Basin.

3.4.1 Agriculture

There are a number of activities associated with agriculture that can serve as sources of water pollution. Land clearing and plowing make soils susceptible to erosion, which can then cause stream sedimentation. Pesticides and fertilizers (including chemical fertilizers and animal wastes) disposal sites. Construction of drainage ditches on poorly drained soils enhances the movement of stormwater into surface waters. Concentrated animal feed lot operations or dairy farms without adequate waste management systems or fencing to keep cows away from streams can be a significant source of BOD, fecal coliform bacteria, sediment and nutrients. Untreated discharge from a large operation can be compared to the nutrient load in the discharge from a secondary waste treatment plant serving a small town.

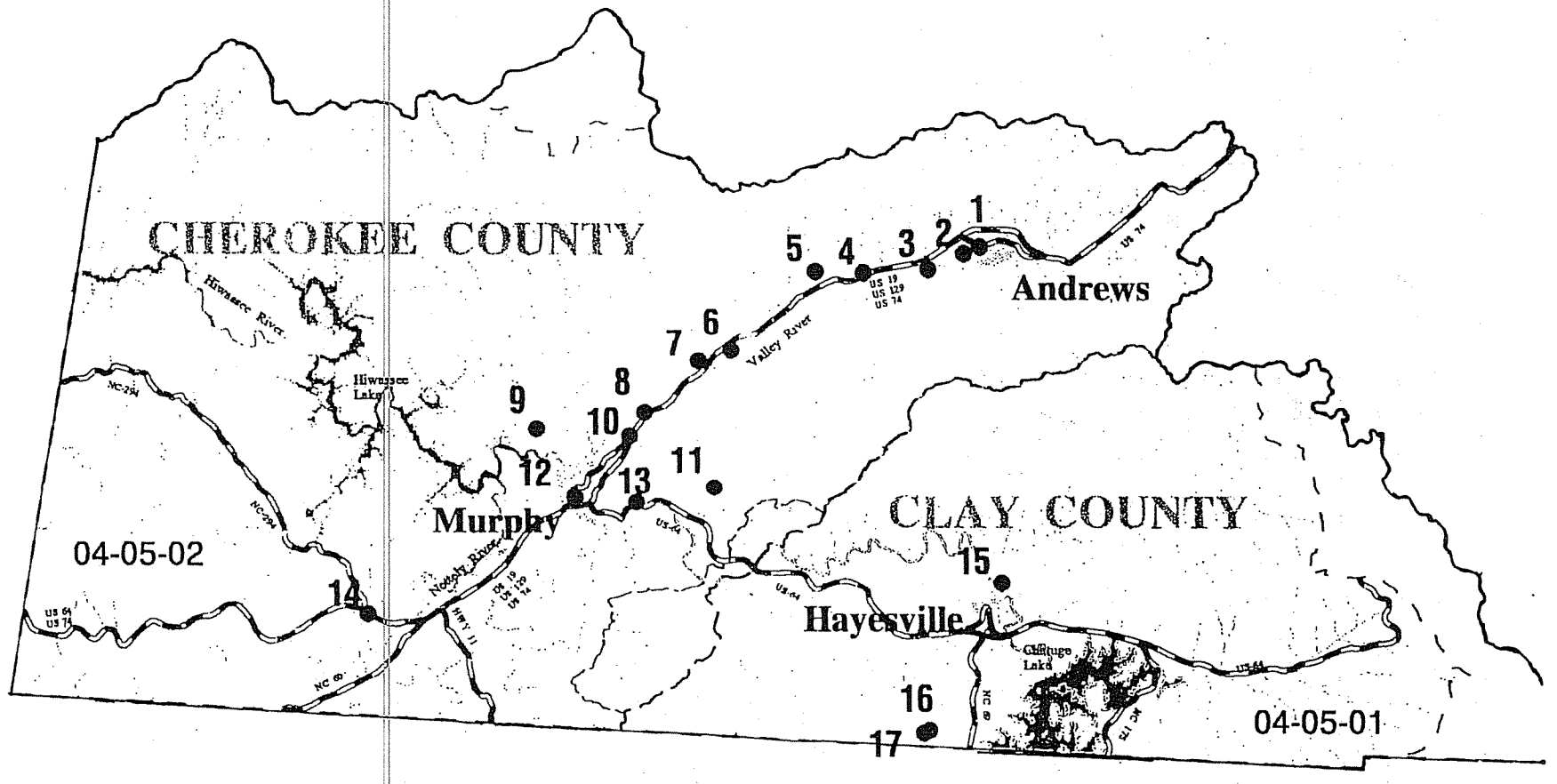
Table 3.9 Summary of NPDES Stormwater Permits in the Hiwassee River Basin

Permit #	Facility	Receiving Stream	County
NCG020244	Harrison Construction Co. Hayesville Quarry	Beech Branch	Clay
NCG030317	Intercomp Wire & Cable	UT Hiwassee River	Clay
NCG160032	APAC Tennessee Inc.	Crooked Creek	Clay
NCG020246	Harrison Construction Co. Hanging Dog Quarry	Hiwassee River	Cherokee
NCG030026	Outboard Marine Corp.	Valley River	Cherokee
NCG030084	Clifton Precision, Div. Of Litton Systems, Inc.	Slow Creek & Hiwassee River	Cherokee
NCG030171	Emerson Electric Co.	Hiwassee River	Cherokee
NCG040125	Cooper Manufacturing Of Murphy, NC, Inc.	Valley River	Cherokee
NCG040129	Valwood Corporation	Welch Mill Creek & Coalville Branch	Cherokee
NCG040294	Bernhardt Furniture Co. Mundy's Lumber	Valley River	Cherokee
NCG070039	Whittaker, Clark & Daniels, Inc., Cherokee Minerals	Marble Creek	Cherokee
NCG140005	Southern Concrete Materials, Inc.	Valley River	Cherokee
NCG140148	Southern Concrete Materials Inc.-Regal St.	Valley River	Cherokee
NCG140154	Southern Concrete Materials Inc.-Whitaker Ln.	Valley River	Cherokee
NCG170268	Coats American-Cherokee	Hyatt Creek	Cherokee
NCG180140	Baker, Knapp & Tubbs	Whittaker Creek	Cherokee

Sediment production and transport is greatest from row crops and cultivated fields (Waters 1995; Lenat et al. 1979). Contour plowing, terracing and grassed waterways are several common methods used by most farmers to minimize soil loss. Maintaining a vegetated buffer between fields and streams is another excellent way to minimize soil loss to streams. Fencing cattle and dairy cows from streams protects streambanks from trampling, protects streamside vegetation and decreases the introduction of nutrients and fecal coliform bacteria from animal waste.

The primary cause of stream impairment associated with agriculture in the mountains is sedimentation. Chapter 5 discusses agricultural nonpoint source control programs. A list of BMPs for addressing agricultural runoff is presented in Appendix V.

Figure 3.3 Map of the Location of NPDES Stormwater Permittees in the Hiwassee River Basin



3.4.2 Urban/Residential

It is commonly known that urban streams are often polluted streams. There are questions concerning what aspects of urbanization cause the degradation, to what extent urbanization alone can be called the source of degradation, and what can be done about the pollutants and human habits that cause the degradation. Some potential impacts of stormwater runoff include:

- Polluted water: Numerous pollutants may be present in urban stormwater, including sediment, nutrients, bacteria, oxygen demanding substances, oil and grease, trace metals, road salt, and toxic/synthetic chemicals. These pollutants can impair aquatic life, reduce recreational value and threaten public health if drinking water sources and fish tissue become contaminated.
- Flooding: Flooding damages public and private property, including infrastructure. It can also threaten public safety.
- Eroded streambanks: Sediment clogs waterways and fills lakes and reservoirs. It can also smother the plants and animals in waterbodies and destroy the habitat necessary for reproduction of fish and aquatic animals. The erosion of streambanks causes loss of valuable property as stream width grows.
- Economic impacts: The economy can be impacted from a loss of recreation-related business and an increase in drinking water treatment costs.

Runoff from urbanized areas, as a rule, is more localized but can often be more severe than agricultural runoff. Any type of land-disturbing activity such as land clearing or excavation can result in soil loss and cause sedimentation into the waters in the watershed. The rate and volume of runoff in urban areas is much greater due both to the high concentration of impervious surface areas and to storm drainage systems that rapidly transport stormwater to nearby surface waters. This increase in volume and rate of runoff can result in streambank erosion and sedimentation in surface waters.

These drainage systems, including curb and guttered roadways, also allow urban pollutants to reach surface waters quickly and with little or no filtering. Pollutants include lawn care products such as pesticides and fertilizers; automobile-related pollutants such as fuel, lubricants, abraded tire and brake linings; lawn and household wastes (often dumped in storm sewers); road salts, and fecal coliform bacteria (from animals and failing septic systems). The diversity of these pollutants makes it very challenging to attribute water quality degradation to any one pollutant.

Replacement of natural vegetation with pavement, removal of streamside buffers and managed lawns reduce the ability of the watershed to filter pollutants before they enter the stream. The chronic introduction of these pollutants and increased flow and velocity into a stream results in degraded waters. Many urban streams are rated as biologically poor.

The population density map presented in Chapter 2 is an indicator of where urban development and potential urban stream impacts are likely to occur. Management strategies for addressing urban runoff are presented in Chapter 6. A list of BMPs for addressing urban runoff is presented in Appendix V.

3.4.3 Construction

Construction activities that entail excavation, grading or filling (such as road construction or land clearing for development) can produce significant sedimentation if not properly controlled. Sedimentation from developing urban areas can be a major source of pollution due to the cumulative number of acres disturbed in a basin. Construction of single family homes in rural areas can also be a source of sedimentation when homes are placed in or near stream corridors. This latter form of development can be seen throughout the Hiwassee River basin.

As a pollution source, construction activities are typically temporary, but the impacts can be severe and long lasting (see discussion in sediment section above). Construction activities tend to be concentrated in the more rapidly developing areas of the basin. However, road construction is widespread and often involves stream crossings in remote or undeveloped areas of the basin. In addition, resort development in relatively undeveloped areas can be devastating to previously unimpacted streams.

Construction-related sedimentation is addressed through the Sedimentation Pollution Control Act (see Section 5.5.3 in Chapter 5). A list of BMPs for controlling erosion and sedimentation is presented in Appendix V.

3.4.4 Timber Harvesting

Forested areas are an ideal land cover for water quality protection. They stabilize the soil, filter rainfall runoff and produce minimal loadings of organic matter to waterways. In addition, forested stream buffers can filter impurities from runoff from adjoining nonforested areas.

Improper forest management practices can adversely impact water quality in a number of ways. This is especially true in mountainous regions where steep slopes and fragile soils are widespread. Without proper BMPs, large clearcutting operations can change the hydrology of an area and significantly increase the rate and flow of stormwater runoff. This results in both downstream flooding and stream bank erosion. Clearcutting, when compared to selective cutting, can cause a much higher rate of erosion (Waters 1995). The hydrology of a watershed can also change due to selective cutting sites if best management practices are not used (Henson, pers. comm.).

Careless harvesting and road and stream crossing construction can transport sedimentation to downstream waters. Streams with sedimentation may require many years to restore. Removing riparian vegetation along stream banks can cause water temperature to rise, destabilize the shoreline and minimize or eliminate the runoff protection benefits of the buffer. Sedimentation due to forestry practices is most often associated with the development and use of logging roads, particularly when roads are built near streams (Waters 1995). Density and length of logging roads can be major factors in the amount of sedimentation produced.

Most forest roads in the basin are under the National Forest Service and are reported to be constructed and maintained very well. Federal forest lands follow the USDA Forest Service Transportation System Management Guidelines (Appendix VII). The NC Division of Forest Resources reports that the US Forest Service complies very well to the NC Forestry Best Management Practices.

Other adverse effects resulting from forestry operations include: 1) an increase in woody debris clogging stream channels which can alter the stream channel and prevent fish movement; 2) loss of riparian vegetation which can reduce shade cover and raise stream temperatures; 3) loss of canopy which can alter the interface of the aquatic and terrestrial ecosystems. This is especially true where populations of amphibians are concerned (Waters 1995).

Timber harvesting is an important industry in the Hiwassee River basin. It is critical that all efforts be made to minimize sediment loss and runoff so as to protect other natural resources in this basin. These resources include trout waters, drinking water supplies and aesthetics. This is especially important in light of a trend toward increased logging in North Carolina and in the southeast United States, in general.

The NC Division of Forest Resources (DFR) presently tracks timber harvesting trends by county rather than by river basin. The DFR is working toward tracking information by river basin in the future. Table 3.7 presents timber harvest trends for private lands in Cherokee and Clay counties.

Actual harvest trends within the basin boundaries are unknown, since only a portion of each county lies within the Hiwassee River basin. Table 3.10 shows that 1987 to 1990 were higher timber harvest years for the region. While total timber harvesting was slightly lower in 1992, both counties show increased harvest rates from 1992 to 1994.

Table 3.10 Timber Harvest Removal Trends (in Thousand Cubic Feet) by County for 1979 to 1994 (Division of Forest Resources).

County	1979	1983	1987	1990	1992	1994
Clay	784	857	1971	1575	695	986
Cherokee	3476	4071	8004	4939	2635	4290
Totals	4260	4928	9975	6514	3330	5276

The DFR is implementing various measures for protecting water quality statewide. These measures include the development of the Forest Practice Guidelines (FPGs) Related to Water Quality of 1976 and Best Management Practices (BMPs) of 1987. The FPGs have mandatory performance standards that must be met in order for landowners to remain exempt from all of the requirements associated with the Sedimentation Pollution Control Act enforced by the Division of Land Resources.

BMP compliance inspections are done by DFR continuously. A recent limited statewide sampling survey (based on 450 site inspections statewide) showed overall compliance rate with forestry BMPs and Forest Practice Guidelines (FPGs) was 92% (Henson 1995; 1996). A summary of activities and past accomplishments in the Hiwassee River basin is reported in Chapter 5.

Section 5.3.6 describes several programs that are aimed at either encouraging or requiring utilization of forest best management practices at the state and federal level. A list of forest BMPs is presented in Appendix V.

3.4.5 Mining

Mining operations can produce high sedimentation in localized streams if not properly conducted. The North Carolina Mining Act of 1971 covers all persons or firms that are involved in any activity or process that disturbs or removes the surface soil in order to remove minerals or other solid matter, or prepares, washes, cleans or in any way treats minerals or other solid materials to make them suitable for commercial, industrial, or construction use. These operations can range from large quarries to small borrow pits. The Mining Act applies only to those operations that affect one acre or more.

The Mining Act requires a permit application form with mine maps and design calculations for erosion and sediment control measures to be submitted to the Division of Land Resources (DLR) for review and approval. The Land Quality Section of DLR is required by law to make routine inspections of all permitted mines and determine if the operator is in compliance with provisions of the mining permit. The Mining Act allows for civil penalties and fines if the Act is violated.

The Mining Act also requires operators to submit a reclamation plan that outlines the method to be used in restoring the land to a condition suitable for its intended future use.

In the Hiwassee River basin there are some gem mining operations. Operators of these mines are not required to file a permit application form if these operations affect less than one acre of soil surface. Most of the gem mines in the Hiwassee River basin are too small to fall within the requirements of the Mining Act.

Information on the North Carolina Mining Act and the state's mining program are listed in Appendix VI. Mining BMPs are listed in Appendix V.

3.4.6 Onsite Wastewater Disposal

Septic systems contain all of the wastewater from a household or business. The septic tank removes some wastes, but the soil drainfield provides further absorption and treatment. Septic tanks can be a safe and effective method for treating wastewater if they are sized, sited, and maintained properly. However, if the tank or drainfield malfunction or are improperly placed, constructed or maintained, nearby wells and surface waters may become contaminated.

Some of the potential problems from malfunctioning septic system include:

- Polluted groundwater: Pollutants in sewage include bacteria, nutrients, toxic substances, and oxygen-consuming wastes. Nearby wells can become contaminated by septic tanks.
- Polluted surface water: Often, groundwater carries the pollutants mentioned above into surface waters, where they can cause serious harm to aquatic ecosystems. Septic tanks can also leak into surface waters both through or over the soil.
- Risks to human health: Septic system malfunctions can endanger human health when they contaminate nearby wells, drinking water supplies, and fishing and swimming areas.

Pollutants associated with onsite wastewater disposal may also be discharged directly to surface waters through *straight pipes* (i.e., direct pipe connections between the septic system and surface waters). These types of discharges, if unable to be eliminated, must be permitted under the NPDES program and be capable of meeting effluent limitations specified to protect the receiving stream water quality, including disinfection. The prevalence of straight piping in some western counties of the state has recently drawn the attention of the Year of the Mountains Commission. Legislation has recently been passed to establish a program to eliminate domestic sewage or wastewater discharges from straight pipes or failing septic systems.

Onsite wastewater disposal is most prevalent in rural portions of the basin and at the fringes of urban areas. Fecal coliform contamination from failing septic systems is of particular concern in waters used for swimming, tubing, water supply and other related activities (Chapter 4). Regulatory programs and BMPs pertaining to onsite wastewater disposal are presented in Appendix V.

3.4.7 Solid Waste Disposal

Solid wastes may include household wastes, commercial or industrial wastes, refuse or demolition waste, infectious wastes or hazardous wastes. Improper disposal of these types of wastes can serve as a source of a wide array of pollutants. The major water quality concern associated with modern solid waste facilities is controlling the leachate and stabilizing the soils used for covering many disposal facilities. Properly designed, constructed and operated facilities should not significantly effect water quality.

Groundwater and surface water monitoring is required at all permitted Municipal Solid Waste Sites (MSW) and all Construction and Demolition landfills. Monitoring efforts have been required since July 1989. All MSW landfills must have a liner system in place by January 1, 1998. All existing unlined landfills must close at this same time.

Section 5.3.5 briefly summarizes state, local and federal solid waste recycling programs.

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CHAPTER 4

WATER QUALITY IN THE HIWASSEE RIVER BASIN

4.1 INTRODUCTION

This chapter provides a detailed overview of water quality and use support ratings in the Hiwassee River Basin.

DWQ Water Quality Monitoring and Assessment

- **Section 4.2** presents a summary of seven water quality monitoring programs conducted by DWQ's Environmental Sciences Branch including consideration of information reported by researchers and other agencies (NCDEM, 1994).
- **Section 4.3** presents a narrative summary of water quality findings for both of the subbasins. The summary is based on the monitoring approaches described in Section 4.2. Subbasin maps showing the locations of monitoring sites are also included.

Use-Support Ratings

- **Section 4.4** describes the use-support concept and the methodology for developing use-support ratings. Using this approach, surface waters in the basin are assigned one of four ratings: fully supporting, fully supporting but threatened, partially supporting, or not supporting uses.
- **Section 4.5** presents a series of tables, figures, and a color-coded use-support map for many of the streams in the basin.

4.2 WATER QUALITY MONITORING PROGRAMS IN THE HIWASSEE RIVER BASIN

DWQ's monitoring program integrates biological, chemical, and physical data assessment to provide information for basinwide planning. Below is a list of the five major monitoring programs that have been performed in the Hiwassee River basin. Each of these is briefly described in the following sections.

- Benthic macroinvertebrate monitoring (Section 4.2.1),
- Fish tissue monitoring (Section 4.2.2),
- Lakes assessment (including phytoplankton monitoring) (Section 4.2.3),
- Aquatic toxicity monitoring (Section 4.2.4),
- Ambient water quality monitoring (covering the period 1988-1994) (Section 4.2.5).

In addition, Section 4.2.6 briefly describes other water quality and acid rain studies conducted by other agencies in the Hiwassee River basin. These studies include:

- Acid Deposition and Sensitivity Studies
- Tennessee Valley Authority
- Duke Power

4.2.1 Benthic Macroinvertebrate Monitoring

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

Criteria have been developed to assign a bioclassification rating 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); or commonly referred to as EPTs. The ratings fall into five categories ranging from Poor to Excellent. Likewise, ratings can be assigned with a Biotic Index (Appendix III). This index summarizes tolerance data for all species in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is poorly assessed by a taxa richness analysis. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina.

Macroinvertebrate Sampling in the Hiwassee River Basin

Macroinvertebrate data were collected at 15 basin assessment sites during 1994. A total of 37 sites (73 samples) were rated using benthic macroinvertebrate data since 1983. Overall water quality was Excellent at most sampling sites in the basin. The fifteen 1994 sites resulted in a bioclassification of Excellent at 9 sites, Good at 3 sites, Good-Fair at 2 sites, and Fair at 1 site (Brasstown Creek). Of the 73 samples collected since 1983, 66% were given an Excellent bioclassification.

4.2.2 Fisheries Monitoring

The condition of the fishery is one of the most meaningful indicators of ecological integrity to the public. Fish occupy the upper levels of the aquatic food web and are both directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food web (such as macroinvertebrates) will affect the abundance, species composition, and condition of the fish population. Two types of fisheries monitoring are conducted by DWQ; fish community assessment and fish tissue analysis. Only fish tissue analyses were conducted in the Hiwassee River basin.

Fish tissue analyses involve examining fish tissues to determine whether they are accumulating chemicals. This information is also useful as a water quality indicator and can be used to determine whether human consumption of fish poses a potential health risk.

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Therefore, by analyzing fish tissue, chemicals in the water can be identified. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species has been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be ingested by fish or shellfish tissues either directly or through aquatic food webs (defined as bioaccumulation). Results from fish tissue monitoring can serve as an important indicator of contamination of sediments and surface water. Fish tissue analyses are also used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

Fish Tissue Analysis in the Hiwassee River Basin

Fish samples collected within the Hiwassee River basin were analyzed for metals contaminants only. Fish tissue samples were collected from Hiwassee River and Hiwassee Lake (13 observations) from 1981 to 1986. Fish species collected for analyses included catfish, walleye and bass. Results of fish tissue analyses indicated that mean levels of metals contaminants were non-detectable or present at levels below FDA and EPA criteria.

4.2.3 Lakes Assessment Program (including Phytoplankton)

Lakes are valued for the multiple benefits they provide to the public. These benefits include recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lakes Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at all publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine the general health, or trophic state, of each lake. The North Carolina Trophic State Index (NCTSI) is a measure of nutrient enrichment and productivity. Lakes are evaluated on whether the designated uses of the lake have been threatened or impaired by pollution. This index is explained more fully in Appendix III.

Lakes Assessed in the Hiwassee River Basin

There were three lakes in the Hiwassee River Basin sampled as part of the Lakes Assessment Program. These lakes are: Chatuge Lake, Apalachia Lake and Hiwassee Lake. Hiwassee Lake was the only lake intensively monitored during the growing seasons of 1991 through 1993 as part of the reference lake program. The purpose of this program was to identify lakes in each of the four regions of the state (Mountain, Piedmont, Sandhills and Coastal Plains) which were representative of minimally impacted lakes by which similar lakes in the same region could be compared.

Each lake is individually discussed in the appropriate subbasin section with a focus on the most recent available data.

4.2.4 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 DEM's Aquatic Toxicology Laboratory. The Aquatic Survey and 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 DEM administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

Aquatic Toxicity Monitoring in the Hiwassee River Basin

There are four facilities in this basin required to conduct whole effluent toxicity testing. A list of each NPDES facility is provided later in this Chapter in the Aquatic Toxicity Monitoring section.

4.2.5 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine (saltwater) water quality monitoring stations (about 380 statewide) strategically located for the collection of

physical and chemical water quality data (or water quality parameters). Sampling stations are sited under one or more of the following monitoring designations:

Fixed Monitoring Stations	Rotating Monitoring Stations
Point Source	Basinwide Information
Nonpoint Source	HQW & ORW
Baseline	Water Supply

Water quality parameters are arranged by freshwater or saltwater waterbody classification and by corresponding water quality standards. Under this arrangement, Class C waters are assigned minimum monthly parameters. Additional parameters are assigned to waters with additional classifications such as trout waters and water supplies. Water quality parameters are organized as shown in Table 4.1.

Table 4.1 Ambient Monitoring System Parameters

C WATERS (minimum monthly coverage for all stream stations)
Field Parameters: dissolved oxygen, pH, conductivity, temperature, chlorine
Nutrients: total phosphorus, ammonia, total Kjeldahl nitrogen, nitrate+nitrite
Physical Measurements: total suspended solids, turbidity, hardness
Bacterial: fecal coliform (Millipore Filter method)
Metals: aluminum (no present water quality standard), arsenic, cadmium, chromium, copper*, iron*, lead, mercury, nickel, silver*, zinc*

NUTRIENT-SENSITIVE WATERS
Chlorophyll *a* (where appropriate)

WATER SUPPLY
chloride, total coliforms, manganese, total dissolved solids

TROUT WATERS
No changes or additions

PLUS any additional parameters of concern for individual station locations.

* Action level water quality standard

Water quality data collected at two sites in the Hiwassee River basin were evaluated for the period 1990 - 1994 since basinwide permitting is done in five year cycles. These data were downloaded from STORET for analysis. Because the methodology for determining parametric coverage within the AMS program has recently been revised, some stations have little or no data for several parameters. however, for the purpose of standardization it was felt that data summaries for each station should include all parameters that will be sampled in the future. These data summaries are found below. AMS stations for the Hiwassee River basin are listed in Table 4.2.

Table 4.2 Ambient Monitoring System Stations Within the Hiwassee Basin.

Primary No	STORET No	Station Name	Subbasin
Hiwassee River Drainage			
03548500	F2500000	HIWASSEE RIVER ABOVE MURPHY NC	040502
03550000	F4000000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	040502

Ambient Monitoring Summary

Table 4.3 summarizes data collected at the ambient stations in the Hiwassee River basin. Each station is listed with associated parameter, the total number of samples, those samples with less than detection level recorded, and the number of excursions from a water quality criterion. It should be noted that the criteria are presented as numerical and represent instantaneous measurements. The actual standard may include a narrative, such as turbidity and, as in some metals criteria, may be based on extended exposure at or above the criteria to expect chronic toxicity of the most sensitive species of organism. Therefore the table is useful for relative comparisons between locations and screening areas where frequent excursions of individual or multiple parameters suggest waters that might be targeted for more detailed evaluations and/or specific management strategies. A more thorough evaluation can include review of temporal and spatial trends, association of concentrations to flow, degree of excursion from the criterion, or use of other analytical methods.

Table 4.3 Summary of Ambient Monitoring System Station Data Excursions from the NC Water Quality Criteria by Parameter. January 1990 to December 1994.

Station Number	Station Name	Parameter/Criterion	Samples All	<Det	Excur
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Arsenic (µg/l) [50]	2727	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Arsenic (µg/l) [50]	2727	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Cadmium (µg/l) [2]	2727	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Cadmium (µg/l) [2]	2727	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Chlorophyll a (Corr)(µg/l) [40]	N/S		
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Chlorophyll a (Corr)(µg/l) [40]	N/S		
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Chromium (µg/l) [50]	2727	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Chromium (µg/l) [50]	2727	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Dissolved Oxygen (mg/l) [4]	270	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Dissolved Oxygen (mg/l) [4]	560	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Fecal Coliform (#/100ml) [200]	198	1	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Fecal Coliform (#/100ml) [200]	222	3	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Hardness (mg/l) [100]	270	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Lead (µg/l) [25]	2727	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Lead (µg/l) [25]	2727	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Manganese (µg/l) [200]	6	0	0
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Mercury (µg/l) [0.012]	2727	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Mercury (µg/l) [0.012]	2727	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Nickel (µg/l) [25]	2727	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Nickel (µg/l) [88]	2726	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	pH (SU) [6.0-9.0]	270	0	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	pH (SU) [6.0-9.0]	530	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Total Residue (mg/l) [500]	250	0	
03548500	HIWASSEE RIVER ABOVE MURPHY NC	Turbidity (NTU) [50]	270	1	
03550000	VALLEY RIVER AT SR 1373 AT TOMOTLA NC	Turbidity (NTU) [50]	370	0	

Hiwassee River Drainage

Two AMS sites are located in the Hiwassee River drainage. One on the Hiwassee River and one on the Valley River. There were very few excursions from the water quality criterion. Four of the five total excursions were from the fecal coliform criterion and this parameter is addressed in the section below on fecal coliform bacteria. There are some historic anomalies in the data that should be noted.

Figure 4.1 shows pH concentrations in the Hiwassee River Basin. As mentioned in the Little Tennessee River Basinwide Assessment Report Support Document, there were low pH concentrations recorded in the basin beginning in the summer of 1991. These readings were consistent throughout the whole basin and extended through 1994. There was a similar pattern for the Hiwassee River basin from 1991 through 1994. In 1995, the pH values were slightly higher

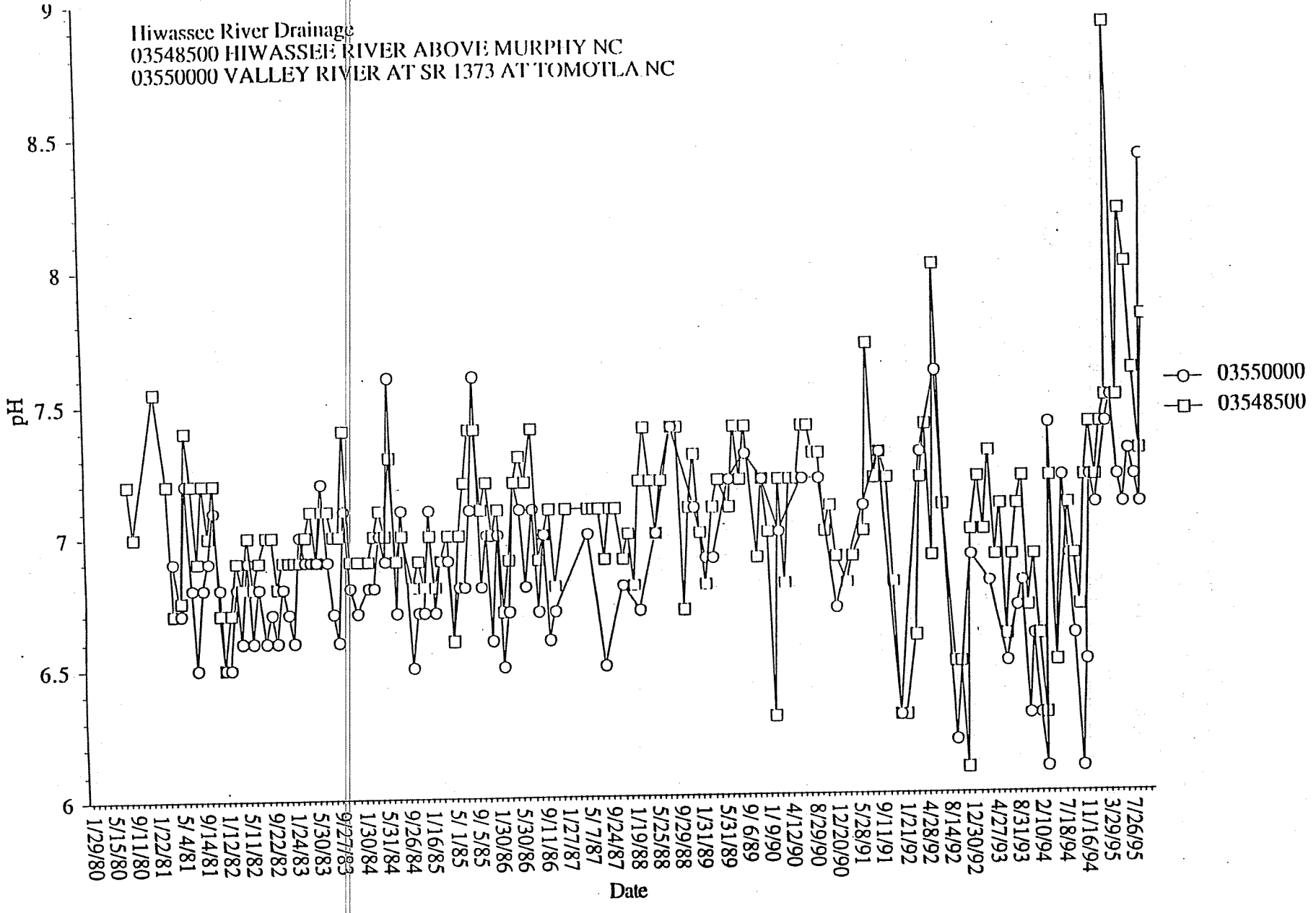

Figure 4.1 pH Concentrations for the Hiwassee River Basin. 1980 to 1995.

than normal. As in the Little Tennessee River basin, the upper range of pH does not change during this time. Air sampling stations in and around this area of the state recorded no abnormal data for this time period and as of the writing of this plan, no apparent reason for the lower pH values has been found.

Fecal Coliform Bacteria

Fecal coliform bacteria are most useful as a screening tool to estimate the cumulative inputs from multiple sources, but in some instances can be used to locate a single large source of bacteria. Summaries of fecal coliform results were provided each regional office in May of 1995. These data will be updated in this and each subsequent Basinwide Assessment Report and will include any additional data collected by staff during the five year cycle.

Summary fecal coliform information is listed in Table 4.4. The primary screening tool used in establishing priority is the geometric mean. Sites with 10 or more fecal coliform samples within the last 5 years, that have a geometric mean exceeding 200 /100ml, are considered highest priority. This information will be reflected in the Use Support Rating for that stream or river. In the Hiwassee River, there were no stations with a geometric mean greater than 200/100ml.

Table 4.4 Fecal Coliform summary data for the Hiwassee River Basin. 1990 to 1995.

Site	Total Samples	Geometric Mean	Samples > 200/100ml	Percent >200/100ml	First Sample	Last Sample
Hiwassee River	19	5.23	1	5.3	6/18/91	12/28/94
Valley River	22	23.47	3	13.6	6/18/91	12/28/94

4.2.6 Other Water Quality Monitoring Programs

Acid Deposition and Sensitivity Studies

The Southern Appalachian Man and Biosphere (SAMAB) was established to address concerns about the adverse effects of air pollution on the environmental resources unique to the Southern Appalachian mountains. Interagency assessment teams were formed to gather and interpret information about the status, management and ecosystem use. The teams prepared status reports on Terrestrial, Aquatic, Social/Cultural/Economic and Atmospheric ecosystems. Of particular interest to this basinwide plan are the effects of acid deposition on the surface waters of the Southern Appalachian mountains. The Hiwassee River basin lies within the boundaries of SAMAB (Figure 5.1). Discussion of SAMAB in this plan is limited to water quality issues as they pertain to the Hiwassee River basin. The National Acid Precipitation Assessment Program (NAPAP) also studied the effects of acid deposition on surface waters. These reports are the basis for the following summaries made by SAMAB (SAMAB 1996).

Based on these studies, several conclusions are made about the effects of acid deposition on streams within the Great Smoky Mountains National Park. The results of these studies are applicable here due to the high elevations within the Hiwassee River basin and the potential for the effects of acid deposition to affect areas outside of the GSMNP.

Perhaps the most important factor is the low acid neutralizing capacity (ANC) of streams throughout the GSMNP. ANC is considered to be the measure of the ability of the stream to neutralize (or buffer) acid inputs. A low ANC is an indicator that the stream is sensitive to acid inputs. The ANC of streams tends to be lower at higher elevations. This makes streams at higher elevations more vulnerable to acid deposition . Therefore, these high elevation streams tend to have a lower pH (at or below 5.5 (Flum and Nodvin 1985)). Fish and amphibian populations need to have pH levels above 5.5 to survive and reproduce. The levels of stream pH are currently

not detrimental to fish, however, the low buffering capacity of these streams makes the waters very vulnerable to chronic acid deposition.

Increasing stream acidity may result in the loss of aquatic species richness and diversity. Nitrates and sulfates are deposited into the forest ecosystem through acid deposition. The concentrations of these inputs can play a major role in ANC. Nitrate and sulfate concentrations tend to be higher at higher elevations. The GSMNP receives some of the highest nitrate concentrations (and the lowest soil nitrogen retention ability) from the atmosphere of any region of SAMAB. Thus, nitrate is entering streams in concentrations as great or greater than sulfate concentrations.

ANC is also affected by bedrock geology. In areas with underlying limestone, ANC is higher and the streams are more buffered from the effects of acid deposition. However, in many watersheds of the GSMNP there are non-limestone areas and Anakeesta rock formations. When Anakeesta is exposed to air and water, the rock reacts to leach sulfuric acid and heavy metals into the watershed. If a stream is nearby (as is the case with Beech Flats Prong, a Support-Threatened HQW in the GSMNP), the effects of the acidification can be long-term and severe.

Some watersheds with long-term monitoring sites show a trend of increasing streamwater sulfate concentrations between 1975 and 1995. Soils in these areas have gradually become saturated with sulfates. Nitrates in streams have also likely increased. In the GSMNP, stream nitrate concentrations are highest at high elevations where forests are older (forest demand for nitrogen is lower). Fifty year projections using a 1985 deposition rate show an increase in the percentage of acidic streams from 0% to 10% (SAMAB 1996).

Acid deposition sensitivity has been broadly determined for the Southern Appalachian Assessment area (Peper et. al.., open file report) by federal agencies of the Southern Appalachian Man and Biosphere Cooperative. Sensitivities to acid deposition are assigned on the basis of bedrock compositions and associated soils, along with their capacity to neutralize acid precipitation. Acid-base status is defined as the balance between acids and bases in the soils and surface waters. This issue is of particular concern in the SAA region due to the low ANC of higher elevation streams, the high rate of acid deposition as compared to other areas in the U.S., the area is affected by surface water acidification due to acid deposition, and the potential for further decreases in pH values in streams as a consequence of continued acidic deposition. Bedrock geology and associated soil types are known to play an important role on the chemical composition of surface water and on the sensitivity of aquatic ecosystems to acidic deposition. This work was done on a broad scale and can only be applied in a general sense to the waters of the Hiwassee River basin. As reported in the SAA report, approximately 363, 536 acres (80.8%) of the Hiwassee River basin are considered to be highly sensitive to acid deposition. An additional 30,982 acres (6.9%) have medium sensitivity and 17,596 acres (3.9%) have low sensitivity to acid deposition.

The Integrated Forest Study (IFS) demonstrated in the 1980's that high elevation spruce-fir ecosystems (common to the GSMNP) receive the highest loadings of nitrogen and sulphur (Nodvin, et. al.. 1985). Nitrification of soils have been known to elevate soil aluminum concentration to values that inhibit calcium uptake in red spruce (Nodvin, et. al.. 1985), thereby altering the forest canopy to a degree that can have additional impacts on water quality and aquatic ecosystems.

An extensive water quality monitoring program within the GSMNP determined that the area receives high rates of both sulfates and nitrogen inputs and that the nitrogen loading has the greatest effect on stream chemistry since sulfate retention by the forest and the soils is high. Nitrogen loading to streams is especially elevated in watersheds with aged growth forests and high elevations. With the likelihood of continued loadings to the ecosystem, it is also likely that nitrogen saturation will extend downslope and downstream as catchments mature and soil saturation is reached (Flum and Nodvin 1985). It is likely that without drastic reductions in acid

deposition that further changes in stream chemistry toward more acidic streamwater will occur in high elevations (greater than 5000 feet).

The National Biological Service has documented low pH problems in some of the streams within the Great Smoky Mountains National Park, including many streams in the Lower Little Tennessee subbasin. They have information on 350 sites in North Carolina and Tennessee, including almost 2500 measurements of stream pH. These data are summarized as follows:

About 5% of the samples were found to have pH values less than 5.0, 11% had pH values less than 5.5, and 22% had pH values less than 6.0. Low pH values were found in two types of streams:

1. *Streams in catchments with Anakeesta rock deposits.* A characteristic symptom of this problem is high sulphate levels, as the weathering of the Anakeesta rock produces sulfuric acid. High concentrations of heavy metals is also indicative of the weathering of Anakeesta rock. Road cuts or landslides in areas of Anakeesta rock can result in stream pH values <5.0.
2. *Streams above 3500' in old-growth (undisturbed) forest.* These terrestrial systems may become nitrogen saturated after many years of acid rain, and the acid-neutralizing capacity of the catchment becomes used up. A characteristic of this problem is high nitrate levels in stream water, especially after rainfall. Lower elevation sites rarely have records of pH < 6.2, but this may reflect monthly or biannual sampling frequency. It is possible that these lower elevation sites may have occasional pH values less than 6.0, but for a period of only a few days.

Tennessee Valley Authority (TVA)

TVA has developed an extensive monitoring program that combines the expertise of water quality professionals with the interests and dedication of local citizens, interest groups, businesses and industry, and other governmental agencies. Refer to Chapter 5 for a more complete summary of this TVA water quality initiative.

Within the Hiwassee River basin, TVA has maintained two sampling sites on both Hiwassee Lake (one near the dam and another mid-lake) and Chatuge Lake (both near the dam). Following is a brief summary of the results of the TVA monitoring.

Hiwassee Lake

While the overall health of Hiwassee Lake was rated fair, there were some changes in water quality observed. For example, algae levels were twice as high as in previous years, presumably due to heavy rainfall events and subsequent runoff carrying nutrients. Algae levels rated fair. Benthic macroinvertebrate life rated poor due to low numbers and diversity. Sediment quality in the lake improved in 1994 and rated good. Previous toxicity problems to test animals improved also. The fish rating improved (good and fair determinations) as a result of improvements in TVA's evaluation method.

Chatuge Lake

In 1994, Chatuge lake rated fair by TVA's determinations, with conditions about the same as the previous year. However, because of changes in TVA's evaluations of algae, the lake rated higher than the previous year (good and fair). Oxygen (good and fair), sediment (fair) and fish community (fair) all improved in rating from 1993. Elevated levels of copper and chromium were detected in sediment samples from the Shooting Creek arm of the lake. Benthic macroinvertebrate samplings showed a decrease in rating (to fair) due to lower numbers and diversity of animals.

DWQ biologists have not established sampling sites at these same location, so no comparison of these data can be made at this time. It is important to note that there are differences in sampling methodology used by DWQ and TVA. For example; 1) TVA does not have an Excellent rating for their EPT methodology, and 2) DWQ biologists identify macroinvertebrate samples to a lower level of taxonomy (to genus and species level). With proper training, it is realistic for volunteers to achieve family level taxonomy. However, it appears that family level identification and the use of a national list of tolerance values may not be sensitive enough to detect subtle water quality changes. It has been further suggested that the use of regionalized data for family tolerance values would improve the quality of volunteer generated data (Penrose and Call 1995) and allow for better comparison between datasets.

In the future, it may be possible for the DWQ biologists to work with TVA to coordinate sampling locations on sites within the Little Tennessee River basin. It may also be possible for DWQ to conduct follow-up field work or QA/QC investigations on those TVA stream sites that do not correspond with DWQ findings.

Duke Power

Duke Power has an ongoing erosion control assessment program designed to document baseline conditions, quickly detect sedimentation impacts and to assess the effectiveness of erosion control measures in protecting water quality. This program is used particularly for transmission line construction activities conducted by Duke Power (see Section 5.6.4 for additional information). The focus of this program is to monitor Total Suspended Solids (TSS) and Total Phosphorous (TP) as key parameters relating to the effects of erosion and sedimentation. Samples are collected using vertical series of depth-integrated single-stage samplers to document before, during and after construction impacts to a waterbody. Information is used to quickly alert field crews where stabilization efforts need to be undertaken. Duke Power has over 100 monitoring sites in western North Carolina and northern South Carolina (Braatz 1996).

In the Hiwassee River basin, Duke Power has eight sampling stations (three stations on the Valley River at Rhodo, Andrews and Marble; one onWebb Creek near the mouth; one on Gipp Creek near the mouth and three sites on Britton Creek). Raw TSS and TP data is available on these sites from Duke Power. Summary information is yet to be compiled.

4.3 NARRATIVE WATER QUALITY SUMMARIES BY SUBBASIN

4.3.1 Chatuge Lake and Hiwassee River (Subbasin 04-05-01)

Description

Hiwassee subbasin 04-05-01 lies primarily within Clay County (Figure 4.2). The Hiwassee River originates in Towns County in north Georgia and flows northward into North Carolina, where it is dammed to form Chatuge Lake. Major tributaries to the Hiwassee River in this subbasin include Shooting Creek, Tusquitee Creek, Fires Creek and Brasstown Creek (which also originates in Georgia). The largest town in this subbasin is Hayesville. Land use within this subbasin is mainly forest and agricultural. The Fires Creek Wildlife Management Area is part of the Nantahala National Forest.

Overview Of Water Quality

Overall water quality in this subbasin is Excellent as most of the streams drain undisturbed, undeveloped and protected mountain areas. The entire Fires Creek catchment has been designated ORW and most of the Tusquitee Creek watershed is classified HQW.

A total of 20 benthos sites (46 collections) have been sampled in this subbasin since 1985. Four of the basin assessment sites in 1994 have long term data for analysis of changes in water quality. Sampling locations are shown in Figure 4.2. Benthos collections from Shooting Creek, a large tributary stream to Chatuge Lake, were part of a special study in 1994 conducted to determine the effects of an illegal discharge from a poultry operation. The water quality declined downstream of the discharge from Excellent to Good, but it was not determined that the poultry operation was the only source of impact to the stream. Shooting Creek may be affected by US 64, which follows the creek for most of its length.

There are four permitted dischargers in this subbasin, however the few water quality problems encountered in this subbasin are primarily due to nonpoint source runoff. In fact, the only site sampled in this subbasin that did not receive an Excellent or Good rating was Brasstown Creek at SR 1104 (Fair). This creek originates in north Georgia and is impacted by nonpoint source runoff, as it flows along NC 66 for most of its length. It also receives effluent from the Young Harris Water Pollution Control Plant in Georgia.

Chatuge Lake, a large reservoir straddling the North Carolina-Georgia state line, lies within this subbasin. Data indicates that Chatuge Lake fully supports its designated uses.

Benthic Macroinvertebrates

Six sites were sampled for benthic macroinvertebrates as part of the basinwide assessment program in 1994 (Table 4.5). Twenty sites have been sampled in this subbasin since 1985, including two special studies.

Table 4.5 Basin Assessment Sites in Hiwassee Subbasin 04-05-01, 1994, Taxa Richness Values and Bioclassification.

Site#	Creek	Date	County	Road	S/SEPT	Rating
B-3	Shooting Cr	940713	Clay	SR 1347	-/32	Good
B-6	Tusquitee Cr	940728	Clay	SR 1330	69/34	Excellent
B-8	Big Tuni Cr	940713	Clay	SR 1311	63/38	Excellent
B-15	Fires Cr	940713	Clay	SR 1330 Bristol Camp	80/43	Excellent
B-16	Fires Cr	940713	Clay	SR 1330 Picnic Area	-/35	Excellent
	Fires Cr	940829	Clay	SR 1330 Picnic Area	81/38	Excellent
B-20	Brasstown Cr	940728	Clay	SR 1104	-/18	Fair

Shooting Creek is a large tributary stream to Chatuge Lake, and had no prior data. It follows US 64 for most of its length. The bottom substrate shows evidence of sedimentation (pools filled in with sand and silt). The Good rating found at SR 1347 is lower than an Excellent rating found further upstream during a special study in August 1994.

Brasstown Creek, received a bioclassification of Fair. This creek originates in north Georgia and is impacted by nonpoint source run-off, as it flows along NC 66 for most of its length. A water quality investigation of Brasstown Creek by the Georgia Department of Natural Resources determined that the effluent from the Young Harris Water Pollution Control Plant exceeded its permit limitation for fecal coliform bacteria. Biological and chemical data, with the exception of fecal coliform bacteria, indicated good water quality in Brasstown Creek (GDNR 1993).

Hiwassee River Basin
040501

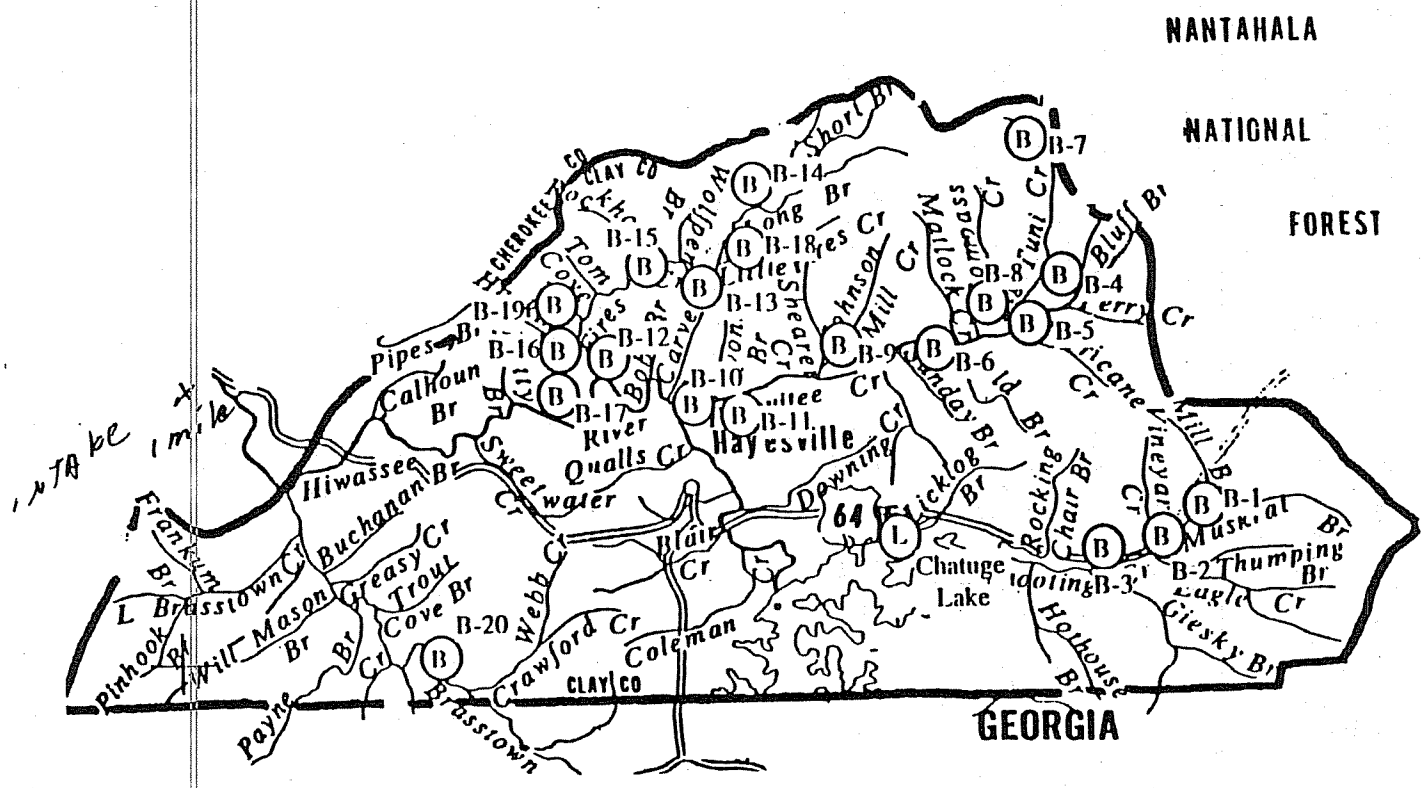

Figure 4.2 Sampling Locations in Chatuge Lake and Hiwassee River (Subbasin 04-05-01)

Long Term Benthic Macroinvertebrate Sites

Tusquitee Creek (and its tributary, Big Tuni Creek), and Fires Creek, major tributaries to the Hiwassee River, remain in Excellent biological condition. The Tusquitee Creek site has consistently rated Excellent since 1987.

A downstream site on Big Tuni Creek at SR 1311 was sampled in 1994, resulting in an Excellent bioclassification. Total taxa richness and intolerant EPT taxa richness decreased from 1989, but the Biotic Index was lower in 1994. This may be due to the effects of heavy rains. This site has also consistently supported a diverse population of pollution intolerant species.
Fires Creek at Bristol Camp is located upstream of the Fires Creek Picnic Area site in a more remote area of the watershed. Fires Creek is a pristine mountain stream which supports populations of several unusual animal species, such as the water shrew, the blackbelly salamander, and the Hellbender (NCDEM Report B-880906). This site has consistently rated Excellent. Fires Creek is classified as an Outstanding Resource Water.

A downstream Fires Creek site at the Picnic Area is subject to more recreational use (swimming) than the Bristol Camp site. This site has consistently been given an Excellent bioclassification.

Special Benthic Macroinvertebrate Studies

Data from all special studies since 1983 are presented in Table 4.6, with a reference to the Biological Assessment Group report file number if more detailed information is needed.

Table 4.6 Benthic Macroinvertebrate Special Studies, Hiwassee Subbasin 040501, 1983-1994.

Site#	Creek	Date	Study	County	Road	S:Rating
B-1	Shooting Cr	940829	Poultry Farm	Clay	SR 1349	68/37:Excellent
B-2	Shooting Cr	940829	Poultry Farm	Clay	SR 1168	59/28:Good

This study was conducted to determine the effects of an illegal discharge from a poultry operation. The water quality did decline downstream of the discharge, but it could not be determined that the poultry operation was the only source impacting the stream. Farther downstream Shooting Creek shows a decline in water quality, probably due to agricultural nonpoint runoff.

A number of streams or stream reaches that were classified as WS-I were not being used as water supply sources. It was proposed by the Planning Branch of DWQ that these streams be reclassified to C-HQW. Little Fires Creek was used as a seasonal reference site in this study. Little Fires Creek was given an Excellent bioclassification rating.

Eight sites in the Tusquitee Creek watershed were investigated for possible HQW reclassification (Table 4.7). Most of Tusquitee Creek and all tributaries except Greasy Creek were reclassified as HQW.

In 1987 and 1988, DEM worked in conjunction with the US Forest Service and the North Carolina Department of Agriculture to assess any effects on stream water quality from the eradication of Gypsy moths in the Fires Creek watershed. Before and after samples were collected. Results suggested that there were no significant changes in the benthic macroinvertebrate community structure between collection periods.

Table 4.7 High Quality Waters Investigation Results for the Hiwassee River Basin

Site#	Creek	Date	Study	County	Road	S:Rating
B-4	Tusquitee Cr	890331	Hiwassee Basin HQW	Clay	ab hatchery	-/35:Good
B-5	Tusquitee Cr	890330	Hiwassee Basin HQW	Clay	SR 1307	-/49:Excellent
B-6	Tusquitee Cr	890330	Hiwassee Basin HQW	Clay	SR 1330	-/45:Excellent
B-7	Big Tuni Cr	890331	Hiwassee Basin HQW	Clay	SR 1311 up	-/46:Excellent
B-8	Big Tuni Cr	890331	Hiwassee Basin HQW	Clay	SR 1311 dn	83/45:Excellent
B-9	Johnson (Mill) Cr	890330	Hiwassee Basin HQW	Clay	SR 1307	-/42:Excellent
B-10	Tusquitee Cr	890330	Hiwassee Basin HQW	Clay	SR 1300	90/47:Excellent
B-11	Greasy Cr	890330	Hiwassee Basin HQW	Clay	SR 1318	-/38:Good

Aquatic Toxicity Monitoring

One facility in this subbasin currently monitors effluent toxicity as per a permit requirement. That facility is:

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Hayesville WWTP	NC0026697/001	Town Cr	Clay	0.072	18.90

Whole effluent toxicity monitoring results for all dischargers in the Hiwassee Basin are presented in Appendix III. This facility has not obtained regulatory relief for its toxicity limit through a special or judicial order. Recently Clay County took over operation of the facility.

Lakes Assessment Program

Chatuge Lake

Chatuge Lake is a large reservoir which straddles the North Carolina-Georgia state line in the southwest portion of North Carolina. The lake is adjacent to the Nantahala National Forest and is an impounded section of the Hiwassee River upstream of Hiwassee Lake and Apalachia Lake. Chatuge Lake is owned by the Tennessee Valley Authority (TVA) and was constructed to provide hydroelectric power, flood control, and recreation. Construction on the Chatuge Dam was completed in 1942. The reservoir has a maximum depth of 144 feet (44 meters), and a mean depth of 36 feet (11 meters). Chatuge Lake is 13 miles (21 kilometers) long with a surface area of 6950 acres (2812 hectares) and 132 miles (212 kilometers) of shoreline. The drainage area covers 187 mi^2 (484 km^2) and is mostly forested with a few residences, campgrounds and small boat docks. Major tributaries include the Hiwassee River and Shooting Creek.

The elevated turbidity observed in 1994, as well as the elevated total phosphorus value, near the Shooting Creek arm may have been the result of sampling the lake during a rainfall event. In 1994, the NCTSI score was -1.3, indicating mesotrophic conditions. Chatuge Lake is classified B waters and fully supports its designated uses.

Chatuge Lake was previously sampled by DEM in 1981 and 1987. In 1981, Chatuge Lake was oligotrophic with a NCTSI score of -3.1. In 1987, the NCTSI value of -4.6 indicated oligotrophic conditions. These results indicate that Chatuge Lake, while still meeting its use-support designation, has declined in water quality.

4.3.2 Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)

Description

Hiwassee River subbasin 04-05-02 lies entirely within Cherokee County (Figure 4.3), where it is impounded to form Hiwassee Lake and Apalachia Lake. The Tennessee Valley Authority (TVA) regulates water releases from these lakes for the production of hydroelectric power.

The Valley River is the largest tributary to the Hiwassee River. The Valley River, flows in a southwesterly direction from Topton through Andrews, Marble, and Tomatla to converge with the Hiwassee River near Murphy. Land use is primarily agricultural and forest, with some urban areas in the Valley River watershed between Andrews and Murphy, along US 19/129. Most of the Hiwassee River drainage is located within the Nantahala National Forest. There are eleven permitted dischargers in this subbasin, the largest of which is the Andrews WWTP with a design flow of 1.5 MGD.

Overview Of Water Quality

A total of 17 benthos sites (27 collections) have been sampled in this subbasin since 1983. Subbasin sampling in 1994 resulted in Excellent bioclassifications for Peachtree Creek, Hanging Dog Creek, Nottely River, Persimmon Creek, and Beaverdam Creek. South Shoal Creek and Shuler Creek received Good ratings.

One site, the Valley River near Tomatla, has long term data and has remained relatively stable with a Good-Fair rating. A special study of the Valley River in 1994 revealed unexpected water quality problems in the Valley River near Andrews. The headwater areas (including Junaluska Creek) were rated Good-Fair, with evidence of some sediment problems. The Valley River between Stewart Road and a site about 3 miles below Andrews, however, was rated Fair with evidence of toxicity problems. There was no evidence that the Andrews WWTP contributed to these problems. The site above the WWTP showed the most severe water quality problems. There are no permitted dischargers in the area where the problem originates.

There are two small watersheds in this subbasin that are classified as High Quality Waters (HQW) or Outstanding Resource Waters (ORW). These watersheds are Britton Creek and Gipp Creek, both tributaries to the Valley River.

There are two ambient monitoring sites in this subbasin, one located on the Hiwassee River near Murphy and the other on the Valley River near Tomatla. There are very few excursions from the water quality criterion in this drainage. Four of the five total excursions were from the fecal coliform criterion and this parameter is addressed later in this section.

Hiwassee Lake and Apalachia Lake are impoundments of the Hiwassee River that lie within this subbasin. Hiwassee Lake is one of sixteen lakes selected throughout the state as representative of minimally impacted lakes. Apalachia Lake is a run-of-the-river reservoir located within the Nantahala National Forest. Located immediately downstream of Hiwassee Lake, this reservoir is owned by the Tennessee Valley Authority (TVA) and was built for hydroelectric power generation, flood control and recreation. These lakes were found to be fully supporting of their designated uses.

Benthic Macroinvertebrates

Thirteen sites were sampled for benthic macroinvertebrates as part of the basin assessment program in 1994. Biological ratings obtained for these stream sites can be found in Table 4.8. With the exception of the Valley River, Junaluska Creek, South Shoal Creek and Shuler Creek, all streams

Hiwassee River Basin
040502

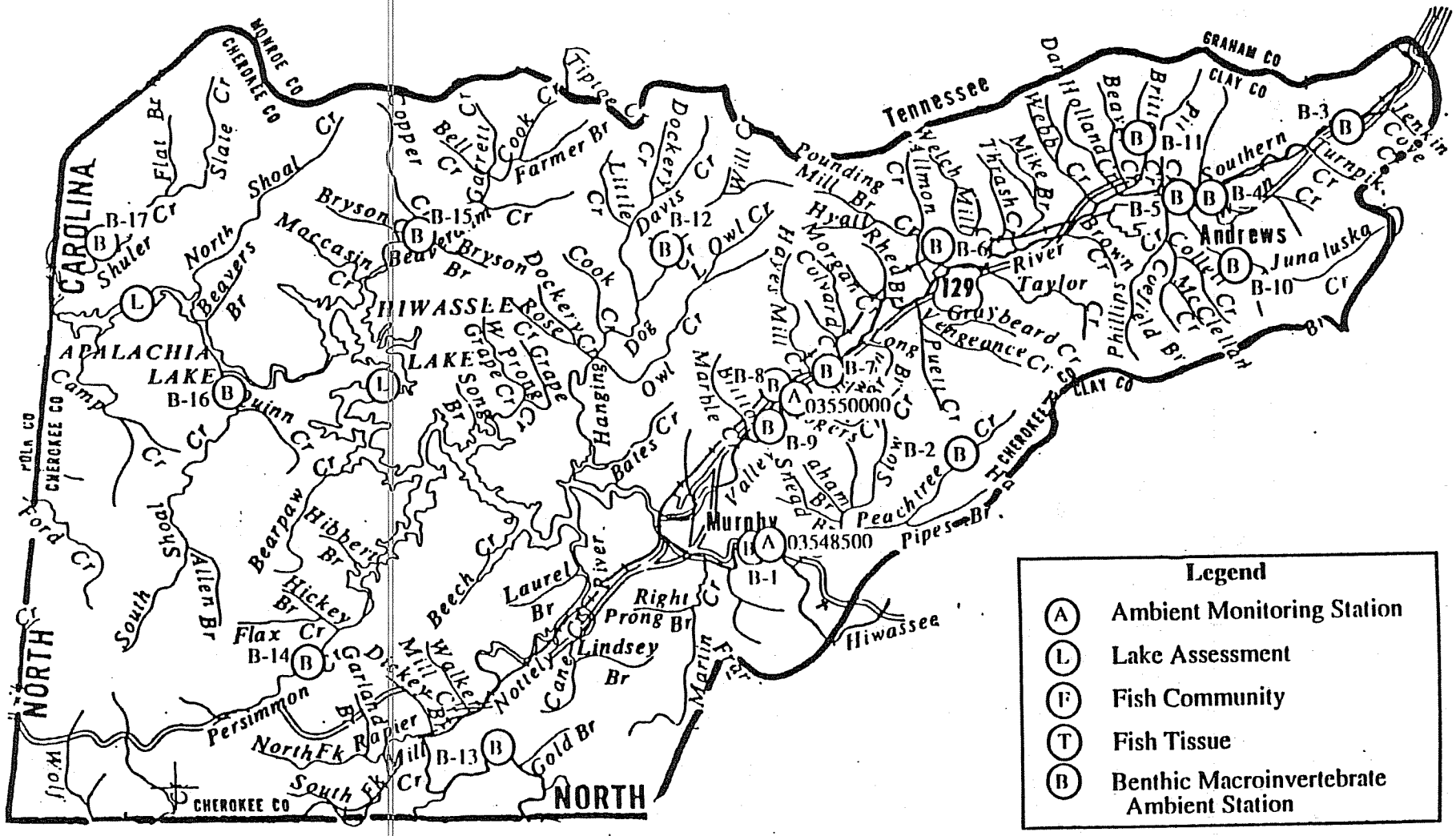

Figure 4.3 Sampling Locations in the Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)

received an Excellent rating. Valley River and Junaluska Creek are discussed further under Long Term Benthos sites and Special Studies. South Shoal Creek, a high gradient rocky stream and Shuler Creek flow into Appalachia Lake. Both creeks are embedded and Shuler Creek has areas of severe bank erosion.

Long Term Benthos Sites

The Valley River is the largest (20 meters wide) tributary of the Hiwassee River. The downstream site near Tomatla is an active ambient sampling location with historical data since 1984. Total and EPT taxa richness at the Valley River site near Tomatla (SR 1554) has remained relatively stable, with a Good-Fair bioclassification. In 1990, this site received a Good rating. There was a decrease in taxa richness in 1994 due to high flow conditions and difficulty in sampling. The biotic index increased slightly in 1994, resulting in a bioclassification of Good-Fair, indicating that the Valley River may be affected by run-off and point sources from the Andrews area. High flows could also cause the biotic index to increase due to flushing out of some of the tolerant species such as midges.

Table 4.8 Basin Assessment Sites in Hiwassee Subbasin 04-05-02, 1994, Taxa Richness Values and Bioclassification.

Site#	Creek	Date	County	Road	S/SEPT	Rating
B-2	Peachtree Cr	940712	Cherokee	SR 1537	-/37	Excellent
B-9	Valley R	940711	Cherokee	SR 1554	77/29	Good-Fair
B-10	Junaluska Cr	940711	Cherokee	SR 1505	-/25	Good-Fair
B-12	Hanging Dog Cr	940712	Cherokee	SR 1331	-/46	Excellent
B-13	Nottely R	940712	Cherokee	SR 1596	-/36	Excellent
B-14	Persimmon Cr	940712	Cherokee	SR 1127	-/42	Excellent
B-15	Beaverdam Cr	940830	Cherokee	SR 1326	-/39	Excellent
B-16	South Shoal Cr	940830	Cherokee	SR 1314	-/30	Good
B-17	Shuler Cr	940830	Cherokee	SR 1323	-/35	Good

Special Studies

Data from all special studies since 1983 are presented in Table 4.9. This portion of the Hiwassee River may be stressed by flow fluctuation due to upstream hydroelectric power dams (Chatuge and Mission) and sedimentation from nonpoint runoff. The biological rating of this stream has increased since the initial survey in 1983 (Good-Fair to Good). This site was not sampled in 1994 due to very high flow conditions. The Hiwassee River at Murphy also is an ambient monitoring location.

Table 4.9 Benthic Macroinvertebrate Special Studies, Hiwassee Subbasin 04-05-02, 1983-1994.

Site#	Creek	Date	Study	County	Road	S:Rating
B-1	Hiwassee R	900808	BMAN	Cherokee	US 64 nr Murphy	38/78:Good
		870806				35/78:Good
		860722				32/65:Good-Fair
		850708				26/56:Good
		840820				29/67:Good
		830815				23/62:Good-Fair

The DWQ Biological Assessment Group received a request from the DWQ Instream Assessment Unit for additional information on the effects of the Andrews WWTP on the Valley River (Table 4.10). This survey revealed unexpected water quality problems in the Valley River near Andrews. The headwater areas (including Junaluska Creek) were rated as Good-Fair with evidence of some

sediment problems. The Valley River between Stewart Road and a site about 3 miles below Andrews, however, was rated Fair with evidence of toxicity problems. There was no evidence that the Andrews WWTP contributed to these problems. The site above the WWTP showed the most severe water quality problems. There are no permitted dischargers in the area where the problem originates.

Junaluska Creek is a small tributary stream of the Valley River. It was initially chosen as a basin assessment site because there was no prior data from this region of the subbasin. Junaluska Creek is bordered by SR 1505 from its headwaters to the Town of Andrews. This could be a factor contributing to its Good-Fair bioclassification. Intolerant EPT species numbers were low at this site and the rocks were "clean", indicating impact by scour.

Table 4.10 Valley River above and below the Town of Andrews WWTP, 1985 - 1994.

Site#	Creek	Date	Study	County	Road	S:Rating
B-3	Valley R	940831	Andrews WWTP	Cherokee	near Rhodo off NC19	-/23:Good-Fair
B-4	Valley R	940831	Andrews WWTP	Cherokee	Stewart Rd, SR 1389	-/15:Fair
B-5	Valley R	940830	Andrews WWTP	Cherokee	Main St, Andrews	40/6:Fair
B-6	Valley R	940830	Andrews WWTP	Cherokee	SR 1515 ab Marble	57/16:Fair
B-7	Valley R	850808	Andrews WWTP	Cherokee	ab Andrews WWTP	76/33:Good-Fair
B-8	Valley R	850808	Andrews WWTP	Cherokee	be Andrews WWTP	75/30:Good-Fair
B-10	Junaluska Cr	940831	Andrews WWTP	Cherokee	SR 1505, first bridge	-/25:Good-Fair

Potential HQW/ORW Streams

A number of streams or stream reaches that were classified as WS-I were identified as not being utilized as water supply sources. It was proposed that these areas be reclassified to C-HQW. Based on benthic macroinvertebrate and physical/chemical data, Britton Creek was recommended for reclassification and was reclassified in August 1992.

Based on data collected from summer 1994 surveys, Peachtree Creek, Hanging Dog Creek, Persimmon Creek and Beaverdam Creek may qualify for ORW/HQW reclassification.

Fisheries

Fish tissue samples were collected at 2 sites within the Hiwassee 04-05-02 subbasin, and are summarized below and in Appendix III.

Station	Years Sampled	# Samples	# Samples exceeding criteria	Criteria exceeded
Hiwassee R at Hiwassee	1981	2	0	NA
Lake Hiwassee	1985 and 1986	11	0	NA

Aquatic Toxicity Monitoring

Three facilities in this subbasin currently monitor effluent toxicity per permit requirements. These facilities are:

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Andrews WWTP	NC0020800/001	Valley R	Cherokee	1.500	13.00
Clifton Precision South Division	NC0080683/001	Slow Cr	Cherokee	0.300	46.00
Murphy WWTP	NC0020940/001	Hiwassee R	Cherokee	0.925	1.50

Whole effluent toxicity monitoring results for all dischargers in the Hiwassee basin are presented in Appendix III. None of these facilities has obtained regulatory relief for toxicity limits through a special or judicial order.

Lakes Assessment Program

Hiwassee Lake

Hiwassee Lake is located on the Hiwassee River near the North Carolina-Tennessee state border. Chatuge Lake is located upstream of Hiwassee Lake and Apalachia Lake is immediately downstream. Hiwassee Lake, which is owned by the Tennessee Valley Authority (TVA) was built between 1936 and 1940 to provide hydroelectric power, flood control and recreation. The maximum depth of the reservoir is 308 feet (94 meters) and the surface area is 6275 acres (2539 hectares). The length of the reservoir is 22 miles (35 kilometers) with 163 miles (262 kilometers) of shoreline at full pool elevation. The major tributaries are the Hiwassee River, Nottely River, Persimmon Creek, Valley River, Hanging Dog Creek, and Bearpaw Creek. The steeply sloped, forested watershed measures 968 mi^2 (2507 km^2). Hiwassee Lake is classified B.

The reservoir was most recently sampled by DWQ on August 30, 1994. There were three violations of the state water quality standard for dissolved gasses near the Grape Creek Arm in the vicinity of the Bearpaw Creek Arm and the Chambers Creek Arm. Ammonia ranged from 0.02 to 0.06 mg/l and nitrite plus nitrate ranged from 0.005 to 0.04 mg/l. The higher values of these two nutrients was observed at the sampling site near the Nottely Creek Arm (for ammonia) and near the Chambers Creek arm (for nitrite plus nitrate). The NCTSI score for 1994 was -3.5, indicating oligotrophic conditions. Hiwassee Lake is fully supported its designated uses.

Hiwassee Lake was one of sixteen lakes selected throughout the state as representative of minimally impacted lakes. This lake was sampled three times per summer from 1991 through 1993. Hiwassee Lake had a consistently low NCTSI score and was oligotrophic during the three years of the monitoring program.

Phytoplankton samples were collected during the summer months from 1991-1993. Algal biovolume and density estimates were generally low during most of the collecting period. However, some samples in 1991 showed moderate to high algal numbers. The predominance of particular species in these samples is usually indicative of soft, relatively unpolluted waters with a slightly acidic pH. Normally unpolluted waters are characterized by a diversity of species. The ecological significance of the dominance of these species is unclear. Overall the algal community during 1991-1993 was indicative of a deep oligotrophic lake.

Hiwassee Lake was previously sampled by DWQ in 1981, 1982 and 1988. In all years the NCTSI score indicated oligotrophic conditions.

Apalachia Lake

Apalachia Lake is a run-of-the-river reservoir located within the Nantahala National Forest. Located immediately downstream of Hiwassee Lake, this reservoir is owned by the Tennessee Valley Authority (TVA) and was built for hydroelectric power generation, flood control and recreation. Construction of the dam began in 1941 and was completed in 1943. Apalachia Lake has a maximum depth of 118 feet (36 meters), a length of 10 miles (16 kilometers), and 31 miles (50 kilometers) of shoreline at full pool elevation. The surface area is 1100 acres (445 hectares). Major tributaries to the lake include the Hiwassee River, Camp Creek, and North and South Shoal Creeks. The drainage area covers 1006 mi^2 (2605 km^2) of forested and mountainous terrain. This lake is classified B.

Apalachia Lake was most recently sampled by DWQ on August 30, 1994. At the time of sampling, water was being released from the Lake Hiwassee dam. The stretch of river between

Lake Hiwassee and Apalachia Lake is approximately one mile in length, therefore, the water released from Hiwassee Lake greatly affected the upstream portion of Apalachia Lake. The NCTSI score for Apalachia Lake in 1994 was -4.5, indicating oligotrophic conditions. The lake fully supported its designated uses.

Apalachia Lake was previously sampled in 1981 and 1987. In both years, the NCTSI score in indicated that the lake was oligotrophic.

4.4 USE-SUPPORT: DEFINITIONS AND METHODOLOGY

4.4.1 Introduction to Use Support

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses (*use support* status) is another important method of interpreting water quality data and assessing water quality. Use support assessments for the Hiwassee River basin are presented in Section 4.5.

Surface waters (streams, lakes or estuaries) are rated as either *fully supporting* (S), *support-threatened* (ST), *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 swimming) are fully supported, partially supported or are not supported. For instance, waters classified for fishing and water contact recreation (class C) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as ST, PS or NS, depending on the degree of exceedence.

Streams rated as either partially supporting or nonsupporting are considered *impaired.* A waterbody is fully supporting but threatened (ST) for a particular designated use when it fully supports that use now, but may not in the future unless pollution prevention or control action is taken. This rating describes waters for which actual monitored or evaluated data indicate an apparent declining trend (i.e., water quality conditions have deteriorated, compared to earlier assessments, but the waters still support uses). Although these waters are currently supporting uses, they are treated as a separate category from waters fully supporting uses. Streams which had no data to determine their use support were listed as non-evaluated (NE).

For the purposes of this document, the term *impaired* refers to waters that are rated either partially supporting or not supporting their uses based on specific criteria discussed more fully below. There must be a specified degree of degradation before a stream is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad.

4.4.2 Interpretation of Data

The assessment of water quality presented below involved evaluation of available water quality data to determine a water body's use support rating. In addition, an effort was made to determine likely causes (e.g., sediment or nutrients) and sources (e.g., agriculture, urban runoff, point sources) of pollution for impaired waters. Data used in the use support assessments include biological data, chemical physical data, lakes assessment data, DEH shellfish sanitation surveys, and monitoring data. Although there is a general procedure for analyzing the data and determining a waterbody's use support rating, each stream segment is reviewed individually, and best professional judgment is applied during these determinations.

Interpretation of the use support ratings compiled by DWQ should be done with caution. The methodology used to determine the ratings must be understood, as should the purpose for which the ratings were generated. The intent of this use-support assessment was to gain an overall picture of the water quality, how well these waters support the uses for which they were classified, and the relative contribution made by different categories of pollution within the basin. In order to comply with guidance received from EPA to identify likely sources of pollution for all impaired stream mileage, DWQ used the data mentioned above.

The data are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Since the assessment methodology is geared toward general conclusions, it is important to not manipulate the data to support policy decisions beyond the accuracy of these data. For example, according to this report, nonpoint source pollution is the greatest source of water quality degradation. However, this does not mean that there should be no point source control measures. All categories of point and nonpoint source pollution have the potential to cause significant water quality degradation if proper controls and practices are not utilized.

The threat to water quality from all types of activities heightens the need for point and nonpoint source pollution control. It is important to consider any source (or potential source) of pollution in developing appropriate management and control strategies. The potential for further problems remains high as long as the activity in question continues carelessly. Because of this potential, neglecting one pollution source in an overall control strategy can mask the benefits achieved from controlling all other sources.

4.4.3 Assessment Methodology - Freshwater Bodies

Many types of information were used to determine use support assessments and to determine causes and sources of use support impairment A use support data file is maintained for each of the 17 river basins. In these files stream segments are listed as individual records. All existing data pertaining to a stream segment (from the above list) is entered into it's record. In determining the use support rating for a stream segment, corresponding ratings are assigned to data values where this is appropriate. The following data and the corresponding use support ratings are used in the process: (note: The general methodology for using this data and translating the values to use support ratings corresponds closely to the 305(b) guidelines with some minor modifications.)

A. Biological Data

Benthic Macroinvertebrate Bioclassification

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPT). The bioclassifications are translated to use support ratings as follows:

Bioclassification	Rating
Excellent	Supporting
Good	Supporting
Good-Fair	Support Threatened
Fair	Partially Supporting
Poor	Not Supporting

Fish Community Structure

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a streams biological integrity by examining the structure and health of its fish community. The index

incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. The index is translated to use support ratings as follows:

NCIBI	Rating
Excellent	Supporting
Good-Excellent	Supporting
Good	Supporting
Fair-Good	Support Threatened
Fair	Support Threatened
Poor-Fair	Partially Supporting
Poor	Not Supporting
Very Poor - Poor	Not Supporting
Very Poor	Not Supporting

Phytoplankton and Algal Bloom Data

Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of alga may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. An algal sample with a biovolume larger than 5,000 mm3/m3, density greater than 10,000 units/ml, or chlorophyll a concentration approaching or exceeding 40 micrograms per liter (the NC state standard) constitutes a bloom. A waterbody is rated ST if the biovolume, density and chlorophyll a concentrations are approaching bloom concentrations. If an algal bloom occurs, the waterbody is rated PS.

B. Chemical/Physical Data

Chemical/physical water quality data is collected through the Ambient Monitoring System as discussed in section 4.2.7. This data is downloaded from STORET to a desktop computer for analysis. Total number of samples and percent exceedences of the NC state standards are used for use support ratings. Percent exceedences correspond to use support ratings as follows:

Standards Violation	Rating
Criteria exceeded < 10%	Fully Supporting
Criteria exceeded 11-25%	Partially Supporting
Criteria exceeded >25%	Not Supporting

C. Fish Consumption Advisory

Fish consumption advisories are issued by the Environmental Epidemiology Section. The advisories correspond to the use support ratings as follows:

Advisory	Rating
No Restriction	Fully Supporting
Restricted Consumption	Partially Supporting
No Consumption	Partially Supporting

D. Lakes Program Data

As discussed in section 4.2.3, assessments have been made for all publicly accessible lakes, lakes which supply domestic drinking water, and lakes where water quality problems have been observed.

E. Sources and Cause Data

In addition to the above data, existing information was entered for potential sources of pollution (point and nonpoint). It is important to note that not all impaired streams will have a potential source and/or cause listed for them. Staff and resources do not currently exist to collect this level of information. Much of this information is obtained through the cooperation of other agencies (federal, state and local), organizations, and citizens.

F. Point Source Data

Whole Effluent Toxicity Data
Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Streams that receive a discharge from a facility that have failed its whole effluent toxicity test may be rated ST (unless water quality data indicated otherwise), and have that facility listed as a Point Source potential source of impairment.

Daily Monitoring Reports
Streams which received a discharge from a facility significantly out of compliance with permit limits may be rated ST (unless water quality data indicated otherwise), and have that facility listed as a Point Source potential source of impairment.

G. Nonpoint Source Data

Information related to nonpoint source pollution (i.e., agricultural, urban and construction) was obtained from monitoring staff, other agencies (federal, state and local), land-use reviews, and workshops held at the beginning of each basin cycle.

H. Problem Parameters

Causes of use support impairment (problem parameters) such as sedimentation and low dissolved oxygen, were also identified for specific stream segments. For ambient water quality stations, those parameters which exceeded the water quality standard > 10% of the time for the review period were listed as a problem parameter. For segments without ambient stations, information from reports, other agencies, and monitoring staff were used if it was available.

I. Monitored vs. Evaluated

Assessments were made on either monitored (M) or evaluated (E) basis depending on the level of information that was used. A monitored basis represents monitored data which are less that five years old. An evaluated basis refers to monitored data older than five years, and/or the use of best professional judgment.

4.4.4 Assigning Use Support Ratings

At the beginning of each assessment, all data is reviewed by subbasin with the monitoring staff, and data is adjusted where necessary based on best professional judgment. Discrepancies between data sources are resolved during this phase of the process. For example, a stream may be sampled for both benthos and fish community structure, and the bioclassification may differ from the NCIBI (i.e., the bioclassification may be S while the NCIBI may be PS). To resolve this, the final rating may defer to one of the samples (resulting in S or PS), or, it may be a compromise between both of the samples (resulting in ST).

After reviewing the existing data, ratings are assigned to the streams. If one data source exists for the stream, the rating is assigned based on the translation of the data value as discussed above. If

more than one source of data exists for a stream, the rating is assigned according to the following hierarchy:

Fish Consumption Advisories
Benthic Bioclassification / Fish Community Structure
Chemical/Physical Data
Monitored Data > 5 years old
Compliance / Toxicity Data

This is only a general guideline for assigning use support ratings and not meant to be restrictive. Each segment is reviewed individually and the resulting rating may vary from this process based on best professional judgment which takes into consideration site specific conditions.

After assigning ratings to streams with existing data, streams with no existing data were assessed. Streams that were direct or indirect tributaries to streams rated S or ST received the same rating (with an evaluated basis) if they had no known significant impacts, based on a review of the watershed characteristics and discharge information. Streams that were direct or indirect tributaries to streams rated PS or NS were assigned a Not Evaluated (NE) rating.

4.5 USE SUPPORT RATINGS FOR THE HIWASSEE RIVER BASIN

Use support ratings and background information for all monitored stream segments are presented in Table 4.11. Ratings for all monitored and evaluated surface waters are presented on color-coded maps in Figure 4.4.

4.5.1 Streams and Rivers

Of the 989 miles of streams and rivers in the Hiwassee River basin, use support ratings were determined for 81% or 797 miles with the following breakdown:

SUPPORTING	78%	
	Fully supporting:	64%
	Support-threatened:	14%
IMPAIRED	3%	
	Partially supporting:	3%
	Not supporting:	0%
NOT EVALUATED:	19%	

These use support values are different from the values in the 1992-1993 305(b) Report. The total waters supporting their uses appear to have increased, while those that are impaired appear to have decreased. While the water quality may have improved since the 1992-1993 305(b) report, the changes in values may also be due to the following:

- Methodology for determining use support has been altered. In the 1992-1993 305(b) Report, evaluated information from older reports and workshops were included in the use support process. Streams rated using this information were considered to be rated on an evaluated basis. In the current use support process, this older, evaluated information has been discarded, and streams are now rated using only monitored information (including current and older monitoring data), or evaluated based on being a tributary to a stream that is monitored.

- The basinwide process allows for concentrating more resources on individual basins during the monitoring phase. Therefore, more streams were monitored, and more information was available to use in the use support process.

Although the majority of the streams have good to excellent bioclassifications and very few standards were violated at the ambient stations, nonpoint source effects such as increased sedimentation, were evident at many of the sampling sites. Table 4.11 provides information on streams and stream segments that were monitored. This includes bioclassification and collection date for macroinvertebrate samples, ambient monitoring station information, problem parameters such as sediment, potential sources of pollution (point or nonpoint), and the overall use support rating. Table 4.12 and Figure 4.5 present the use support determinations by subbasin.

Impaired Waters

Only two streams were given an impaired rating of partially supporting. In Subbasin 04-05-01, 8.5 miles of Brasstown Creek received a bioclassification of Fair which resulted in a partially supporting rating. This creek originates in north Georgia and is impacted by nonpoint source run-off, as it flows along NC 66 for most of its length. All tributaries to Brasstown Creek which were not monitored were given a Not Evaluated (NE) rating.

In Subbasin 04-05-02, the Valley River between Stewart Road and a site about 3 miles below Andrews received a bioclassification of Fair, which resulted in a partially supporting rating. This 19.6 mile stretch of the river showed evidence of toxicity problems although there are no permitted dischargers in the area where the problem originates. All tributaries to this section of the Valley River which were not monitored were given a Not Evaluated (NE) rating.

Lakes

Chatuge Lake, Hiwassee Lake and Apalachia Lake were all sampled in August 1994 and found to be supporting their designated uses (Table 4.13).

Table 4.11 Monitored Stream Sites in the Hiwassee River Basin.

Station Number	Station Location	Classification	Index Number	Miles	Chem. Rating 90-94	<----Biological Rating----> 1990	1991	1992	1993	1994	OVERALL/WARNING RAT Prob. Param.	Use Support	Major Source
40501													
	Shooting Cr, SR 1349, SR 1168, SR 1347, Clay	C Tr	1-5	5.0						Excellent	Sed	S	NP
	Tusquitee Cr, SR 1330, Clay	C Tr HQW	1-21-(4.5)	5.8						Excellent		S	
	Big Tuni Creek at FS Rd 440 & SR 1311, Clay	C Tr HQW	1-21-5	6.4						Excellent		S	
	Fires Cr,Bristol Camp, Picnic Area, & SR 1300, Clay	WS-IV Tr ORW	1-27-(5.5)	8.8						Excellent		S	
	Little Fires Cr, FS Rd nr mouth, Clay	WS-IV Tr ORW	1-27-7	2.9			Excellent				Sed	S	NP
	Brasstown Cr, SR 1104, Clay	WS-IV	1-42	8.5						Fair		PS	
40502													
03548500	Hiwassee River US 64, nr Murphy, Cherokee	WS-V	1-(43.7)	3.1	S	Good						S	
	Peachtree Cr, SR 1537, Cherokee	C	1-44	8.3						Excellent		S	
	Valley River, off US 19, nr Rhodo, Cherokee	C Tr	1-52a	4.6						Good-Fair		ST	
	Valley R. above Andrews, Main St Andrews ab WWTP,	C Tr	1-52b	19.6						Fair		PS	
	ab landfill off US 19, Cherokee												
3550000	Valley R. SR 1554 nr Tomatla, Cherokee	C Tr	1-52c	4.7	S	Good				Good-Fair		ST	
	Junaluska Cr. SR 1505, Cherokee	C Tr	1-52-25	7.4						Good-Fair		ST	
	Britton Cr, off FS Rd nr SR 1339, Cherokee	C HQW	1-52-29-(1)	0.9			Excellent					S	
	Hanging Dog Cr, SR 1331, Cherokee	C	1-57	12.8						Excellent		S	
	Nottely River, SR 1596, Cherokee	C	1-58	18.7						Excellent		S	NP
	Persimmon Cr, SR 1127, Cherokee	C	1-63	9.1						Excellent		S	
	Beaverdam Creek, SR 1326, Cherokee	C Tr	1-72	6.4						Excellent		S	
	South Shoal Cr, SR 1314, Cherokee	C Tr	1-77	11.9						Good		S	
	Shuler Creek, SR 1323, Cherokee	C	1-86	12.2						Good		S	NP

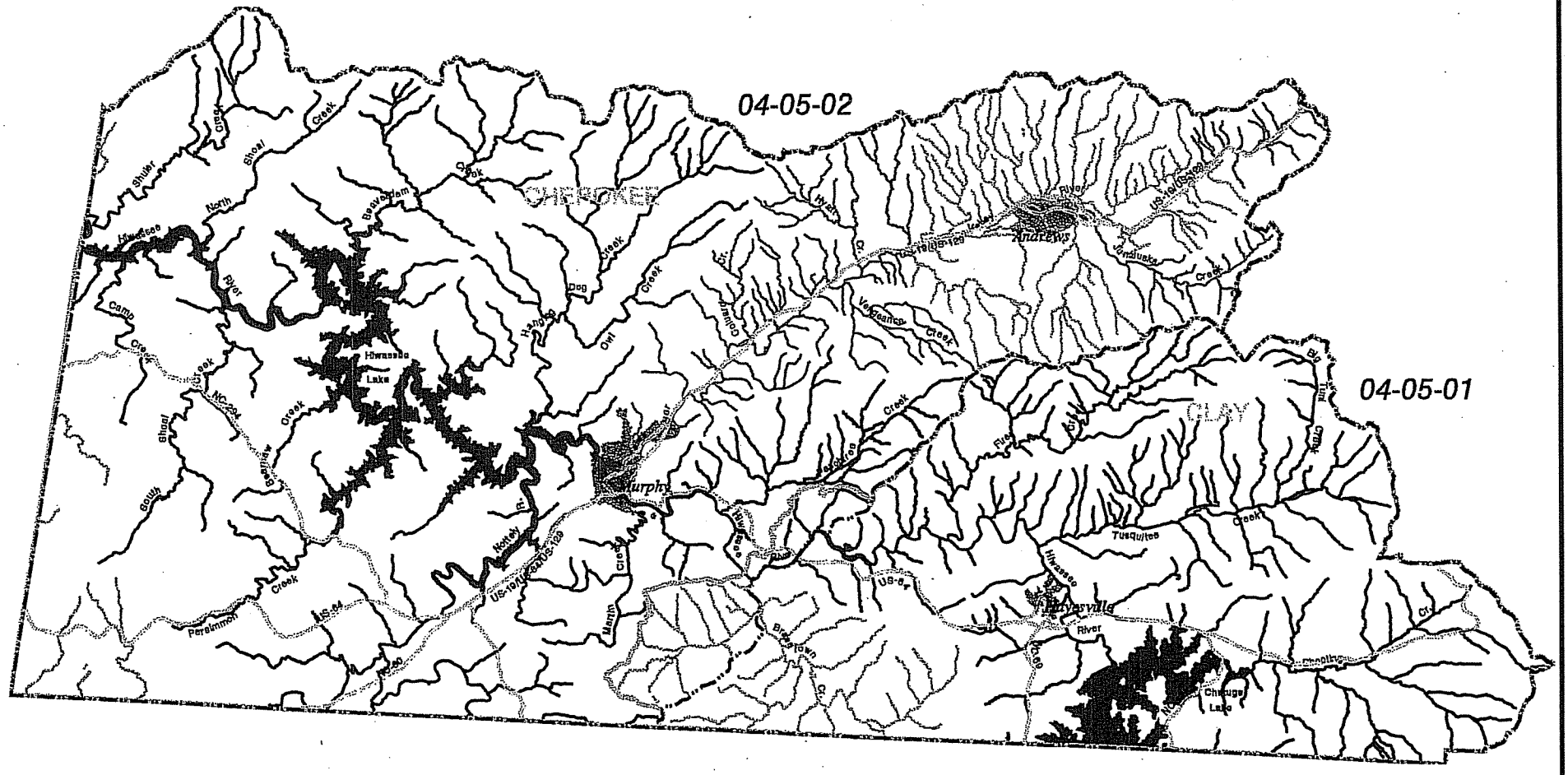

Figure 4.4 Use Support Map for the Hiwassee River Basin

LEGEND

- Supporting
- Support Threatened
- Partially Supporting
- Not Evaluated
- County Boundary
- Primary Roads
- Basin / Subbasin Boundary

VICINITY MAP

N
W E
S

1:270,000

2 0 2 4 6 8 Miles

Division of Water Quality
November 1996

Table 4.12 Overall Use Support Status for Streams (Miles) by Subbasin for Hiwassee River Basin (1990 - 1994)

Subbasin	Support	Support Threatened	Partially Supporting	Not Supporting	Not Evaluated	Total Miles
04-05-01	288.8	0.0	8.5	0.0	49.5	346.8
04-05-02	340.9	139.4	19.6	0.0	142.8	642.7
Total	629.7	139.4	28.1	0.0	192.3	989.5
Percentage	64%	14%	3%	0%	19%	

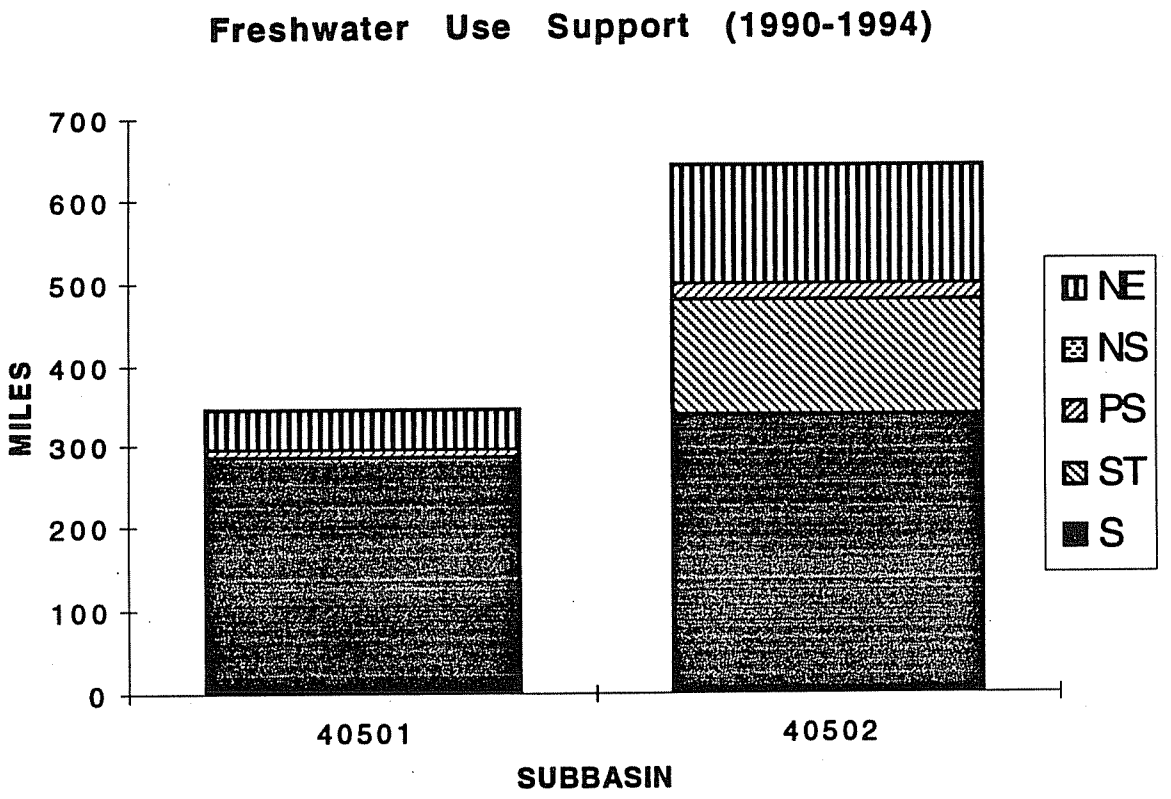

Figure 4.5 Use Support for Hiwassee River Basin

Table 4.13 Monitored Lakes in the Hiwassee River Basin

LAKE NAME	COUNTY NAME	Subbasin	SIZE (acres)	CLASS	OVERALL USE	FISH CONSUMP.	AQ. LIFE & SECONDARY CONTACT	SWIMMING	DRINKING WATER	TROPH STATUS
CHATUGE LAKE (NC portion)	CLAY	40501	6950	B	FULL	FULL	FULL	FULL	n/a	MESOTROPHIC
HIWASSEE RESERVOIR	CHEROKEE	40502	6275	B,C	FULL	FULL	FULL	FULL	n/a	OLIGOTROPHIC
APALACHIA LAKE	CHEROKEE	40502	1100	B	FULL	FULL	FULL	FULL	n/a	OLIGOTROPHIC

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CHAPTER 5

WATER QUALITY PROGRAMS AND PROGRAM INITIATIVES IN THE BASIN

5.1 INTRODUCTION

This chapter summarizes the programs available for protecting water quality and addressing water quality problems in the Hiwassee River Basin. It also includes a number of important initiatives being implemented by federal, state, local and private interests. **Section 5.2** summarizes the state and federal legislative authorities developed to protect water quality. **Section 5.3** presents the water quality standards and classifications program. **Sections 5.4 and 5.5**, respectively, present existing point and nonpoint source pollution control programs. A more complete description of these programs can be found in Appendix VI. **Section 5.6** presents water quality program initiatives that have been implemented within the basin. **Section 5.7** discusses integration of point and nonpoint source control management strategies and introduces the concept of *total maximum daily loads* (TMDLs). **Section 5.8** presents potential sources of funding for water quality projects.

5.2 STATE AND FEDERAL LEGISLATIVE AUTHORITIES FOR NORTH CAROLINA'S WATER QUALITY PROGRAM

Authorities for some of the programs and responsibilities carried out by the Water Quality Section are derived from a number of federal and state legislative mandates outlined below. The major federal authorities (Section 5.2.1) for the state's water quality program are found in sections of the Clean Water Act (CWA). State authorities listed in Section 5.2.2 are from state statutes.

5.2.1 Federal Authorities for NC's Water Quality Program

- **Section 301** - Prohibits the discharge of pollutants into surface waters unless permitted by EPA.
- **Section 303(c)** - States are responsible for reviewing, establishing and revising water quality standards for all surface waters.
- **Section 303(d)** - Each state shall identify those waters within its boundaries for which the effluent limits required by section 301(b)(1) A and B are not stringent enough to protect any water quality standards applicable to such waters.
- **Section 305(b)** - Each state is required to submit a biennial report to the EPA describing the status of surface waters in that state.
- **Section 319** - Each state is required to develop and implement a nonpoint source pollution management program.
- **Section 402** - Establishes the National Pollutant Discharge Elimination System (NPDES) permitting program. Allows for delegation of permitting authority to qualifying states (includes North Carolina).
- **Section 404/401** - Section 404 regulates the discharge of fill materials into navigable waters and adjoining wetlands unless permitted by the US Army Corps of Engineers. Section 401 requires the Corps to receive a state Water Quality Certification prior to issuance of a 404 permit.

5.2.2 State Authorities for NC's Water Quality Program

- **G.S. 143-214.1** - Directs and empowers the NC Environmental Management Commission (EMC) to develop a water quality standards and classifications program.
  G.S. 143-214.2 - Prohibits the discharge of wastes to surface waters of the state without a permit.
- **G.S. 143-214.5** - Provides for establishment of the state Water Supply Watershed Protection Program.
- **G.S. 143-214.7** - Directs the EMC to establish a Stormwater Runoff Program.
- **G.S. 143-215** - Authorizes and directs the EMC to establish effluent standards and limitations.
- **G.S. 143-215.1** - Outlines methods for control of sources of water pollution (NPDES and nondischarge permits, statutory notice requirements, public hearing requirements, appeals, etc.).
- **G.S. 143-215.1** - Empowers the EMC to issue *special orders* to any person whom it finds responsible for causing or contributing to any pollution of the waters of the state within the area for which standards have been established.
- **G.S. 143-215.3(a)** - Outlines additional powers of the EMC including provisions for adopting rules, charging permit fees, delegating authority, investigating fish kills and investigating violations of rules, standards or limitations adopted by the EMC.
- **G.S. 143-215.6A, 143-215.6B and 143-215.6C** - Includes enforcement provisions for violations of various rules, classifications, standards, limitations, provisions or management practices established pursuant to G.S. 143-214.1, 143-214.2, 143-214.5, 143-215, 143-215.1, 143-215.2. 6A describes enforcement procedures for civil penalties. 6B outlines enforcement procedures for criminal penalties. 6C outlines provisions for injunctive relief.
- **G.S. 143-215.75** - Outlines the state's Oil Pollution and Hazardous Substances Control Program.

5.3 Surface Water Classifications and Water Quality Standards

Program Overview

North Carolina has established a water quality classification and standards program pursuant to G.S. 143-214.1. Classifications and standards are developed pursuant to 15A NCAC 2B. 0100 - Procedures for Assignment of Water Quality Standards. Waters were classified for their "best usage" in North Carolina beginning in the early 1950's, with classification and water quality standards for all the state's river basins adopted by 1963. The effort to accomplish this included identification of waterbodies (which included all named waterbodies on USGS 7.5 minute topographic maps), studies of river basins to document sources of pollution and appropriate best uses and formal adoption of standards/classifications following public hearings.

The Water Quality Standards program in North Carolina has evolved over time and has been modified to be 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. Classifications and standards are applied to provide protection of uses from both point and nonpoint source pollution.

Statewide Classifications

Appendix II summarizes the state's primary and supplemental classifications including, for each classification, the best usage, key numeric standards, stormwater controls and other requirements as appropriate. This information is derived from 15A NCAC 2B .0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina.

Primary Classifications

Under this system, all surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water body (e.g., aquatic life support and swimming). Primary freshwater classifications include the following: *C*, *B* and *WS* (Water Supply) *I* through *WS-V*. The WS freshwater classifications may also include a *CA* designation which stands for critical area. The critical area is an area in close proximity to a water supply intake and/or the shoreline of the reservoir in which it is located. Primary saltwater classifications include *SC*, *SB* and *SA*. SC and SB are saltwater counterparts to the freshwater C and B classifications. SA is a classification assigned to waters used for shellfish harvesting. SA, WS-I and WS-II are also, by definition, considered to be High Quality Waters, as discussed below.

Supplemental Classifications

In addition to primary classifications, surface waters may be assigned a supplemental classification. The supplemental classifications include *HQW* (High Quality Waters), *ORW* (Outstanding Resource Waters), *NSW* (Nutrient Sensitive Waters), *Tr* (Trout Waters) *FWS* (Future Water Supply) and *Sw* (Swamp Waters). Most of these have been developed in order to afford special protection to sensitive or highly valued resource waters. Therefore, while all surface waters are assigned a primary classification, they may also have one or more supplemental classifications. For example, a typical freshwater stream in the mountains might have a C Tr classification where C is the primary classification followed by the Tr supplemental classification.

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 the water body 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 C and SC waters establish the basic protection level for all state surface waters. With the exception of Sw, all of the other primary and supplemental classifications have more stringent standards than for C and SC and therefore require higher levels of protection.

High Quality Waters

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.

In an effort to protect waters that possess such characteristics, surface waters in the following categories qualify for classification as High Quality Waters or HQW:

1) waters rated as Excellent based on chemical and biological sampling (Division of Water Quality (DWQ) assigns water quality ratings to North Carolina's surface waters based on biological and chemical data);
2) streams designated by the Wildlife Resources Commission as native and special native trout waters or primary nursery areas;
3) waters designated as primary nursery areas by the Division of Marine Fisheries; and

4) critical habitat areas designated by the Wildlife Resources Commission or the Department of Agriculture. Waters classified by the Division of Water Quality as WS-I, WS-II and SA are HQW by definition, but these waters are not specifically assigned the HQW classification because the standards for WS-I, WS-II and SA waters are at least as stringent as those for waters classified as HQW.

Special HQW protection management strategies are presented in 15A NCAC 2B.0201(d), and implemented through 15A NCAC 2B .0224. Copies of these rules can be found in Appendix II. These measures are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater discharge facilities and facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

For nonpoint source pollution, development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control program approved in accordance with 15A NCAC 4B . 0218, and which drain to and are within one mile of HQWs will be required to control runoff from the development using either a low density or high density option described in 15A NCAC 2H. 1006. In addition, the Division of Land Quality requires more stringent sedimentation controls for land disturbing projects within one mile and draining to HQWs.

Outstanding Resource Waters

A small percentage of North Carolina's surface waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource. The Outstanding Resource Waters rule defines outstanding resource values as:

1) outstanding fishery resource;
2) a high level of water-based recreation;
3) a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
4) being within a state or national park or forest; or 5) having special ecological or scientific significance.

The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to North Carolina ORWs are set forth in 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted, and stormwater controls for most new development are required. In some circumstances, the unique characteristics of the waters and resources that are to be protected require that a specialized (or customized) ORW management strategy be developed.

5.4 NORTH CAROLINA'S POINT SOURCE CONTROL PROGRAM

North Carolina does not allow point source discharges without a permit. Discharge permits are issued under the authority of North Carolina General Statute (NCGS) 143.215.1 and the National Pollutant Discharge Elimination System (NPDES) program. The NPDES program was delegated to North Carolina from the US Environmental Protection Agency. These permits serve as both state and federal permits. North Carolina has a comprehensive NPDES program which includes the permitting of both wastewater and stormwater discharges. Refer to Appendix VI for a full program description and Appendix I for the Organizational Duties Flow Chart for the DWQ Water Quality Section.

NPDES permits are issued in two categories; individual or general. Individual permits are issued to a specific facility and contain site specific requirements and incorporate recommendations from the basinwide water quality management plan. Individual NPDES permits are typically issued for

a five year cycle with all permits in a river basin expiring at the same time. This permitting strategy allows for comprehensive review of individual dischargers within the basin and implementation of recommendations contained in the basinwide water quality management plan. New discharge permits issued during an interim period are given a shorter cycle so that expiration coincides with the basin permitting cycle. Individual permits in the Hiwassee River basin are scheduled for expiration and renewal in December 1997.

General permits are developed for a general type of industry and contain permit requirements that are appropriate for a typical facility within a specific industrial classification. Facilities engaged in the specific industrial activities are eligible for permit coverage under the general permit. Facilities that are deemed to be atypical or have a history of water quality problems are required to obtain an individual permit. Because general permits are specific to a type of industrial activity and are issued statewide they do not contain basin specific measures. A general permit is typically issued for a five year cycle, which expires statewide on the same date.

5.4.1 NPDES Permits for Wastewater Discharges

Under the NPDES wastewater permitting program, each NPDES discharger is assigned either *major* or *minor* status. For municipalities, all dischargers with a flow of greater than 1 million gallons per day (MGD) are classified as major. There is only one major discharger (Town of Andrews) in the Hiwassee River basin.

All new wastewater discharge permit applications must include an engineering proposal which includes a description of the origin, type, and flow of wastewater, a summary of waste treatment and disposal options, and a narrative description of the proposed treatment works and why the proposed system and point of discharge were selected. The summary must contain sufficient detail to assure that the most environmentally sound alternative was selected from the reasonably cost effective options. An assessment report describing the impact on waters in the area must be submitted for all applications of new discharges in excess of 500,000 gallons per day or 10 million gallons per day of cooling water or any other proposed discharge of 1 million gallons per day or more.

Under the NPDES program, wastewater treatment systems must be operated by a certified operator. Training and certification of operators is conducted by DWQ. It is the goal of the program to provide competent and conscientious professionals that will protect both the environment and public health.

The amount or loading of specific pollutants that are allowed to be discharged into surface waters are defined in the NPDES permit and are called *effluent limits*. Point source discharges generally have the most impact on a stream during low flow conditions when the percentage of treated effluent within the stream is greatest. Effluent limits are generally set to protect the stream during these low flow conditions. The standard low flow used for determining point source impacts is called the *7Q10*. This is the lowest flow which occurs over seven consecutive days and which has an average recurrence of once in ten years. Computer modeling may be used to determine the fate and transport of pollutants, reduction goals for contaminants, and to derive effluent limits for NPDES permits. A wasteload allocation is performed to ensure the effluent limits are set at levels that can be safely assimilated by the receiving stream.

Most dischargers are required to periodically sample their treated effluent. This process is called self-monitoring. Larger and more complex dischargers are also required to sample both upstream and downstream of the discharge point. NPDES facilities are required to monitor for all pollutants for which they have permit limits as well as other pollutants which may be present in their wastewater. Sampling results are submitted to DWQ each month for compliance evaluations. If

limits are not being met, various legal actions may be taken against the discharger to ensure future compliance.

All domestic wastewater dischargers are required to monitor flow, dissolved oxygen, temperature, fecal coliform, BOD, ammonia, and chlorine (if they use it as a disinfectant). In addition, wastewater treatment facilities with industrial sources may have to monitor for chemical specific toxicants and/or whole effluent toxicity, and all dischargers with design flows greater than 50,000 gallons per day (GPD) monitor for total phosphorus and total nitrogen. Minimum NPDES wastewater monitoring requirements are provided in 15A NCAC 2B .0500.

Other methods of collecting point source information include effluent sampling by DWQ during inspections and special studies. The regional offices may collect data at a given facility if they believe there may be an operational problem or as a routine compliance check. DWQ may collect effluent data during intensive surveys of segments of streams. Extensive discharger data have been collected during on-site toxicity tests.

A pretreatment program is aimed at protecting municipal wastewater treatment plants and the environment from the adverse impacts that may occur when hazardous or toxic wastes are discharged into a public system. This program requires that businesses and other entities that use or produce toxic wastes pretreat their wastes prior to discharging into a public wastewater system.

5.4.2 NPDES Permits Stormwater Discharges

As currently defined by the NPDES program, stormwater point source discharges originate from two distinct sources; municipalities and selected industrial facilities. Subject municipalities are defined as those incorporated areas that encompass a population of 100,000 or more. There are currently no municipalities in the Hiwassee River basin that are subject to NPDES stormwater permitting.

Stormwater discharges directly related to manufacturing, processing or raw materials storage areas at industrial plants are also subject to NPDES stormwater permitting. A complete definition of "stormwater discharge associated with industrial activity" including a comprehensive listing of subject industries can be found in 40 CFR 122.26. The types of industrial activities that are subject to permitting are typically defined by Standard Industrial Classification (SIC) codes. SIC codes have been developed by the federal Office of Management and Budget to define industries in accordance with the composition and structure of the economy.

There are currently 19 general stormwater permits available for specific types of industrial activities across the state. In the Hiwassee River basin, all of the sixteen issued stormwater discharge permits are general permits. These sixteen permittees fall into eight specific types of industrial activities covered by general permits. As previously explained, the general permits define stormwater controls and monitoring for a typical facility within an industrial classification. General stormwater permits incorporate requirements determined to be appropriate based upon an analysis of available analytical monitoring data, input from industry and associations, site visits, and review of federal and other documents providing guidance on specific types of industries, pollutants and stormwater discharges.

General permits may specify monitoring and reporting requirements for both quantitative and qualitative assessment of the stormwater discharge as well as operational inspections of the entire facility, including all stormwater systems. The specific pollutant parameters for which sampling must be performed are based upon the types of materials used and produced in the manufacturing processes and the potential for contamination of the stormwater runoff at a typical facility.

All NPDES stormwater permits require the development and implementation of a Stormwater Pollution Prevention Plan (SPPP). The SPPP requires the permitted facility to develop a comprehensive stormwater management plan. This plan is the basis for evaluating the pollution potential of the site and implementing best management practices (BMPs) to reduce pollutants in runoff from the site.

All stormwater permits specify qualitative monitoring of each stormwater outfall for the purposes of evaluating the effectiveness of the Stormwater Pollution Prevention Plan and assessing new sources of stormwater pollution. Qualitative monitoring parameters include color, odor, clarity, floating and suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution.

Stormwater permits may provide for the use of cut-off concentrations in order to minimize the required analytical monitoring for facilities which are not significant contributors to stormwater pollution. These cut-off concentrations are not intended to be effluent limits (as used in wastewater permitting), but to provide guidelines for determining which facilities are major contributors to stormwater pollution and need further monitoring. The arithmetic mean of all monitoring data collected during the term of the permit must be calculated for each parameter and compared to the permitted cut-off concentration. If the mean is below the cut-off concentration, then the facility may discontinue analytical monitoring for that parameter until the final year of the permit. This approach inhibits facilities from using the cut-off concentrations as target concentrations for purposes of evaluating the effectiveness of the Stormwater Pollution Prevention Plan while ensuring that problem facilities continue to collect analytical information on their discharges.

5.5 NONPOINT SOURCE CONTROL PROGRAMS

When rainfall or snowmelt washes off an undisturbed natural area, it contains few pollutants and a significant portion of it infiltrates into the ground. This infiltration process cleanses, reduces and delays runoff. However, human disturbances of land often cause runoff of pollutants into surface waters. For instance, runoff from agricultural lands can include fertilizers, sediment and pesticides; runoff from roads and parking lots in urban areas can include petroleum products and toxic substances (these impervious surfaces also increase flow volume and velocity); construction activities can cause runoff of sediment, etc. These are examples of *nonpoint source* (NPS) pollution. Unlike effluent from a wastewater treatment plant, NPS pollution often originates from harder to identify, widely dispersed areas.

In addition to over-land runoff, some NPS pollution originates from the atmosphere, such as acid deposition. Some of the most common nonpoint sources of pollution and their causes are presented in Chapter 3.

The two approaches that are used to address nonpoint source pollution are prevention and engineered controls. Some of the methods of pollution prevention include minimizing built-upon areas, protection of sensitive areas, optimum site planning, use of natural drainage systems rather than curb and gutter, nutrient management plans, public/farmer education, storm drain stenciling, and hazardous waste collection sites. It is generally more cost-effective to prevent and minimize pollution than to build engineered controls. For example, developers who are subject to stormwater requirements often choose to build low density developments rather than bearing the expense of building engineered BMPs. Engineered BMPs also have on-going expenses associated with long-term operation and maintenance.

Engineered BMPs generally work by capturing, retaining, and treating runoff before it leaves an area. Some commonly used types of BMPs include stormwater wetlands, wet detention ponds, water control structures, bioretention areas, and infiltration basins. Often higher levels of pollutant

removal can be achieved by using a combination of different control systems. The main advantage of engineered controls is that they can treat runoff from high density developments.

The current trend is toward a more comprehensive "systems approach" to managing nonpoint source pollution. This involves using an integrated system of preventive and control practices to accomplish nonpoint pollution reduction goals. This approach emphasizes site planning, protecting important natural areas such as wetlands, and finding the most cost-effective engineered controls for high density areas. Programs which are currently using the systems approach include the animal waste regulations and the regulations for coastal stormwater management and water supply watersheds. In general, the goals of the nonpoint source management program include the following:

1. Continue to build and improve existing programs,
2. Develop new programs to control nonpoint pollution sources that are not addressed by existing programs,
3. Continue to target geographic areas and waterbodies for restoration and protection,
4. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico Estuarine Study, Clean Water Trust Fund, Wetlands Restoration Program) and
5. Monitor the effectiveness of BMPs and management strategies, both for surface and groundwater quality.

Table 5.1 lists a number of federal and state programs that address nonpoint source pollution. These programs are listed by category based on the type of activity. A complete program description can be found in Appendix VI for nonpoint source control programs. Refer to Table 5.2 for a brief description of each program and the contact persons within the basin for each program.

Table 5.1 List of Nonpoint Source Programs

PROGRAM	LOCAL	STATE	FEDERAL
AGRICULTURE:			
Agriculture Cost Share Program	SWCD	SWCC, DSWC	
N.C. Pesticide Law of 1971		NCDA	
Pesticide Disposal Program		NCDA	
Animal Waste Management	SWCD	DWQ,DSWC, CES	NRCS
Laboratory Testing Services		NCDA	
Watershed Protection (PL-566)			NRCS
1985 ,1990 and 1995 Farm Bills			USDA
- Conservation Reserve Program; Conservation Compliance; Sodbuster/Swampbuster; Conservation Easement; Wetland Reserve; Water Quality Incentive Program			
URBAN			
Coastal Stormwater Program		DWQ	
ORW, HQW, NSW Management Strategies		DWQ	
Water Supply Watershed Protection Program	city, county	DWQ	
Stormwater Control Program	city, county	DWQ	EPA
CONSTRUCTION			
Sedimentation and Erosion Control	ordinance	DLR, DOT	
Coastal Area Management Act	ordinance	DCM	
Coastal Stormwater Program		DWQ	
ON-SITE WASTEWATER DISPOSAL			
Sanitary Sewage Systems Program	county	DEH	
SOLID WASTE DISPOSAL			
Resource Conservation and Recovery Act			EPA
Solid Waste Management Act of 1989	city, county	DSWM	
FORESTRY			
Forest Practice Guidelines		DFR	
National Forest Management Act			NFS
Forest Management Program Services		DFR	
Forestry Best Management Practices		DFR	
Forest Stewardship Program		DFR	
MINING			
Mining Act of 1971			DLR
HYDROLOGIC MODIFICATION			
Clean Water Act (Section 404)		DCM, DWQ	COE
Rivers and Harbors Act of 1899			COE
Dam Safety Permit		DLR	
WETLANDS:			
Wetlands Restoration Program		DWQ	
Clean Water Act (Sections 401 and 404)		DWQ	COE
Wetland Reserve Program			USDA

COE: US Army Corps of Engineers
DCM: Division of Coastal Management
NCDA: NC Department of Agriculture
DWQ: Division of Water Quality
DLR: Division of Land Resources
NRCS: Natural Resources Conservation Service
DFR: Division of Forest Resource
DOT: Department of Transportation
SWCC: Soil and Water Cons. Commission
DSW: Division of Soil and Water
DSWM: Division of Solid Waste Mgt.
SWCD: Soil and Water Conservation District
USDA: US Department of Agriculture

Table 5.2 Hiwassee River Nonpoint Source Program Description and Contacts

Agriculture

USDA Natural Resources Conservation Service -- Soil & Water Conservation Districts:

Formerly the Soil Conservation Service; provides technical assistance for numerous issues, including:

- certifying waste management plans and training animal waste applicators;
- helping farmers and ranchers to develop conservation systems suited to their individual land and business;
- assisting rural/urban communities in reducing erosion, protecting water, and solving other resource problems;
- conducting site evaluations and soil surveys;
- administering the Agriculture Cost-Share Program and assisting landowners in installing BMPs; and
- administering the Wetlands Reserve Program and offering technical assistance for wetlands determination.

Clay County	Clay Logan	704-389-9764	P.O. Box 57 Hayesville, NC 28904
Cherokee County	Richard Greene	704-837-6928	409 Valley River Ave. Suite J Murphy, NC 28906

NC 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	Donna Moffitt (ACSP)	919-715-6108	512 N. Salisbury St. Raleigh NC 27626
Regional Office	Ralston James	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

NC Department of Agriculture (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	Tom Ellis	919-733-7125	Box 27647 Raleigh, NC 27611

NC Cooperative Extension Service:

Provides practical, research-based information and education programs to help individuals, families, farms, businesses and communities.

Clay County	Terry King	704-389-6305	P.O. Box 1156 Hayesville, NC 28904
Cherokee County	Craig Mauney	704-837-2210	115 Peachtree St. Murphy, NC 28906

Forestry

NC 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	Mickey Henson	919-733-2162	P.O. Box 29581 Raleigh, NC 27626-0581

S Department of Agriculture - US Forest Service:

Develop, protect and manage North Carolina's federal forest lands for multiple uses including sustainable timber harvest, recreation, and motorized vehicle access.

Asheville Office	Richard Burns	704-257-4248	PO Box 2750 Asheville, NC 28802

Table 5.2 Hiwassee River Nonpoint Source Program Description and Contacts (Cont'd)

General Water Quality

NC 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	Linda Hargrove (319 Projects)	919-733-5083	DWQ - Planning Branch, P.O. Box 29535 Raleigh NC 27626
Asheville Region	Forrest Westall	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

NC 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	919-528-9886	P.O. Box 118 Northside, NC 27564
Local Office	Mark Davis (?)	704-452-0422	Balsam Depot, Rt. 1, Box 624 Waynesville 28786

U.S. 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 401 Water Quality certifications.

Asheville Office	David Baker	704-271-4854	151 Patton Ave., Rm. 141 Asheville, NC 28801-5006

NC 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	919-733-3221	P.O. Box 29578 Raleigh, NC 27626-0578
Asheville Region	Don Link	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

Table 5.2 Hiwassee River Nonpoint Source Program Description and Contacts (Cont'd)

Construction/Mining			
NC Division of Land Resources: Conducts inspections 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
Asheville Region	Dennis Owenby	704-251-6208	59 Woodfin Pl. Asheville, NC 28801
Solid Waste			
NC Division of 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.			
Asheville Region	Jim Patterson	704-251-6208	59 Woodfin Pl. Asheville, NC 28801
On-Site Wastewater Treatment			
NC 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
Clay County	Tim Birch	704-389-6301	P.O. Box 55 Hayesville, NC 28904
Cherokee County	Mike Thompson, Anthony Tipton or Kim McClain	704-837-7486	206 Hilton St. Murphy 28906

5.6 PROGRAM INITIATIVES IN THE HIWASSEE RIVER BASIN

Through the development of this plan, efforts were made to identify efforts that have been undertaken within the basin to protect water quality. The following discussion focuses on program initiatives that have been implemented or are underway within the Hiwassee River basin. These initiatives demonstrate a tremendous effort to protect surface waters in the basin. There may be other initiatives underway in the basin that we are not yet aware of. Table 5.3 presents a summary of the agency or organizations that have program initiatives in the basin.

Table 5.3 Program Initiatives in the Hiwassee River Basin

Level of Agency	Name of Agency	Type of Initiative
Federal	Southern Appalachian Assessment	Ecosystem, Social/Cultural/Economic and Atmospheric Conditions
	US Department of Agriculture - National Resource Conservation Service	Various Projects
	US Forest Service	Land and Resource Management Plan for the Nantahala National Forest
	US Forest Service - Coweeta Hydrologic Laboratory	Hydrologic Studies
	Southeastern Natural Resources Leaders Group	Interagency Project
State	NC Soil and Water Conservation District	Various Projects
	NC Cooperative Extension Service	Various Projects
	NC Department of Transportation	Road Construction Erosion Control
	NC Division of Forest Resources	Forest Practice Guidelines Best Management Practices Forest Management Program Services
	NC Division of Land Resources	Sedimentation Pollution Control Act Mining Act
	Southern Appalachian Mountains Initiative	Regional Partnership on Air Quality Issues
Local Govt. and Citizen Groups	Hiawassee Watershed Coalition	Various Projects
	Town of Murphy	Developed Hiwassee River Park
	Town of Andrews	Developed Tree Ordinance
	Clay County	Took Over Operations of WWTP
Corporate	Tennessee Valley Authority	Clean Water Initiative, Shoreline Management Initiative, Hiwassee River Action Team
	Duke Power	Total Suspended Solids and Total Phosphorous Studies
Regional Organizations and Commissions	Year of the Mountains Commission	Recommendations to Governor Relating to Natural Resource Protection

5.6.1 Federal Initiatives

The Southern Appalachian Assessment

The Southern Appalachian Assessment (SAA) is a cooperative effort among many federal and state agencies and was conducted through coordination with the Southern Appalachian Man and Biosphere (SAMAB) program. The SAA began in the summer of 1994 and was completed in May 1996. Public meetings were conducted in the SAA study area (Figure 5.1) to get input from the public on specific issues. Several teams of professionals were formed to gather and interpret information about terrestrial and aquatic ecosystems, social/cultural/economic status, and atmospheric conditions for the SAA area. Full reports have been published on each of these categories (SAMAB 1996).

While the findings of the SAA are based on information to be used at a larger scale than a single river basin, some of the key findings of the SAA pertaining to water quality are notable here. Of particular interest to the Hiwassee River basin are the findings related to acid deposition and its effects on the aquatic ecosystem. While overall atmospheric sulfate concentrations seem to be decreasing, so too is the ability of the aquatic systems to buffer the incoming acidity (SAMAB 1996). This program and issue is discussed further in Chapter 4.

U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS)

- NRCS has developed several prototypes of trout waste management systems using Agriculture Cost Share Funds. One of these projects is the first trout waste spray irrigation system in the state. Another farm, located in the Savannah basin on Thompson River, has retrofit its existing trout raceways with baffles and computer actuated valves to collect waste and uneaten food. These trout waste management facilities exceed the requirements of the law; however, managing this type of waste is important to protecting water quality in this part of the state.
- NRCS is initiating "critical area treatment", the control of sediment by vegetating areas that show serious erosion problems. Many of their critical areas include highway corridors.
- NRCS and the SWCD have a partnership with Duke Power to protect the company's 6,000 acre "auger hole area." Previously, the unsupervised use of off-road vehicles in this area caused serious erosion problems. Now, the area is closely supervised and the property has been stabilized and seeded. The roads have also been stabilized with gravel.
- A federal Farm Bill program administered by the NRCS provides an incentive not to farm on highly erodible land (HEL) by taking away federal subsidies from a farmer that fails to comply with the provision.

US Forest Service - Land and Resource Management Plan (Amendment 5) for Nantahala-Pisgah National Forests

The US Forest Service released the Land and Resource Management Plan Amendment 5 in April 1994. Amendment 5 is a major revision to the 10-year 1987 forest plan established to manage the 1.2 million acres of Nantahala-Pisgah National Forests in North Carolina. The revised plan was in response to public concerns over past forest management practices. The new forest service approach applies the principles of ecosystem management; fostering old growth forests, neo-tropical bird habitat, and biodiversity; reducing clearcutting activities by providing a wood product supply that is sustainable and cost-effective; and maintaining forest aesthetics.

The 1994 amendment reduces the clearcutting rate from 1,500 acres per year to 240 acres per year. Under the new plan, total timber harvested will be reduced by 50% with a reduction from 72 million board feet annually to 34 million board feet. In addition, the primary method of harvesting trees shifted away from clearcutting to shelterwood (2-age) regeneration and selection harvesting in 1990. The two-age shelterwood harvest method allows 15 to 40 percent of the trees to grow,

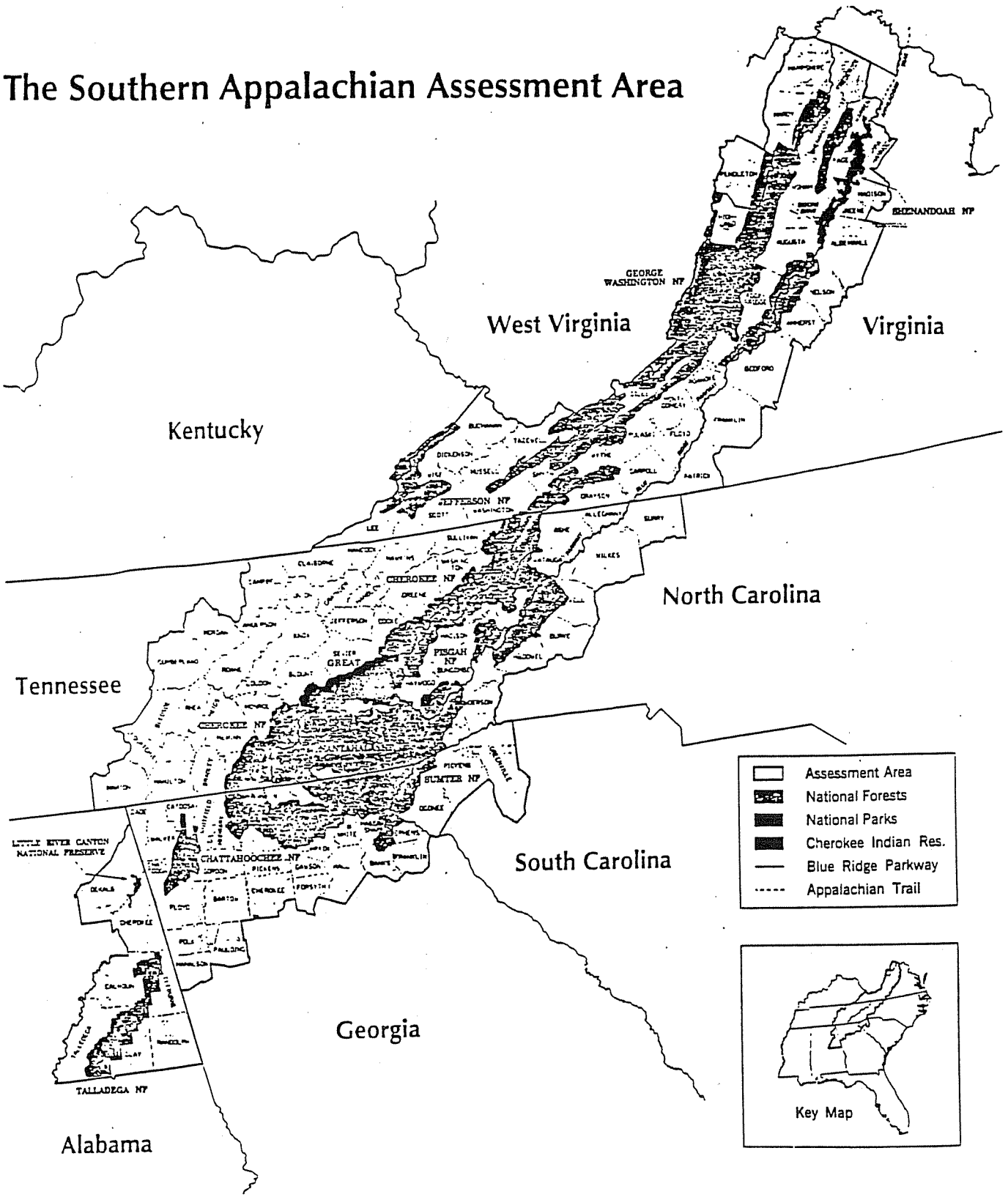

Figure 5.1 Southern Appalachian Assessment Study Area (Source SAMAB 1996)

creating a stand with at least two ages of trees. Selective harvesting allows for groups of trees averaging one acre in size or less to be removed. Harvested acres and percent of total acreage per county in the basin can be found in Chapter 2 of this plan. Total harvest activities on the Nantahala and Pisgah National Forests as an annual percentage of total National Forest acres has gradually declined from 44% in 1990 to 26% in 1995.

In using this new approach, the US Forest Service has identified transportation system management standards (Appendix VII) in an effort to reduce water quality problems due to roads. Implementation of these standards in all National Forests should help reduce sedimentation due to roads. The US Forest Service is also testing the effectiveness of BMP's to reduce sedimentation from roads (Burns, 1994).

Southeastern Natural Resources Leaders Group (SENRLG)

SENRLG is an association of regional managers from federal agencies with natural resource management responsibilities. SENRLG has four main purposes: 1) to broaden the perspective of regional natural resource leaders on economic, social, political and environmental issues and trends and their implications for natural resource programs; 2) to further develop community, constituency and agency support for natural resource activities; 3) to establish and maintain an interagency network of natural resource managers; and 4) to collaborate on specific activities of mutual interest which enable the Federal natural resource agencies to more effectively carry out their missions and responsibilities.

SENRLG has chosen the Hiwassee River watershed in North Carolina, Georgia and Tennessee as a demonstration watershed. A working group has been formed to coordinate the various activities of federal agencies in this watershed. The proposed North Carolina waterbodies for fiscal year 1997 activities include Shuler Creek (streambank stabilization) and Brasstown Creek (survey for potential restoration activities).

For more information on the Hiwassee Interagency Working Group, contact Janice Cox with TVA at (423) 751-7337.

5.6.2 State Agency Initiatives

NC Division of Soil and Water Conservation

The NC Division of Soil and Water Conservation administers the *NC Agriculture Cost Share Program for Nonpoint source Pollution Control (NCACSP).* This program provides incentives to farmers to install best management practices (BMPs) by offering to pay up to 75% of the average cost of approved BMPs. The NC Agriculture Cost Share Program funding totals for the Hiwassee River basin from 1985 through 1995 is $121,497. The cost share figures include a wide array of BMPs including conservation tillage, crop conversion to grass or trees, critical area plantings, sod-based rotation, land application of animal waste, diversions, livestock exclusion, grade stabilization structures, and animal waste management systems.

- Through the Agriculture Cost Share Program, agricultural land in these basins has 45% compliance with required BMPs for livestock stream crossings and 84% compliance with other BMPs.
- The Clay and Cherokee County Soil and Water Conservation Districts have developed over 250 agricultural related water quality plans and implemented 90% of them, covering over 25,000 acres.

NC Cooperative Extension Service

- The Cooperative Extension Service works with the NRCS on trout farm projects. They have an aquacultural specialized agent who helps trout farmers to address waste management problems. (Contact Skip Thompson, 704-456-3575)
- The CES has produced an educational booklet and cassette titled "Tobacco Scouting Manual" that instructs farmers about how to determine if pesticide applications are necessary. The material is easy to understand and using this program reduced pesticide use up to 40% for those who have implemented it. This program not only saves the environment, it saves money. (Contact Alan Caldwell, 704-757-1290)
- The CES has a comprehensive natural resources education program for children and adults. Some of the components of this program include Project Learning Tree, Teacher education, and field days (four each year). (Contact Craig Mauney, 704-389-6305)
- The CES also facilitates recycling and composting programs as well as Community Development Groups which clean up unattractive, bare urban areas.

NC Department of Transportation

- DOT uses intensive erosion controls for road construction in mountain areas. Some of the practices they use include working on only a small portion of roadway at once, seeding and mulching immediately after construction, and using straw bales in addition to the required silt fences.
- DOT's Transportation Improvement Program calls for paving all gravel roads by the year 2002. This will eliminate sediment runoff from gravel roads which is one of the biggest contributors of sediment in the basin.
- Anakeesta rock formations are sometimes found as underlying rock in the Hiwassee River basin. As explained in Chapter 4, this type of rock formation can cause serious water quality impairment when the rock is disturbed and exposed to air and water. DOT geotechnical staff do exploratory drilling for Anakeesta early in the stages of road planning to allow time for road alignment to minimize contact with the rock. DOT implements two primary management strategies to reduce the potential for leachate from the rock surfaces from entering surface waters. These strategies include: 1) removing waste rock from the site and placing on DOT property in clay liners that are encapsulated or using as road fill materials and encapsulating with the paved surface; or 2) creating wetlands areas downstream of the site to allow wetland plants to reduce the acidity of the water before entering a surface water. Using this method, a series of dams are built with Gabion baskets to catch overflow. The dams are filled and islands are built within the pond. Riparian vegetation is planted around the wetland.
- Where there is the potential for water quality degradation due to unavoidable disturbance with Anakeesta rocks, stream sites are monitored for water quality changes over time. Monitoring is coordinated with the US Army Corps of Engineers, the Department of Environmental Health, the US Fish and Wildlife Service and private consultants. Streams are monitored at least one year in advance of construction for baseline data. The streams are monitored throughout construction and then for one year after construction is complete.

NC Division of Land Resources

The NC Division of Land Resources (DLR) is responsible for administering the Sedimentation Pollution Control Act of 1973 (SPCA). Since the inception of the SPCA, the Sedimentation Control Commission has funded extensive workshops and educational programs aimed at children throughout the state. During fiscal year 1996, the DLR conducted workshops and symposiums, funded research and intern programs, reprinted manuals and developed video modules and produced newsletters on a budget of over $270,000 for the entire state. The DLR has the following materials available.

- Erosion and Sediment Control Field Manual
- Erosion and Sediment Control Practices: Video Modules
- Erosion and Sediment Control "Inspector's Guide"
- Erosion and Sediment Control Planning and Design Manual
- "Erosion Patrol" Package for Grade 3

The DLR is also responsible for administering the Mining Act of 1971. The mining program currently has the "Surface Mining Manual" available to the public. This manual covers the requirements of the Mining Act and for final reclamation of the site. The DLR has conducted mine operator workshops, has a reclamation awards program in place and has calendared "Surface Mining Manual" workshops.

NC Division of Forest Resources

The DFR is implementing various measures for protecting water quality statewide. These measures include the continued implementation of the Forest Practice Guidelines (FPGs) Related to Water Quality of 1976 and Best Management Practices (BMPs) of 1987. The FPGs have mandatory performance standards that must be met in order for landowners to remain exempt from all of the requirements associated with the Sedimentation Pollution Control Act enforced by the Division of Land Resources.

The FPG requirements include:
- establishment of a Streamside Management Zone,
- prohibition of debris entering streams,
- access and skid trail stream crossing protection measures,
- access road entrance restriction,
- prohibition of waste entering streams,
- waterbodies, and groundwater,
- pesticide and fertilizer application restrictions, and
- rehabilitation of project site requirements.

Overall compliance with Best Management Practices (BMP) in the Hiwassee River basin has been very good. Permanent logging roads in the basin avoided sensitive areas, met grade specifications, crossed streams properly, and BMPs were used and prevented sediment from reaching the stream. Skid trails and temporary roads in the basin had minimized and correct stream crossings, BMPs were used and prevented sediment from reaching the stream, water bars were evident and working 50% of the time. Streamside Management Zones (SMZs) in the basin were usually free of activity, ground cover was adequate, and the stream was clear of debris. However, SMZs met Forest Practice Guidelines (FPG) requirements only 17% of the time. All landings were in good shape. Landings were free of oil/trash, were located outside of the SMZ, were on a well-drained location, and were adequately stabilized.

Refer to Appendix V, page A-V-14 for a complete list of FPG requirements.

Southern Appalachian Mountains Initiative (SAMI)

Research and monitoring in national parks and national forest wilderness areas of the Southern Appalachian Mountains have documented adverse air pollution effects on visibility, streams, soils, and vegetation. Beginning in 1990, the Federal Land Managers for Shenandoah National Park, Great Smoky Mountains National Park, and Jefferson National Forest/James River Face Wilderness Area made several adverse impact determinations in the review of proposed air permits for major new sources of air pollution. These actions led to the voluntary formation of a regional public-private partnership called the Southern Appalachian Mountains Initiative (SAMI) in 1992. Now a nonprofit organization, SAMI's goal is to provide a regional strategy for assessing and

improving air quality, based on sound science and data, to protect this unique and sensitive ecosystem.

SAMI is a partnership of more than 100 agencies, including eight state environmental regulatory agencies (AL, GA, KY, NC, SC, TN, VA, and WV), several federal agencies, industries, academia, environmental organizations, and other stakeholders across the region. SAMI addresses the public, policy, and technical aspects of air quality issues through the consensus-building efforts of three main advisory committees comprised of leading scientific experts, as well as corporate, citizen and government stakeholders. SAMI gives affected states, federal agencies, regulated industry and the public an opportunity to broadly debate environmental issues and to propose reasonable solutions to identified problems, based on available science.

Since it's formation in 1992, SAMI has operated with limited funding from the EPA and state regulatory agencies and countless in-kind contributions from all participants. By pooling regional resources, SAMI has worked to identify, gather, and evaluate all existing data, models, and studies to establish a foundation of current knowledge and identify critical information gaps. SAMI is now finalizing the design for an integrated assessment framework (IAF) that will project the environmental and socioeconomic responses to changes in air emissions. This tool will be useful to decision-makers in evaluating the costs and benefits to society and the environment of the 1990 Clean Air Act Amendments (CAAA) and selected emission management options.

The IAF is divided into six linked areas of concern: (1) base year emission inventory, emissions projections and control costs, (2) atmospheric transport and air chemistry, (3) effects of acid deposition on aquatic and terrestrial resources, (4) effects of ozone deposition on terrestrial resources, (5) effects of visibility degradation, and (6) socioeconomic consequences.

The entire integrated assessment is projected to cost about $3 million overall and should be completed June 1998. SAMI peer-reviewed reports have been compiled on the following topics which describe the current state of knowledge as it pertains to air quality related values of the Southern Appalachian region: (1) emission inventories, (2) atmospheric transport and air chemistry, (3) acid deposition effects to aquatic resources, (4) acid deposition effects to terrestrial resources, (5) ozone effects to terrestrial resources, (6) visibility degradation, and (7) IAF design. During this information gathering phase, SAMI collaborated with other organizations with similar regional concerns to avoid duplication of efforts.

In order to evaluate how changes in emissions will affect natural resources, SAMI is establishing an emission-response relationship for the entire SAMI region by a series of computer model runs. By first characterizing an emission-response "surface," SAMI hopes to produce an analytical tool that can be used by decision makers to estimate the benefits and costs of custom "what if" emission management scenarios. Currently, SAMI is attempting to determine what pollutants and magnitude of emissions reductions will be necessary to detect a change at the resource (receptor) of concern.

For instance, work in the acid deposition area is occurring in two phases. The first phase focuses on understanding how selected sensitive receptors might respond to changes in deposition levels of sulfate and nitrate using indicators, such as soil solution chemistry, stream water quality, vegetation nutrient content, or forest productivity. Of particular interest to this basinwide report, Noland Divide in Swain County, North Carolina (having tributaries to the Little Tennessee River) has been selected as one of three targeted watersheds for this scope of work. The second phase will take a more regional approach to assessing resource responses to changes in deposition and will use indicators that are more meaningful to the general public, such as acres of forests that are healthy or miles of streams that support fish. Work in the other IAF areas of concern is proceeding concurrently or in phases, as appropriate.

Upon completion of this project, SAMI will have accomplished several things: a better understanding of the current health of the ecosystem (baseline); a projection of the changes in ecosystem health due to the CAAA; an idea as to whether or not such changes are enough to protect and preserve the air quality related values of the region; an evaluation of many options for reducing emissions (appropriateness, cost effectiveness, environmental benefit, etc.); better working relations among government, industries, and public interest groups; and recommendations for managing air quality in the Southern Appalachians.

SAMI has undertaken a task of monumental proportions with enormous implications for future economic development and environmental sustainability. The most extraordinary aspect of SAMI is that it is a voluntary effort not required by federal nor state statutes. This is truly the first attempt to define an equitable and objective process for addressing complex environmental issues fraught with uncertainties. It is hoped that this process will stimulate efforts to develop cost-effective, innovative and flexible solutions to balance future economic growth with environmental protection.

The above summary was exerpted from chapter titled: "Air Quality Management: A Policy Perspective", in J. Peine et. al., In Press..

5.6.3 Local Government and Citizen Initiatives

Hiawassee River Watershed Coalition

The Hiawassee River Watershed Coalition is a local organization with representatives from North Carolina and Georgia, the four counties of Clay, Cherokee (N.C.), Towns and Union (GA.), three Soil and Water Conservation Districts (Blue Ridge Mountain, Clay County and Cherokee County), several towns (Andrews, Hayesville, Murphy (all N.C.) and Hiawassee, Young Harris, Blairsville (all GA) and individuals, businesses and organizations throughout the basin. A Memorandum of Agreement was signed in June 1994 to form the basis of cooperation and coordination for these Soil and Water Conservation Districts and county commissions. Initial funding for the Coalition came from each district and counties.

The goal of the organization is to increase emphasis on improving water quality for recreation use, water supply, fishery and wildlife habitat and other associated environmental amenities in the watershed above the Hiawassee Dam. The Coalition would like to oversee and coordinate watershed planning and water quality efforts throughout this portion of the watershed in NC as well as the upper Hiawassee watershed in GA. (42% of the Hiwassee River watershed is in GA). The mission of the coalition is to develop and implement a total watershed-water quality plan for the Upper Hiawassee River. The Coalition is promoting and encouraging quality growth and development while maintaining a quality environment.

The Coalition is working with GA and N.C. state wildlife biologists and the TVA River Action Team (see Corporate Initiatives below) to develop a Lake Chatuge Fisheries/Water Quality Plan.

A public opinion survey developed by the Coalition and sponsored by the Cooperative Extension Service was sent to 800 randomly selected citizens in the four county area of the upper Hiwassee watershed (Clay and Cherokee counties in NC and Union and Towns counties in GA). The purpose of the survey was to determine the interest level of the citizens regarding water quality issues and to gauge public perceptions of the severity of water quality problems and sources of these problems. The survey resulted in a 29.8% response rate (238 responses). The survey results suggest that the citizens of the area appreciated natural beauty and opportunities for outdoor recreation, but they are concerned about rapid development, poor construction activities and emerging water quality problems.

The Coalition has recently received Section 319 grant money to hire a full-time coordinator to provide administrative and educational assistance in both Georgia and North Carolina.

Water Quality Improvement Projects
The Coalition, in coordination with the Clay County Soil and Water Conservation District, the TVA Hiwassee River Action Team, and the USDA Natural Resources Conservation Service established a demonstration site on Blair Creek. The demonstration site is intended to stabilize streambanks using a "vortex rock weir". The weir dissipates the flow of water as a natural curve would do (the stream has been straightened). The Coalition has been involved in other streambank stabilization projects.

For more information about the Hiwassee Watershed Coalition, contact Hayesville, NC office at (704) 389-9764.

Town of Murphy

- Obtained an Urban Forestry Grant from the NC Division of Forest Resources to create the Hiwassee River Park in a previously run-down, bare area.
- The town has problems with Inflow/Infiltration to the wastewater system and there have been problems at the Iceplant Lift Station. The town is currently on a moratorium for sewer hook-ups. The town is working with McGill Associates to address these problems. This should be accomplished within a couple of years.

Town of Andrews

- Implements a Tree Ordinance that requires that bare areas be covered.
- The town has problems with Inflow/Infiltration to the wastewater system, along with many other infrastructure problems. There are no funds to correct these problems. The town hopes to obtain grant funding to update their infrastructure.

Clay County

Clay County took over operations of the wastewater and water treatment previously operated by the Town of Hayesville. Because of infrastructure problems, Hayesville was no longer able to provide these services. Hayesville is now at plant capacity, so the county is proposing to build a new treatment plant and install two large aeration lagoons. Hopefully this will get failing septic tanks onto an improved treatment facility. The new facility will improve discharge quality over the previous facility.

5.6.4 Corporate Initiatives

Tennessee Valley Authority Clean Water Initiative

The goal of the Tennessee Valley Authority (TVA) Clean Water Initiative is to develop a partnership approach to preventing and cleaning up pollution on the Tennessee River and its watershed. In North Carolina, the Watauga, French Broad, Little Tennessee and Hiwassee River basins make up portions of the Tennessee River basin watershed. TVA is working with other agencies to identify pollution problems and implement solutions. TVA is looking for answers to key questions such as: If the water safe for swimming? Are the fish safe to eat? What is the health of the lake? Answers to these questions have been provided to the public in the form of an annual report called, RiverPulse. The RiverPulse report has recently been replaced by a fold-out brochure. A brochure is prepared for each river basin of the Tennessee Valley.

TVA has developed a very comprehensive monitoring program that combines the professional expertise of water resource specialists with local citizens, interest groups, business and industry, and other governmental agencies. This is the baseline for the concept of River Action Teams (RAT's). Water quality data collected from key locations on lakes and streams in the Tennessee River watershed is used to draw attention to pollution problems, set cleanup goals, and measure the effectiveness of water quality improvements over time. Measurements on water quality are based on physical, chemical, and biological variables. There are four RAT sites in the Hiwassee River basin. The results of this monitoring can be found in Chapter 4.

For more information on the TVA Clean Water Initiative contact: Wayne Poppe at (423) 632-8502 or Vicki Warren at (423) 632-3034.

For more information on the Hiwassee River Action Team contact: Jim Hagerman at (423) 632-1822 or Janice Cox at (423) 751-7337.

Lakes in the Hiwassee River basin are operated and managed by TVA. Lake shorelines are under severe pressure from residential development. TVA has recognized the need to control the development of lake shorelines to preserve their aesthetic quality and to reduce the potential for shoreline erosion. The Shoreline Management Initiative (SMI) was launched in 1994 to establish policy to protect shoreline and aquatic resources while allowing adjacent residents reasonable access to the water. TVA requested comments during the scoping phase of the SMI from other agencies and the public. With this feedback, TVA developed a Draft Environmental Impact Statement (DEIS) to examine the issues and alternatives of the expressed viewpoints and alternatives. At the time of writing, the DEIS was out for public review and comment.

Key issues identified in the scoping process are Resource Issues (shoreline vegetation, wetlands, aquatic habitat, water quality, etc.) and Other Public Issues (education and communication, land use rights, enforcement/patrol and design standards). Six alternatives that focus on such activities as dredging and filing, soil erosion, pollution, increased human presence on shoreline areas,, and construction of buildings, piers, etc. are presented in the DEIS.

For more information on the TVA Shoreline Management Initiative contact: David Harrell at (423) 632-1636.

Duke Power

Duke Power Company is the major hydroelectric power generating industry in western North Carolina. Crescent Resources and Nantahala Power and Light are both subsidiaries of Duke Power Company. Duke Power is involved in transmission line construction activities which include clearing of tower sites and upgrading access roads. With the purchase of the subsidiaries over one hundred miles of transmission lines were constructed.

These transmission line activities can increase the potential for erosion and sedimentation which can have an impact on water quality. One water quality monitoring program developed by Duke Power focuses on streamflow total suspended solids (TSS) and Total Phosphorous (TP). Monitoring sites have been established at over 40 sites in western North Carolina. Discussion on the findings of this program as they pertain to the Hiwassee River basin can be found in Chapter 4.

The goals of the Duke Power monitoring program are to assess the effects of BMP's and sediment control plans developed and implemented by Duke Power, and to estimate transport to reservoirs. The program is designed to also identify the extent and source of pre-existing impacts (Braatz 1994).

Depth-integrated composite samples collect baseflow conditions and a series of vertical single-stage samplers are used to collect water samples representative of the rising stage of storm events. As the stream rises due to rainfall or snowmelt, stream water from several stages of the rising flow collects in the sample bottles. In this way, under the rising stage storm event, water samples are collected that represent the worst-case sediment loads to a stream (i.e. - when flow is rising and runoff is greater). Any impacts from Duke Power transmission line activities can be compared to control areas (upstream versus downstream) to paired watersheds, or by time series changes (before, during, and after site activity).

Results from sampling devices are collected on a regular basis and analyzed for TSS and TP. This information is provided to the field crews if impacts from Duke Power activities are documented. Thus, field crews are given quick feedback on where remediation efforts need to be implemented to correct sedimentation problems and protect water quality.

For more information on the Duke Power Stream Sediment Transport Program contact: Dave Braatz at 704-875-5430. For more information on the Duke Power Erosion and Sedimentation Control Program contact: Jim Hollifield at (704) 382-3509.

5.6.5 Regional Organizations and Commissions

Year of the Mountains Commission

The Year of the Mountains Commission was created and organized under an Executive Order in March 1995 by Governor James B. Hunt. The work plan of the Commission was fashioned after the work of the "Year of the Coast" Commission. The objectives of the Commission were to: 1) Educate, promote and celebrate the distinctive natural and cultural heritage of the WNC communities and region; and 2) Develop and market public policy goals which can address the issues of quality growth and development, natural resource protection, and preservation of the cultural identity of the WNC mountain region. The recommendations of the Commission were presented to the Governor at the final conference of the Commission in June 1996. The Commission was dissolved as of June 30, 1996.

The Commission's recommendations are presented in Section 6.1 of Chapter 6.

5.7 Integrating Point And Nonpoint Source Pollution Control Strategies

Integrating point and nonpoint source pollution controls and determining the amount and location of the remaining assimilative capacity in a basin are key long-term objectives of basinwide management. The information is used for a number of purposes including: determining if and where new or expanded municipal or industrial wastewater treatment facilities can be allowed; setting the recommended treatment level at these facilities; and identifying where point and nonpoint source pollution controls must be implemented to restore capacity and maintain water quality standards.

Total Maximum Daily Loads

The U.S. Environmental Protection Agency (USEPA) has developed the means to help accomplish these objectives called *total maximum daily loads (TMDL).* USEPA requires the TMDL approach pursuant to Section 303(d) of the Clean Water Act. The approach uses the concept of determining the total waste (pollutant) loading from point and nonpoint sources that a waterbody (such as a stream, lake or estuary) can assimilate while still maintaining its designated uses.

TMDL's are part of a process in which States identify waterbodies that do not meet water quality standards, establish priorities for action, and determine reductions in pollutant loads or other actions needed to meet water quality goals. This information is submitted to USEPA for approval every two years. The approach is flexible and promotes a watershed approach driven by local needs and States priorities. The TMDL approach emphasizes priority waters and real world solutions.

The TMDL strategy establishes water quality-based controls on point and nonpoint sources of a given pollutant identified as contributing to a waterbody's impairment. The TMDL can reflect quantifiable limits placed on specific pollution sources or it can be programmatic strategies (e.g., implementation of nonpoint source best management practices) established to reduce pollutant loadings in the targeted waterbody. The overall goal in establishing the TMDL is to establish the management actions necessary for a waterbody to meet water quality standards.

A targeted waterbody does not necessarily refer to an entire basin. In the Cape Fear River Basin, for example, there are several major drainage areas (e.g., Deep River, Haw River and Cape Fear River) for which individual TMDLs are being recommended. TMDLs for smaller streams may also serve as important elements in a TMDL covering a larger portion of the basin. Nesting of TMDLs in this fashion constitutes a flexible yet comprehensive management approach that allows for the development of specific strategies for smaller problem areas and yet offers the means to address the large scale problems as well.

As DWQ's abilities to quantify and predict the impacts of point and nonpoint source pollution becomes more sophisticated, the basinwide approach in the Hiwassee River basin will make more innovative management strategies possible.

Other Possible Strategies

- *Industrial recruitment mapping* involves providing specific recommendations on the types of industry and land development best suited to the basin's long-term water quality goals and an individual basin's ability to assimilate a particular type or quantity of discharge or nonpoint source pollutants.
- *Consolidation of wastewater discharges*, also referred to as regionalization, entails combining several dischargers into one facility. Local authorities, regulated industries, landowners, and other interested parties are encouraged to provide ideas to develop these strategies. By accommodating, to the degree possible, local needs and preferences, the probability of the plan's long-term success will be increased.

5.8 POTENTIAL SOURCES OF FUNDING FOR WATER QUALITY PROJECTS

Section 319(h) Grants:

Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects that have been funded in the past include BMP demonstrations, watershed water quality improvement projects, data management, educational activities, modeling, stream restoration efforts, riparian buffer establishment, and others. DWQ established a Workgroup process in 1995 for prioritizing and selecting projects from the pool of cost-share proposals and includes this list in its annual application to EPA. The Workgroup consists of representatives from the state and federal agencies that deal with NPS issues, including agricultural, silvicultural, on-site wastewater, mining, solid waste and resource protection.

DWQ staff first reviews proposals for minimum 319 eligibility criteria such as:

- Does it support the state NPS Management Program milestones?
- Does the project address targeted, high priority watersheds (See Table 5.4)?
- Is there sufficient nonfederal cost-share match available (40% of project costs)?
- Is the project period adequate?
- Are measurable outputs identified?
- Is monitoring required? Is there a QA/QC plan for monitoring?
- If GIS is used, is it compatible with those of the state?
- Is there a commitment for educational activities and a final report?

Workgroup members separately review and rank each proposal which meets the minimum 319 eligibility criteria. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; degree of balance lent to the statewide NPS Program in terms of project type; and competence/reliability of contracting agency. They then convene to discuss individual projects' merits, to pool all rankings and to arrive at final rankings for the projects. The Workgroup seeks a balance between geographic regions of the state and types of projects. All proposals that rank above the funding target are included in the annual grant application to EPA, with DWQ reserving the right to make final changes to the list. Actual funding depends on approval from EPA and yearly Congressional appropriations.

While it is preferable that 319(h) proposals address high or medium priority watersheds, it is not necessary.

Table 5.4 Nonpoint Source (NPS) 319 Priority Ratings for Non-Coastal Waters

High priority waters
• monitored waters that have an overall use support rating of non-supporting,
• monitored waters that have a use support rating of partially supporting but have a high predicted loading for one or more pollutants,
• highly valued resource waters as documented by special studies - High Quality Waters - Outstanding Resource Waters - Water Supply I, Water Supply II, Critical areas of WS-II, WS-III or WS-IV
Medium priority waters (None in the Savannah River basin):
• monitored waters that have an overall use support rating of partially supporting,
Low priority waters:
• All other waters not considered high or medium priority

All proposals that rank above the annual funding target are included in the grant application to EPA, with DWQ reserving the right to make final changes to the list. Obtaining the funding depends on approval from EPA and yearly Congressional appropriations. To obtain more information about applying for section 319(h) grants, contact:

Linda Hargrove, DWQ - Planning Branch
P.O. Box 29535, Raleigh, NC 27626-0535
(919) 733-5083 ext. 352

Other Sources of Funding

Besides Section 319(h) funding, there are numerous sources of funding for all types of water quality projects. The sources of funding include federal and state agencies, nonprofits, and private funding. Funds may be loans, cost-shares, or grants.

If a local government, environmental group, university researcher, or other individual or agency wants to find funding to address a local water quality problem, it is well worth the time to prepare a thorough but concise proposal and submit it to applicable funding agencies. The list of goals for Section 319(h) proposals can be used as a guideline for other funding agencies. Even if a project is not funded, persistence may be beneficial when funding agencies observe several consecutive proposals from the same group.

Tables 5.5 and Appendix VIII provide summaries of the agencies that are potential sources of funds for point sources of pollution. Table 5.6 and Appendix IX provide summaries of the agencies that are potential funding sources for nonpoint sources of pollution.

In addition to these sources, the Clean Water Management Trust Fund will be another source of funding for both point and nonpoint sources of pollution. The 1996 General Assembly earmarked 6.5% annually of the year end General Fund credit balance to help finance projects that address water pollution problems and focus on upgrading surface waters, eliminating pollution and protecting and preserving unpolluted surface waters. Contact the Executive Director, Dave McNaught at 919-974-5497 and refer to Appendix VI for more details on this program.

Table 5.5 Funding Agencies for Assistance With Point Sources

Source	Agency and Name of Funding Source
Federal	U.S. Rural Utilities Service: Water and Wastewater Loan and Grant Program Rural Business and Cooperative Service: Rural Business Enterprise Grants Appalachian Regional Commission: Supplements to Other Federal Grants in Aid U.S. Economic Development Administration: Public Works and Development Facilities Grant Program
State	NC Division of Water Quality: ~~Construction Grants and Loans Program~~ NC Division of Community Assistance: Small Cities Community Development Block Grant NC Commerce Finance Center: Industrial Development Fund
Private	Rural Economic Development Center, Inc.: Supplemental and Capacity Grants Program

Table 5.6 Funding Agencies for Assistance with Nonpoint Sources

NPS Assistance Needed	Name of Funding Source
Agriculture	NC Agriculture Cost Share Program for NPS Pollution Control (NCACSP) Environmental Quality Incentives Program (EQIP) Conservation Reserve Program (CRP) Wetland Reserve Program (WRP) Small Watershed Program, PL-566 Conservation Easement Soil and Water Conservation Loan Program
Education	GTE Foundation Toyota TAPESTRY Grants National Environmental Education and Training Foundation (NEETF)
Water Quality Planning	Section 205(j) Water Quality Planning Grants
Stream Restoration	NC Division of Water Resources Stream Repair Funding
Forestry	Forestry Stewardship Incentive Program Forestry Incentives Program
Land Conservation	National Wetland Priority Conservation Plan NC Conservation Tax Credit Program Federal Wild and Scenic Rivers Program Emergency Wetlands Resources Act of 1986

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CHAPTER 6

MAJOR BASINWIDE WATER QUALITY CONCERNS AND RECOMMENDED MANAGEMENT STRATEGIES

6.1 INTRODUCTION

Clean water is critical to the health, economic and ecologic well-being of this region of the state. Tourism, water supplies and a high quality of life are dependent on the water resources of this basin. Fortunately, many of the waters within the basin are still of high quality. The exceptions are Brasstown Creek and portions of the Valley River, which are currently rated Partially Supporting their intended uses. However, there are reasons to be concerned about the quality of other portions of the Valley River and Junaluska Creek, which are rated Support Threatened and are showing some signs of water quality degradation. The major concern for waters of the basin is erosion from such land use activities as residential developments, private road construction and agriculture. Other concerns include impacts associated with population growth and development of thoroughfares. Unfortunately, solving these problems and protecting water quality in the face of continued growth and development will be a major challenge.

Protecting water quality standards and intended uses requires controlling the causes and sources of water pollution. Sediment, toxics and fecal coliform bacteria are problem pollutants of concern in the Hiwassee River basin. Sedimentation, perhaps the problem most likely to worsen with future development of the mountain region, is discussed in section 6.4.

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 Hiwassee River basin's waters.

In striving towards this mission, DWQ's highest priority near-term goals are as follows:

- **To identify and restore impaired waters in the basin.** Section 6.3 discusses impaired waters (there is one impaired water in the basin). Section 6.4 discusses threatened waters and recommended strategies for restoring these waters.

- **To identify and protect high value resource waters and biological communities of special importance.** Section 6.5 discusses management strategies for protecting the HQW/ORW's in the basin.

- **To manage the causes and sources of pollution so as to ensure the protection of those waters currently supporting their uses while allowing for reasonable economic growth.** Major water quality issues addressed under this topic include management of growth and development (Section 6.6.1), sedimentation (Section 6.6.2), urban stormwater runoff (Section 6.6.3), fecal coliform bacteria (Section 6.6.4), toxic substances (Section 6.6.5), and oxygen-consuming wastes (Section 6.6.6).

6.2 MAJOR WATER QUALITY CONCERNS AND PRIORITY ISSUES

6.2.1 Growth and Development

Growth Trends and Water Quality

There has been limited growth in the Hiwassee River basin, with growth occurring primarily in Clay County and near Hayesville. This trend is expected to continue. Impacts to water quality from growth and development can include sedimentation, streambank erosion and degradation from a variety of fertilizers, chemicals, and road salts.

Traditionally, growth and development within the basin has occurred mostly along streams and rivers where lands are less steep. Growth along waterways can have a significant negative impact on water quality if construction activities are not undertaken with proper care. Recently, construction activities have also occurred on mountain ridges and slopes to obtain views of valleys and ridges. Building on slopes can be particularly harmful to water quality if appropriate erosion and sedimentation control measures are not used. Slopes tend to have soil types that are more shallow and unstable than those in valleys. Often, driveways to home sites on slopes are greater than 12% slope, the recommended slope for reducing erosion potential (Willett, pers. comm.).

In recent years, there has been a wave of development from Atlanta, Georgia to the North Carolina state line. Parcels of property have sold rapidly throughout areas of the Hiwassee River basin. Clay County has seen an approximate doubling of land parcels over the last ten years (Willett, pers. comm) as land is subdivided. Clay County is especially attractive to developers because of the beauty of the area, easy access due to new multi-lane highways, close proximity to Atlanta and recreation opportunities on Chatuge Lake. To date, most of the land has not been built upon. Approximately 61% of the land parcels in Clay County are held by out-of-state developers that intend to subdivide these large parcels when the market is most receptive Mike Decker, pers. comm). When these developers perceive that the timing is right for building out these parcels, the rate of growth within this basin will accelerate quickly and may be too fast for local governments to keep pace with (Willett, pers. comm). The basin also receives a tremendous seasonal population fluctuation.

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains the high water quality that is presently attracting people to the area. While increases in tourism and development can be seen as very positive for this portion of the state with some of the lowest average per capita incomes in the state, it is also very important for local governments and community leaders to look towards the future and balance economic growth with protection of the natural resources that draw people to the area.

Growth management requires planning for the needs of future population increases as well as maintaining a strong tourism base. These actions are critical to water quality management and the quality of life for the residents of the basin. Refer to section 6.6.1 for recommended management strategies relating to proper planning for growth and development.

Influence of the Cherokee Reservation Gambling Casino on Growth and Water Quality

The Cherokee Reservation gambling casino, the only legalized gambling casino in the Southeast, is geographically situated to become "...one of the primary gambling centers east of the Mississippi. It will be centrally located to many eastern cities and is within 500 miles of over half the U.S. population " (Willett and Eller, 1995). The development of the gambling casino on the Cherokee Indian Reservation is estimated to attract an additional 2 million visitors per year to the Reservation (Willett and Eller, 1995). It is expected that these visitors will tour surrounding areas.

A recent NC Division of Community Assistance study (Willett and Eller 1995) suggests that western North Carolina will be permanently impacted by the development of the Cherokee Indian Reservation gambling casino. In addition to other effects not related to water quality, the region is likely to experience:

1) The need for additional state support for road improvements. Road improvements will entail construction and the potential for increased erosion and sedimentation, as well as the potential for increased effects of acid runoff to streams if Anakeesta rock formations are exposed (See Multi-Lane Highways discussion below);

2) Increased traffic which may result in increased water quality impacts through stormwater runoff and exhaust emissions that contribute to acid rain (See discussion on acid deposition below);

3) The need for higher taxes to pay for the increased need for local government services (water and sewer improvements alone are estimated at $5.6 million); and

4) The diversion of dollars from existing businesses to gambling enterprises and displacement of non-gambling tourists who travel to other areas to avoid increased traffic, lack of hotel accommodations, and avoidance of the gambling atmosphere (Willett and Eller, 1995).

The gambling casino may have effects on water quality as the outlying areas experience accelerated commercial activity due to displacement and spill-over. Commercial activity in these outlying areas will increase the demand for roads and services. In addition, strong economic activity may be viewed as an additional reason to build second homes or establish a new business by an outside entrepreneur. Construction of homes, commercial areas and roads increase stormwater runoff and sedimentation problems. This demand for goods, services and homes will need to be planned for and managed in order to reduce the potential for degradation of water resources. (See section 6.1 for recommended management strategies relating to proper planning for growth and development.)

Multi-Lane Highways

The NC Division of Community Assistance report estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout western North Carolina. At present, there are six major corridors (See Chapter 2) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation and provide opportunities for easy access to rather remote areas of the state. Corridor 1, through the Hiwassee River basin, is expected to carry an additional 72,800 vehicles on US 19/129.

The development of the four-lane thoroughfare from Andrews to Almond (via Robbinsville) will provide access to Robbinsville and Graham county for economic development in the area (DOT, 1996). This thoroughfare should also increase traffic flow across the mountains through the Hiwassee River basin, from Atlanta to the Great Smoky Mountains National Park and the Cherokee Indian Reservation gambling casino. Under the DOT Transportation Improvement Program, US Hwy. 64 will be widened to a five lane highway from NC 69 to the Hiwassee River. NC Highway 175 will be upgraded from the Georgia state line to the junction with US 64. That portion of US 64 from the Clay county line to Murphy is expected to be rerouted to a new location and developed to a two lane roadway, ultimately to become a four lane stretch of highway. NC 60 is planned to be developed to a four lane highway from the Georgia state line to US 64-74.

During road construction there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are sometimes found in this region of the state. These rock formations

can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff.

Acid Rain/Deposition

The developments of thoroughfares will make it easier for tourists and developers to access and use the area. As traffic flow increases, the emission of nitrous oxides from vehicles to the atmosphere will increase. Nitrous oxides react with volatile organic compounds to create ozone. At times, ozone levels in the Great Smoky Mountains National Park can reach levels nearly double the average ozone level in Raleigh (News and Observer, Sept. 1, 1996). The man-made pollutants that trouble the peaks of the Smokies is creating more widespread problems throughout the Southern Appalachians, as noted by the Southern Appalachian Man and the Biosphere (SAMAB). The region of the GSMNP presently receives some of the most acidic deposition in the country. This high amount of deposition combined with the low stream buffering capacity and the fact that the capacity of the soils to absorb excess nutrients has been reached in many areas, has produced many low pH streams at higher elevations and higher stream nitrogen levels than in any other national park (News and Observer, Sept. 1, 1996). Refer to Chapter 4 for a more thorough discussion of the effects of acid deposition of high elevation streams in western North Carolina.

6.2.2 Priority Issues as Identified by Workshop Participants

A public workshop was conducted in the Hiwassee River basin in Murphy in November 1995. Participants were asked to identify what they saw as the priority issues for the Hiwassee River basin. After issues were identified, participants were asked to recommend management actions to address the priority issues. Issues and actions were grouped into major categories by DWQ. A complete listing of workshop responses is presented in Appendix XI.

Table 6.1 provides the priority issues as identified by workshop participants. Issues are identified by category with a summary of the comments for each category. While each identified issue may not be directly responded to in the plan, an effort has been made to consider these issues within the framework of the basinwide approach. Where there has been some discussion about the category or specific comments within the plan, the table provides this reference.

Some suggested solutions to the identified priority issues were also presented by workshop participants and they have been incorporated into the summaries. Many of these solutions have likewise been recommended within this plan. Other recommendations by workshop participants will require further discussion with other agencies over the five year planning cycle of the basin.

6.2.3 Priority Issues and Recommended Actions Identified by Nonpoint Source (NPS) Team Members

DWQ has begun setting up nonpoint source teams in each of the state's 17 major river basins. These teams will have representatives from agriculture, urban stormwater, construction, mining, on-site wastewater disposal, forestry, solid waste, wetlands, groundwater, natural resource agencies, local governments, special interest groups and citizens. These teams will provide descriptions of current NPS management activities within a basin, conduct assessments of NPS controls in targeted watersheds, prioritize impaired waters for development and implementation (including funding) of restoration strategies and prioritize NPS issues for remedial action. The team will develop five year action plans to reflect these priorities.

Table 6.1 Priority Issues Identified by Workshop Participants (Sheet 1 of 2)

Comment Summary	DWQ Comments	Reference
WASTEWATER TREATMENT PLANT DISCHARGES		
Concerns were expressed over whether the state could do more to clean up sewage treatment water and control toxic discharges from individual WWTP permits. Participants wanted to make sure the Valley River was protected. One participant observed that water quality in the river was much better than it was 20 years ago because of WWTP improvements.	NPDES permit limits are set to protect stream uses and limits are established for each individual discharger. As noted in the comment column, there have been major improvements, over the years, in the treatment levels at WWTPs. However, better treatment is expensive, and problems still persist for some facilities.	See Sections 3.3, 5.4, 6.5.2 and 7.3
BALANCING WATER USES AND FUTURE PLANNING		
Need to recognize and accommodate a wide range of stream uses. Tourism versus private property was mentioned at the workshop, as was the need to protect water resources for the future.	Protecting water uses is a basic premise of the federal Clean Water Act and the state's Water Quality Program. Finding ways of protecting competing uses is a major challenge and is one of the reasons for establishing the basinwide approach. Local land use planning will be important and recommendations are presented later in this Chapter. Information on water supply uses is presented in Chapter 2.	Sections 4.4, 4.5, 6.2, 6.6.1, Chapter 2 and Appendix II.
EMPHASIZE LOCAL VOLUNTARY EFFORTS		
Several comments were made indicating that we have enough regulation, that more emphasis should be placed on voluntary efforts and that the counties should be able to control their own affairs and not be told what to do by the state. It was also stated there should be more emphasis on proactive management versus reactive and that cooperative efforts should be encouraged. Participants suggested that the basinwide approach could be marketed better (delivery of message).	DWQ recognizes and strongly supports local efforts to protect water quality. This is one of the reasons the Division has begun establishing nonpoint source teams in each basin. This is a way of encouraging and involving governments, ag community reps and others in water quality management activities. NPS teams may play a growing role in targeting expenditure of state & federal funds for WQ protection.	Sections 5.6.3 and 7.2.2
PRIVATE PROPERTY RIGHTS		
Private property owner rights (the "takings" issue) needs to be addressed, particularly as it relates to wetlands regulation. If lands or land uses are to be restricted or taken away, then compensation should be provided. Development of a local conservation trust that could help property owners gain tax relief for setting aside buffers or other lands is a possibility.	DWQ has recently adopted new wetlands rules that help address this issue through providing more flexibility to property owners in the form of mitigation. In addition, The General Assembly passed a Wetlands Restoration Bill (HB 53) that is intended, in part, to simplify mitigation and streamline permit processing for permit applicants.	

Table 6.1 Priority Issues Identified by Workshop Participants (Sheet 2 of 2)

Comment Summary	DWQ Comments	Reference
WATER QUALITY MONITORING		
The question was asked, "why can't we monitor all streams?" More complete water quality monitoring would provide better understanding of water quality and sources of pollutants.	DWQ agrees with the need for accurate and comprehensive monitoring data for both assessing water quality and identifying pollution sources. Since resources are limited, efforts are underway to explore data sharing with others such as TVA.	Chapter 4 and Section 7.3
GOVERNMENT MISTRUST		
There was strong sentiment expressed by some participants that government misrepresented facts and that regulations were not enforced equally. It was recommended that government activities be better coordinated and that government set an example for the private sector.	DWQ acknowleges that major inconsistencies sometimes occur in the ways laws are enforced. This can result from a number of factors such as differences between regulations of different agencies at different levels of government (federal, state, local), or differences of opinion on how a specific law or regulation should be enforced. Having said that, it is strongly recommended that government (including DWQ) make every effort to address inconsistencies and that it be forthcoming with the facts. The basinwide planning approach is one way in which DWQ attempts regulatory programs to the public.	

"Comment Summary" is a summary of workshop comments summarized by DWQ. Complete comments are presented in the Appendix.

"DWQ Comments" are comments/responses from the Division of Water Quality.

"Reference" means the section of the basinwide plan where additional information may be found. The first number of each section refers to the chapter.

At the first meeting of the Hiwassee NPS Team in April 1996, the Team members identified development as the priority issue within the basin. The team also presented recommended actions to address development issues (Table 6.2). Issues and recommendations presented by the NPS team members will be incorporated into the five-year action plan being developed by the team. DWQ will continue to work with the NPS team to clarify the water quality issues of the Hiwassee River basin and formulate implementable strategies to deal with these issues.

Table 6.2 Priority Issues and Actions Recommended by the Nonpoint Source Team Members

Priority Issue	Recommended Actions
• Golf courses, strip malls, and second homes are being constructed all over the basins. • Private access roads and forest service roads are causing erosion problems.	• Buffers need to be established and protected to shade waters. • Streambanks in developed areas should be properly stabilized.

Refer to Chapter 3 for discussion on how development can impact water quality. Refer to Section 6.6 for recommended strategies to protect waters from being degraded by the sedimentation often associated with development activities.

6.2.4 Priority Issues and Recommended Actions Identified by the Year of the Mountains Commission

The Year of the Mountains Commission was organized under an Executive Order of the Governor in 1995. The objectives of the Commission were to: 1) Educate, promote and celebrate the distinctive natural and cultural heritage of the WNC communities and region; and 2) Develop and market public policy goals which can address the issues of quality growth and development, natural resource protection, and preservation of the cultural identity of the WNC mountain region. The following recommendations relating to natural resource protection and specifically to water quality issues were made by the Commission .

- The establishment and/or expansion of sound planning capabilities throughout the 29 counties involved in The Year of the Mountains. The State should provide direct financial assistance to the counties of Haywood, Jackson, Swain, and Macon to assist in planning and preparing for development pressures as direct or indirect consequences from gaming on the Cherokee Indian Reservation.
- The State should encourage local governments to implement capital improvement planning in WNC. Encourage a system of long-term capital improvements planning through project grants or loans to local governments, perhaps through a baseline capital improvements financing fund; encourage congressional delegates to reconfigure and increase federal payments to local governments that have a lot of public lands.
- Protect and Enhance Water Quality. Establish a state and regional partnership to aggressively pursue a program to eliminate "straight-piping"; increase funding to the N.C. Agricultural Cost Share Program; increase funding and personnel for inspections of mines, dams and development sites; increase funding to the Governor's Task Force on Forest Sustainability to ensure inspection and mitigation of any negative forest impacts on water quality.
- Improve the air quality in WNC to reduce adverse effects on human health and the environment. Encourage support of Southern Appalachian Mountain Initiative (SAMI) and the Southern Appalachian Man and Biosphere (SAMAB) initiatives; seek and support federal and state regulations to limit air pollutants and to monitor the effects of air pollutants on ecosystems.
- Improve integration of environmental education into school curricula. Increase appropriations to the N.C. Environmental Education Plan and establish an Environmental Education Trust Fund for education grants to schools and communities.

6.3 IDENTIFICATION AND RESTORATION OF IMPAIRED AND "THREATENED" WATERS

6.3.1 What Are the Impaired Waters?

Impaired waters are those waters identified in Chapter 4 as partially supporting or not supporting their designated uses. The impaired streams in the basin are Brasstown Creek and portions of the Valley River (Table 6.3) These are the only waterbodies in the basin identified as impaired based upon biological or chemical monitoring data collected between 1990 and 1994. Some impaired waterbodies may not have been identified by DWQ due to the unavailability of chemical or biological monitoring data for those areas, so it cannot be assumed that there are no other impaired waters in the Hiwassee River basin. See Chapter 4 for explanation of use support ratings.

Table 6.3 Partially Supporting or Not Supporting Waters in the Hiwassee River Basin

Subbasin	Waterbody	Use Rating	No. of Miles	Source	Management Strategy	Chp. 6 Reference Section
04-05-01	Brasstown Creek	PS	8.5	NPS, P	Water quality problems are partially due to point source discharges in Georgia. Further monitoring at this site and coordination with Georgia's EPD is recommended. Impairment is likely primarily due to runoff from NC 66 and land use activities. The SENRLG (pg. 5-16) plans to survey the creek for potential restoration activities.	Section 6.4.1
04-05-02	Valley River (above Andrews)	PS	19.6	NPS	The source of impairment is unknown. Investigations of the river length could be a focus of the NPS team.	Section 6.4.2
NOTES:						
PS	Partially Supporting classified uses					
NS	Not Supporting classified uses					
NPS	Impairment due to Nonpoint Source pollution, though specific sources may not be known					
P	Impairment attributed to Point source pollution					

6.3.2 What are the "Threatened Waters"?

The following waters have notable water quality problems (Table 6.4) but the impact of the problem is not severe enough to cause the stream to be considered impaired under the state use support designation described in Chapter 4. These waters are rated support-threatened. These support-threatened waters may require additional monitoring to follow any changes in water quality over time. The identification of support-threatened waters can be useful to determine the sources and causes of degradation and determine if management strategies can be used to reduce or eliminate the causes of pollution.

Table 6.4 Support-Threatened Waterbodies in the Hiwassee River Basin

Subbasin	Waterbody	Use Rating	No. of Miles	Source	Management Strategy	Chp. 6 Reference Section
04-05-02	Valley River near Rhodo and Tomatla	ST	9.3	NPS	The pollution source is unknown and needs to be identified.	Section 6.4.2
04-05-02	Junaluska Creek	ST	7.4	NPS	Sources of degradation need to be identified.	Section 6.4.2
NOTES:						
PS	Partially Supporting classified uses					
NS	Not Supporting classified uses					
NPS	Impairment due to Nonpoint Source pollution, though specific sources may not be known					
P	Impairment attributed to Point source pollution					

6.3.3 How are Waters Prioritized for Restoration or Protection?

Priority Ratings for Nonpoint Source Control Federal Grant Spending

DWQ has developed criteria for assisting in the selection of NPS-impaired waters for prioritization by NPS agencies. It is expected that theses priority waterbodies will be targeted by the various NPS agencies and groups in the allocation of the financial, technical, or educational assistance they deliver. These criteria are discussed in Appendix VII in the discussion of NPS Teams. In summary, the criteria for NPS-impaired waters are:

- highly valued resource waters in need of restoration or protection from NPS pollution, and
- waters with impaired water quality as a result of NPS pollution.

In all cases, waters prioritized for action should be those that have a high likelihood for restoration.

Section 303(d) of the Clean Water Act (CWA)

States are required to develop a list of waters not meeting water quality standards or which have impaired uses (Partially Supporting or Not Supporting) under Section 303(d) of the Clean Water Act. Waters may be excluded form the list if existing control strategies are expected to achieve the standards or uses. Control strategies may be both point or nonpoint programs. Waterbodies which are listed must be prioritized and a management strategy or Total Maximum Daily Load (TMDL) must be developed.

Use support ratings for the 303(d) list are based on monitoring data collected in the last five years. Further information on the 303(d) program and a complete list of waters in the Hiwassee River basin can be found in Appendix X. The list includes use support ratings, major causes and sources of impairment, descriptions of potential sources of pollution and the stream priority rating.

6.4 PRIORITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES BY SUBBASIN

6.4.1 Chatuge Lake and Hiwassee River (Subbasin 04-05-01)

Overview

Overall water quality in the subbasin is considered Excellent based on benthic macroinvertebrate data collected since 1985. Very little physical/chemical water quality data has been collected in the subbasin to support or contradict the biological assessment. There are no ambient water quality monitoring stations in this subbasin, and only one (Hayesville) of the four NPDES permitted dischargers is required to conduct instream monitoring. The Town of Hayesville, with a maximum permitted waste flow of 0.073 MGD to Town Creek, is the only significant discharger of oxygen consuming waste. The TVA-Chatuge Hydro Electric plant is the largest discharger with a maximum permitted flow of 0.36 MGD. However, the TVA discharge is not known to contain oxygen consuming wastes or toxicants, and is not considered to have a significant impact on water quality.

Issues and Recommended Management Strategies

Brasstown Creek

Brasstown Creek is rated Partially Supporting its designated uses and is therefore considered impaired. The creek originates in north Georgia and flows along NC 66 for most of its length. The creek is affected by nonpoint source runoff from the highway and various land use activities. Brasstown Creek is also affected by elevated levels of fecal coliform bacteria relating to the effluent from the Young Harris Water Pollution Control Plant.

Senior U.S. District Judge Marvin Shoob recently noted that Georgia's Environmental Protection Division (EPD) had missed the 1979 Clean Water Act deadline for states to identify which waters are heavily polluted and to identify the assimilative capacity of these waters. This realization occurred due to a suit brought against EPA by the Sierra Club in 1994. By 1994, Georgia had set pollution limits for only two of the 340 polluted waterways it had identified. The Judge ordered the EPA and the Sierra Club to submit plans to remedy the problem and ordered a trial to consider whether the EPA should have approved Georgia's list of 340 polluted waters. The outcome of this case is still pending.

The Southeastern Natural Resources Leaders Group (SENRLG) has chosen Brasstown Creek as a potential waterbody for conducting a survey of land use activities and identifying potential restoration projects. The efforts of SENRLG could have very positive benefits for Brasstown Creek.

The State of North Carolina and DWQ should work more closely with Georgia's EPD to assure that proper NPDES limits are established and maintained for those dischargers in the upper Hiwassee River watershed as these streams enter North Carolina.

Town of Hayesville

The Hayesville WWTP has experienced chronic compliance problems over the years with its BOD5, fecal coliform, and flow permit limits. Operational problems and high waste flows appear to be the primary cause. In January 1996, Clay County took over operation of the plant from the town. Since the Hayesville plant is at capacity, the county is planning to construct a new 0.3 MGD WWTP with an outfall to the Hiwassee River. The additional capacity will help get failing septic systems connected as well as to help prepare the county for the predicted future growth. Construction of a new WWTP should be considered environmentally preferable over the current

situation given that the new plant should produce a better quality effluent and the Hiwassee River has a greater assimilative capacity than Town Creek.

The impact the Hayesville WWTP has had on Town Creek is difficult to assess because the town has not been conducting its instream monitoring in accordance with its permit. The town has been collecting downstream data too close to the outfall. As a result, the downstream dissolved oxygen (DO) measurements are likely not capturing the DO sag. The Asheville regional office has contacted the town about this error and more representative data should be forthcoming in the future. Improved water quality in Town Creek is expected once the Hayesville discharge is removed.

Chatuge Dam Operation

The Tennessee Valley Authority (TVA) operates Chatuge Dam on the Hiwassee River approximately 4.5 miles upstream of the proposed new Hayesville WWTP. The dam is used for flood control, recreation, and power generation from its single turbine. TVA has no minimum release requirement from the dam. A discontinued USGS gauging station located approximately 1.5 miles downstream of the dam repeatedly recorded monthly minimum stream flows of < 2.0 cfs over the last ten years of its operation (1965-1975). When water is being released from the dam maximum stream flows can be over 1000 cfs.

Since water used to generate electricity is drawn from near the bottom of Chatuge Lake, instream dissolved oxygen (DO) concentrations below the dam can be <1.0 mg/L. In order to minimize the wide fluctuations in streamflow as well as to increase the instream DO concentration, TVA constructed a reaeration weir approximately 0.8 mile downstream of the dam. The reaeration weir was put into service in November 1992. The weir is designed to maintain a minimum instream DO concentration of 5.0 mg/L and a minimum flow of 60 cfs from the weir pool.
Given the potential for DO concentrations to be near the state standard of 5.0 mg/L immediately below the reaeration weir, it is recommended that Hayesville conduct instream DO monitoring once Clay County relocates the outfall to the Hiwassee River.

6.4.2 Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)

Overview

Overall water quality in this subbasin is considered very good. The majority of the 17 benthos sites surveyed resulted in excellent bioclassifications for the streams sampled. The two ambient monitoring stations in the subbasin did not detect any dissolved oxygen or toxicant violations during the period January 1990 to December 1994. However, Valley River near the Town of Andrews was identified in 1994 by DWQ biologists in a special study as having lower than expected water quality.

Issues and Recommended Management Strategies

The Town of Andrews

The Town of Andrews operates a 1.5 MGD WWTP which discharges to Valley River. The 1994 special study could not attribute the observed water quality problems in Valley River (rated as Partially Supporting) solely to the Andrews discharge since samples taken upstream of the discharge indicated water quality problems as well. The Andrews WWTP had compliance problems when it failed three toxicity test in 1995. Since those three failures the town has passed its toxicity test the last four consecutive times. It is recommended that the Andrews municipal area be targeted for a non-point source survey to determine if non-point sources of pollution are contributing to the water quality problems in the area.

The Town of Murphy
The Town of Murphy operates the second largest WWTP in the subbasin with a maximum permitted discharge of 0.925 MGD to the Hiwassee River. The town has had no significant compliance problems nor has it failed any toxicity tests since 1992. However, the Asheville Regional Office has reported that the town has substantial inflow and infiltration (I&I) problems. The I&I problems have resulted in occasional raw wastewater discharges to the Hiwassee River. Currently the town is under a flow moratorium for additional sewer hookups. The Town of Murphy is working with an engineering consulting firm to alleviate the I&I problems as well as to investigate the possibility of an expansion. Long term instream dissolved oxygen problems are not anticipated as a result of this discharge. It is recommended that the facility continue to monitor its effluent for total phosphorus and total nitrogen in order to provide nutrient data for the future management of Hiwassee Lake.

Clifton Precision South Division
Clifton Precision South Division operates a 0.3 MGD groundwater remediation facility which discharges to Slow Creek. The instream waste concentration is 46%. The facility failed its toxicity test six consecutive times during a period stretching from August 1995 to March 1996. The Asheville Regional Office investigated the problem and it was determined that the treatment units were undersized. Clifton Precision has responded by adding an additional carbon adsorption unit as well as recirculation equipment. Since the treatment upgrade the facility has passed the subsequent two toxicity tests. Extra attention should be given to this facility to ensure that long periods of toxicity test failures do not reoccur.

Valley River
The Valley River is rated either Support Threatened or Partially Supporting its designated uses at the three DWQ sampling sites above Andrews, near Rhodo and near Tomatla. The Partially Supporting portion of the river is addressed above under discussion for the Town of Andrews. The entire length of the Valley River should be a focus of the Hiwassee NPS team to determine the sources of degradation to the river.

Junaluska Creek
Junaluska Creek is bordered by SR 1505 from its headwaters to the Town of Andrews. It is likely that this road is contributing to its Support Threatened status. As a tributary of the Valley River, Junaluska Creek should also be investigated for potential sources of degradation by the Hiwassee NPS team.

6.5 IDENTIFICATION AND PROTECTION OF HIGHLY VALUED RESOURCE WATERS

6.5.1 Overview of High Quality and Outstanding Resource Waters as well as Special Classifications and Habitats

Waters considered to be biologically sensitive or of high resource value may be given protection through reclassification to HQW (high quality waters), ORW (outstanding resource waters), Tr (trout) or WS (water supply), or they may be protected through more stringent NPDES permit conditions. Waters eligible for reclassification to HQW or ORW may include native trout waters, designated critical habitat for threatened or endangered species (as designated by the NC Wildlife Resources Commission), waters having Excellent water quality or those classified for domestic water supply purposes (WS I and II). The HQW, ORW and WS classifications generally require more stringent point and nonpoint source pollution controls than do basic water quality classifications such as C or SC (see Appendix II).

The Hiwassee River basin contains a large number of streams that have either ORW or HQW classifications, as well as trout (Tr) and water supply (WS) status. Britton Creek was reclassified to HQW in August 1992. Based on data collected from summer 1994 surveys, the following streams may qualify for ORW/HQW reclassification:

- Peachtree Creek
- Hanging Dog Creek
- Persimmon Creek
- Beaverdam Creek

There are eleven species listed by the NC Natural Heritage Program as Endangered, Special Concern or Significantly Rare in the Hiwassee River basin. Those listed as Endangered and Special Concern are given special protection status by the North Carolina Wildlife Resources Commission and/or the North Carolina State Endangered Species Act (G.S. 113-331 to 113-337). The species and the status of each can be found in Section 2.5.

Where waters are known to support state or federally listed endangered or threatened species or species of concern, consideration will be given during the NPDES permitting process to minimize impacts to habitat areas consistent with the requirements of the federal Endangered Species Act and North Carolina's endangered species statutes. Possible protection measures may include but are not limited to dechlorination or alternative disinfection, tertiary or advanced tertiary treatment, outfall relocation, and backup power provisions to minimize accidental plant spills. The need for special provisions will be determined on a case-by-case basis during review of individual permit applications and take into account the degree of impact and the costs of protection.

6.5.2 Strategies for Controlling Discharges to High Quality Waters (HQWs) and Outstanding Resource Waters (ORWs)

The presence of many HQW and ORW streams in the basin (Refer to Figure 2.9) will prevent the addition of any new discharges or expansion of existing discharges in many parts of the basin.

High Quality Waters (HQWs)

Many streams in the Hiwassee River basin are classified as high quality waters. For HQWs, a distinct set of management strategies applies to wastes discharged from a facility. New discharges and expanding discharges that have an increase in pollutant load to HQW streams are subject to the following management strategies adopted by DWQ pursuant to 15A NCAC 2B.0224 (1) and 15A NCAC 2B .0224 (1)(b)(vii):

- Discharges from new single family residences will be prohibited. Those that must discharge must install a septic tank, dual or recirculating sand filters, disinfection and step aeration. (15A NCAC 2B.0224 (1)(a)).

- All new or expanded wastewater discharges (except single family residences) will be required to meet effluent limitations for oxygen consuming wastes as follows: BOD_5 = 5 mg/l, NH_3-N = 2 mg/l, and DO = 6 mg/l. More stringent limitations will be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen consuming wastes will not cause the DO of the receiving water to drop more that 0.5 mg/l below background levels, and in no case below the standard. Where background information is not readily available, evaluations will assume a percent saturation determined by staff to be generally applicable to that hydroenvironment. (15A NCAC 2B .0224 (1)(b)(i)).

- Emergency Requirements: Failsafe treatment designs will be employed (except single family residences), including stand-by power capability for entire treatment works, dual train design

for all treatment components, or equivalent failsafe treatment designs. (15A NCAC 2B .0224 (1)(b)(iv).

- Volume: The total volume of treated wastewater for all discharges combined will not exceed 50 percent of the total instream flow under 7Q10 conditions. (15A NCAC 2B 0.224 (1)(b)(v)).

- Toxics: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor will be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent will be allocated at one half of the normal standard at design conditions. Whole effluent toxicity will be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration or 90 percent. Ammonia toxicity shall be evaluated according to EPA guidelines promulgated in "Ambient Water Quality Criteria for Ammonia - 1984"; EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784).

- North Carolina does not have a numeric water quality standard for suspended solids. All dischargers must meet federal effluent guideline values at a minimum (e.g. 30 mg/l for domestic discharges). New discharges to high quality waters (HQW) must meet a total suspended solids (TSS) limit of 10 mg/l for trout waters and primary nursery areas and 20 mg/l for all other HQWs.

Outstanding Resource Waters (ORWs)

No new discharges nor expansions of existing discharges directly to waters classified as ORW are permitted in accordance with 15 NCAC 2B .0225 (c)(1) (see Appendix II). Those existing discharges will be handled on a case-by-case basis following standard operating procedures.

6.6 GENERAL MANAGEMENT STRATEGIES FOR PROTECTING WATER QUALITY IN THE BASIN

6.6.1 Management Strategies for Growth and Development in Western North Carolina

The institution of programs and initiatives to balancing economic growth with water quality protection is the responsibility of local governments. The following strategies are examples of a few of the initiatives local governments in the region could pursue.

- Develop a Regional Organization. It is suggested that a regional organization be developed for the western eight counties of North Carolina (covering the Hiwassee, Little Tennessee, Savannah and French Broad River basins). While the focus of this group could primarily be aimed at sustainable economic growth development, a separate task force could be developed to conduct an analysis of the impacts of the Cherokee gambling casino on natural resources. Several economic development organizations are already in existence in the region.

- Develop a variety of land use management tools. Land use management issues will need to be addressed either by the local governments or by the natural resource task force of the regional organization. The lack of land use planning can have long-term negative impacts on water quality. Chapter 5, Section 5.6.3 presents information on local governments that have some land use planning in effect.

Both of the counties within the Hiwassee River basin should have a Sedimentation and Erosion Control Ordinance, Pre-Development Ordinance (or subdivision ordinance) and a Land Use Plan in effect. The development of a Land Use Guidance System (LUGS) may be a feasible system to enact within these counties. LUGS is a systematic land use planning and management tool that allows for land use decisions to be made on a site specific basis. The concept behind LUGS is that projects are heard case-by-case, often based on a pre-existing growth guidance assessment. A committee reviews the project for its compatibility with the growth guidance assessment. Anyone from the surrounding area that may be affected by the project is invited to attend review meetings. The Board of Commissioners typically makes a final decision on the project. This process is less generic in its approach than zoning and yet allows for protection of the integrity of the community.

- Pursue Funding for Local Water Quality Protection Projects. The Clean Water Management Trust Fund (see Chapter 5, Section 5.8) may be a source of funding to assist local governments in obtaining a balance between economic growth and protecting surface waters of the state. Local governments will need to take responsibility for planning for the additional tourists and growth and development. This region of the state typically has a lower tax base than other areas of the state. Problems with aging infrastructure are also typical, especially for the small towns in the region. The Clean Water Management Trust Fund can be used for many purposes including: acquiring land for conservation easements and riparian buffers, restoring degraded lands to protect water quality, repairing failing waste treatment systems and septic tank systems and improving stormwater management. Local governments and regional organizations should consider pursuing funding through the Clean Water Management Trust Fund as a means to upgrade infrastructure and manage land to protect water quality. Contact the Executive Director, Dave McNaught at (919) 974-5497 for more information.

- Support Local Initiatives for Water Quality Protection. Local governments and regional organizations can also support local efforts to protect areas by developing greenways, bikeways and monitoring efforts conducted by citizen volunteers and protection of lands near surface waters and wetlands.

- State support to encourage the development and implementation of land use plans. This incentive policy has been applied in other states. The premise of an incentive program is to provide partial funding to staff the program if a local government develops a land use plan and then enforces its plan. If the land use plan is not developed or enforced, no funding would be available. Such a program has not yet been developed in North Carolina.

- DWQ assistance to local governments for wastewater planning. Over the past several years DWQ has been involved in a number of projects to encourage and assist local governments in carrying out wastewater planning and growth management activities. DWQ will continue to work with local governments to encourage them to take steps to manage the effects of growth.

6.6.2 Management Strategies For Controlling Sedimentation

Sedimentation has not been identified as a major source of water quality degradation and stream impairment in the Hiwassee River basin (See Table 6.3).

Sedimentation is a widespread nonpoint source-related water quality problem that results from land-disturbing activities. The most significant of these activities include agriculture and land development (e.g., highways, shopping centers, and residential subdivisions). For each of these major types of land-disturbing activities, there are programs being implemented by various government agencies at the state, federal and/or local level to minimize soil loss and protect water quality. Some of these programs are listed in Table 6.5 and are briefly described in Appendix VI.

Table 6.5 State and Federal Sediment Control-Related Programs

Agricultural Nonpoint Source (NPS) Control Programs	North Carolina Agriculture Cost Share Program NC Cooperative Extension Service and Agricultural Research Service Watershed Protection and Flood Prevention Program (PL 83-566) Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA). (Includes Conservation Reserve Program, Conservation Compliance, Sodbuster, Swampbuster, Conservation Easement, Wetland Reserve and Water Quality Incentive Program)
Construction, Urban and Developed Lands	Sediment Pollution Control Act Federal Urban Stormwater Discharge Program Water Supply Protection Program ORW and HQW Stream Classification
Forestry NPS Programs	Forest Practice Guidelines National Forest Management Act Forest Stewardship Program Best Management Practices Forest Management Program Services
Mining	The Mining Act of 1971
Wetlands Regulatory NPS Programs	Section 10 of the Rivers and Harbors Act of 1899 Section 404 of the Clean Water Act Section 401 of the Water Quality Certification (from CWA) North Carolina Dredge and Fill Act (1969)

Construction activities, private access roads, state road construction and agriculture are sources of sediment and are discussed below. Golf courses and urban stormwater are other potential sources of sediment that are discussed in separate sections.

Before action is taken to restore a stream channel and riparian area, it is essential to understand the cause and nature of the problem. For example, if a landowner notices that excess gravel is accumulating in the stream on their property, they should first investigate the causes on their property and, if necessary, throughout the watershed. Stabilizing a streambank can result in an expense of time and money which will have to be repeated until the underlying cause is addressed. It is important to understand that a streambank may erode for many different reasons and the cause is not always obvious. Underlying causes might be as simple as a lack of bank vegetation to hold the soil in place or as complex as changes in runoff caused by urban runoff, poor logging or farming practices or other activities in the watershed.

Also, watershed inventories should not focus solely upon problem areas. Without advance planning and protection, sensitive resources, highly productive resource or critical components of natural systems are easily degraded or lost through development or overuse. Riparian buffers, wetlands, floodplains, animal movement corridors and rare species should be identified and their protection incorporated into watershed planning and management efforts.

Proven Techniques for Controlling Sediment and Protecting Streams

The following techniques are proven to be effective at controlling sedimentation to streams, thereby protecting the water quality of streams.

- Protect existing riparian forest buffers.
- Avoid disturbance of streams and the riparian zone. Restore vegetation that has been cleared from the riparian zone.
- Use BMPs for sediment control. A wide variety of agricultural BMPs have proven effective for sediment control. These include conservation tillage/residue management, filter strips and field borders, and cover crops.
- Don't straighten channels. Maintain natural channels or, if modification is unavoidable, design channels based on the stability and behavior of natural stream channels. Channel designs based on natural stability principles will be less susceptible to erosion, dissipate energy more effectively, remain more stable, and provide more habitat than traditional engineered channel designs.
- Maintain pre-development peak flows, flow velocities, and flow timing to the extent possible through the use of stormwater management techniques and appropriate BMPs.

The Use of Riparian Buffers to Protect Stream Quality and Integrity

A stream and its riparian area function as one. The condition of the riparian area and its vegetation play a central role in determining the integrity of stream channels and water quality. Although streamside vegetation of any kind is desirable, forests provide the greatest amount of benefit and highest potential for meeting both water quality and habitat restoration objectives. A sound scientific foundation exists to support the sediment reduction, nutrient reduction, and ecological values and functions of riparian forest buffers. The use of riparian buffers as a management tool should be promoted.

Riparian Forest Buffers are streamside ecosystems, managed for the protection of water quality through control of nonpoint source pollution and maintenance of the stream environment. Riparian Forest Buffer Systems are typically managed as three integrated streamside zones which are designed to intercept surface runoff and subsurface flow. They comprise an area of trees, usually accompanied by shrubs and other vegetation, that is adjacent to a body of water. The Riparian Forest Buffer is managed to:

- maintain the integrity of stream channels and shorelines,
- reduce the impact of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals, and
- supply food, cover, and thermal protection to fish and other wildlife.

Construction Activities

Construction activities can dramatically increase the sediment delivered to streams. Construction activities can be especially harmful in the mountains where slopes are steep and rainfall is frequent. Construction activities are controlled under the Sedimentation and Erosion Control Act administered by the NC Division of Land Resources (DLR). This act requires anyone disturbing more than one acre of land to submit a Sedimentation and Erosion Control Plan to DLR. One of the major requirements is that there are adequate erosion control measures to retain all sediment on a development site during the 25-year storm. Generally, a land owner must install acceptable Best Management Practices (BMPs) when the land is disturbed by construction or development activities. Management practices may include barriers, filters, or sediment traps to reduce the amount of sediment that leaves a site. Under this act, local governments may take responsibility

for reviewing and enforcing the Sedimentation and Erosion Control Program within their jurisdiction; however, their program must be at least as stringent as DLR's.

In the Hiwassee River basin, development pressure is likely to increase. In order to match the pace of land disturbing activity, more staff hours will be needed within the DLR in order to effectively administer and fully enforce the provisions of the Act. At present, planning and inspection staff are stretched thinly across large geographic areas and a wide variety of projects. Careful planning prior to construction, perhaps the most important part of erosion control, may often be neglected due to lack of available staff time.

The responsibility for controlling sediment from construction activities falls on many shoulders. The parties with the greatest responsibility include: homeowners, developers/contractors, local governments, and the NC Division of Land Resources. Table 6. 6 presents actions that will help to address sediment problems associated with construction activities.

References/Resources:

- The following can be ordered from the NC Division of Land Resources at P.O. Box 27687, Raleigh, NC 27611, (919)733-3833:
  1) *NC Erosion and Sediment Control "Planning and Design Manual"* ($55 for in-state, $75 for out-of-state)
  2) *NC Erosion and Sediment Control "Inspector's Guide"* ($20 for in-state or out-of-state)
  3) *NC Erosion and Sediment Control "Field Manual"* ($20 for in-state or out-of-state)
  4) *NC Erosion and Sediment Control "Video Modules"* ($15 for in-state, $50 for out-of-state)
- Asheville Regional Office of the Division of Land Resources at (919)251-6208.

No sediment control measures are 100% effective so some level of sedimentation will occur with land-disturbing activities. Education and promotion of stewardship are keys to reducing sedimentation, along with judicious strengthening of regulations and enforcement.

Private Access Roads

Improperly designed, constructed, and maintained private access roads are a significant source of sediment in the mountains. Often, landowners do not realize the importance of building driveways for lasting service. Some landowners depend entirely on their contractor to design the road. Others try to design it themselves without consulting a reputable source. The consequences of not paying attention to an access road as it is designed and constructed can be serious. In addition to losing the road and potentially losing land and property, the washed-out road can damage water quality.

Most of the responsibility for an access road rests on the landowner. However, local governments, citizens, and state/federal agencies can also make their contribution to solving this problem. Recommendations for controlling sediment loss from private access roads are presented below in Table 6.7.

References/Resources:

- *Guidelines for Drainage Studies,* NCDOT Hydraulic Design Unit (1995). To obtain, call NCDOT at (919)250-4128.
- *Final Report: Timbered Branch Demonstration/BMP Effectiveness Monitoring Project* by Richard Burns, USDA Forest Service (1994). To obtain, call USDA at (704)257-4214.
- Asheville Regional Office of the Division of Land Resources, (919)251-6208.

Table 6.6 Recommended Actions to Address Construction-Related Sediment Problems

Homeowners	Know and follow state and local erosion and sedimentation ordinances. Fit the development to existing site conditions. Development that follows natural contours and avoids flood plains and highly erodible soils, is much easier to control erosion and sedimentation. Establish, maintain, and protect vegetation beside streams on your property. Buffers provide a filter for sediment and other pollutants. Carefully monitor the construction process. Ensure permanent vegetation is established and maintained on construction site ASAP. Continue to control sediment after construction is complete.
Developers Contractors	Fit the development to existing site conditions. Development that follows natural contours and avoids flood plains and highly erodible soils is much easier to control erosion and sedimentation. Minimize the extent and duration of exposure. Schedule construction according to weather and season. Try to pick dry times. Protect areas to be disturbed from stormwater runoff. Use dikes, diversions, and waterways to intercept runoff and divert it away from cut-and-fill slopes or other disturbed areas. To reduce erosion, install these measures before clearing and grading. Keep runoff velocities low. Convey stormwater away from steep slopes to stabilized outlets, preserving natural vegetation when possible. Inspect and maintain control structures during the construction process. If not properly maintained, some erosion control measures can cause more damage than they correct. Retain sediment onsite. Protect low points below disturbed areas. Build barriers to reduce sediment loss. When possible, construct sediment traps before other land disturbing activities. Stabilize disturbed areas as soon as possible after construction. Apply mulch and vegetation to land and line channels for protection. Consider future repairs and maintenance of these measures. Train equipment operators to execute erosion and sediment control practices.
Citizens	Report any serious sediment problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls.
Local Govts. Without Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control before they begin construction activities to ensure they understand their responsibilities under the State Sedimentation Pollution Control Act. Report any serious problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls. If your resources allow, consider taking responsibility for sediment and erosion control in your jurisdiction. This will allow greater control over implementation and enforcement of the program. It will also offer the opportunity to require sediment control on developments disturbing under one acre. Maintain publicly-owned open space. Will prevent sediment loss from certain tracts of land.
Local Govts. With Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control. Maintain publicly-owned open space. Will prevent sediment loss from certain tracts of land. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts.

Table 6.6 Recommended Actions to Address Construction-Related Sediment Problems (Cont'd)

NC Div. of Land Quality	Continue to promote effective implementation and maintenance of erosion and sediment control measures on construction sites. Research innovative new ways to control sediment on construction sites. Evaluate the effectiveness of current sediment control enforcement & Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts. Encourage more delegated programs by local governments where resources allow, especially in rapidly developing areas.

Table 6.7 Recommended Actions to Address Sediment from Private Access Roads

Homeowners	Know the state and local laws, ordinances and regulations about access road construction. Construct a good road that will last. The cost of constructing a road will vary greatly from site to site. The cost may increase due to steep or rocky land, low stability soils, or drainage needs. In the long run, it does not pay to skimp. Avoid steep grades. Sustained grades should not exceed 10% for gravel or crushed stone roads. Make sure the road has adequate drainage. Adequate drainage is necessary to control erosion. The following water sources must be considered: rainfall on the roadbed and cut/fill slopes, overland storm flows from the watershed above the road, and springs or streams intercepted by the road. Use drainage methods that protect water quality. These methods include capture areas to treat runoff and routing runoff parallel to streams. Inspect the road periodically. Check for ruts and dips in the road, the condition of the drainage outlets, and the general condition of the cut and fill slopes. Repair any problems immediately. Any problems with ruts, drainage outlets, bare areas, etc. should be repaired before a small problem turns into a large problem.
Contractors	Watch for signs of subsurface drainage problems before, during, and after construction. Some things to look for include: soils that are gray in color, areas with springs or seeps, low areas, and areas dominated by water-tolerant plants such as alders, black walnut, poplar, cattails, reeds, etc. Road and ground cover should be applied as soon as possible after construction.
Citizens	Report any serious problems with access roads. Some problems to look for include big ruts in the roadway, wash-outs, and clogged drainage outlets. You can report problems to your local government officials. If they are not able to help, contact the regional office of the NC Division of Land Resources.
Local Governments	Require properly designed and constructed roads as part of the building permit process. Institute ordinances requiring proper maintenance of private access roads.
State and Local Agencies	Provide citizens with information about how to properly construct private access roads. Investigate innovative new ways of constructing private access roads while protecting water quality.

State Road Construction

Like any impervious surface, roadway systems have the potential to generate stormwater runoff problems. Various types of pollutants from the road surface can be carried to surface waters by rainfall. In addition, roadway construction, roadside vegetation management and roadway operation and maintenance activities can contribute to stormwater pollution problems.

The Division of Water Quality is currently working with the NC Department of Transportation (DOT) to finalize a stormwater management permit for DOT activities. This permit will address pollution from stormwater runoff related to roadways, road construction, vegetation management, operation and maintenance and other related DOT activities throughout the state. The major permit requirements are the implementation of a comprehensive stormwater management program, monitoring programs to direct the stormwater program and annual reports to outline the effectiveness and direction of the program.

The initial emphasis of the stormwater programs will be on high volume roadway segments in sensitive water areas such as coastal areas and water supply watersheds. The stormwater management programs will try to locate and characterize pollutant problems and to develop and implement appropriate best management practices to protect surface waters.

DOT is responsible for its own sedimentation and erosion control program. DOT has a number of projects with effective sedimentation and erosion control in mountain areas. Table 6.8 presents recommended road construction measures.

Table 6.8 Recommended State Road Construction Measures

NC Dept. of Transportation	Know the state and local laws, ordinances and regulations about construction. Implement high quality sediment and erosion control. This is extremely important in areas with steep slopes. Increase training for DOT staff to ensure that sedimentation and erosion control devices are properly sized and installed. It is also important to include specific instructions for sediment and erosion control and phasing on the plans so that contractors can understand their responsibility. Inspect sedimentation and erosion control devices frequently. This is particularly important when contractors are responsible for the work. Implement pre-, during, and post-construction water quality monitoring at selected sites. This is the only way to tell for sure if sediment and erosion controls are working effectively. Reduce the threshold of exposed area when roads are constructed on steep slopes.
Citizens and Local Governments	Contact the district DOT office if you observe sediment problems at a road construction site. Some things to watch out for include: bare soil that is not mulched and/or planted within 30 days, washed-out sediment basins and filter cloths, and soil disposal sites that are placed in or directly adjacent to creeks.

References/Resources:

- Dan Martin, District Office of DOT, (704)586-2141.

Agriculture

Streambank Fencing and Alternative Livestock Water Supply

Streambanks trampled by livestock can be a significant source of sediment. Streambank fencing and livestock watering facilities outside the riparian zone can help maintain the vegetation necessary for stabilizing streambanks and preventing erosion. The water quality benefits of streambank fencing have been well documented. Fencing and exclusion can create vegetative buffer strips along streams that trap sediment and reduce pesticide and nutrient runoff before they enter the stream. Streambank fencing also provides food, cover, and nesting sites for upland and aquatic

wildlife. Allowing natural vegetation to re-establish can not only provide better habitat within the stream but also create a corridor for wildlife movement and a connection with other habitat.

Livestock exclusion may also improve water quality by preventing manure deposition in the stream. For example, according to Penn State University, one cow produces approximately 5.4 billion fecal coliform bacteria per day. At this rate, unrestricted access of fifty cows to a stream for a 24 hour period could contaminate the equivalent of one day's untreated water supply for a city the size of Baltimore.

Exclusion from the riparian area may also improve the health of livestock. Bacteria and other disease-causing organisms entering the stream can transmit diseases between and within livestock herds. Streambank fencing reduces contact with disease-causing organisms that thrive in these environments. For example, environmental mastitis is most commonly caused by coliform bacteria which enter teats as cows wade in streams. The first recommendation in any mastitis prevention program is to provide a clean, dry environment for the cows. Streambank fencing also reduces the risk of foot and leg injuries and can be part of an effective lameness prevention program.

6.6.3 Management Strategies For Urban And Industrial Stormwater Control

Recommendations for Urban Stormwater Control

Urban stormwater runoff can be a significant contributor to water quality problems. In the Hiwassee River basin, urban development is relatively limited at present. As land is converted to impervious surfaces with construction of housing developments and commercial areas, careful attention to stormwater control will be more important. Stormwater problems are likely to be centered around the Towns of Andrews, Murphy and Hayesville, and any high density developments that may arise. There are no municipalities in the Hiwassee River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

The best time to address urban stormwater impacts are when it is most effective and least costly to do so -- before development occurs. Numerous studies have demonstrated a serious decline in the health of receiving waters when 10 to 15 percent of a watershed is turned into impervious surfaces (Schuler 1995). The entire community plays a role in controlling the quality and quantity of urban stormwater. Table 6.9 is a list of recommendations for local governments, citizens, businesses, developers, and state agencies. Table 6.10 offers tips for minimizing water quality impacts from lawn and car care. Table 6.11 presents non-toxic alternatives to commonly used, but potentially toxic, home care products (e.g., cleaning agents and paints).

References/Resources for Urban Stormwater:

Stormwater Management Guidance Manual, 1993, Cooperative Extension Service

Stormwater Management in North Carolina: A Guide for Local Officials, 1994, Land-of-Sky Regional Council, Asheville, NC (Eaker 1994)

Stormwater Fact Sheets by Land-of-Sky Regional Council, 1994

1. *Stormwater Problems and Impacts: Why all the Fuss?*
2. *Stormwater Control Principles and Practices*
3. *Stormwater Management Roles and Regulations*
4. *Local Stormwater Program Elements and Funding Alternatives*
5. *Municipal Pollution Prevention*
6. *Managing Stormwater in Small Communities: How to Get Started*
7. *Maintaining Wet Detention Ponds*
8. *Plan Early for Stormwater in Your New Development*
9. *How Citizens Can Help Control Stormwater Pollution*

Stormwater Best Management Practices, 1995, DWQ Stormwater Group: (704)251-6208.

Table 6.9 Recommendations for Urban Stormwater Control

Local governments	Create public education programs. These programs advise citizens about how to care for their homes, businesses, and neighborhoods while minimizing stormwater pollution. Topics that can be covered include environmentally sensitive methods of caring for lawns and vehicles (see Table 6.8). Support stream clean-up programs. Clean-up programs such as Big Sweep remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. Create and enforce strict penalties for improper waste disposal. Local governments should provide fencing around dumpsters and clean them regularly. Institute land use planning to protect water quality. Through planning, local governments can reduce flooding by limiting the total area of impervious surfaces and directing runoff into vegetated areas or stormwater control devices. In addition, planning can be used to protect surface waters by directing growth away from sensitive areas/waters such as floodplains, steep slopes, wetlands, high quality waters, and water supplies. Review local ordinances pertaining to parking and curb and gutter. Local ordinances often require larger parking lots than are needed. Parking lots should be designed to handle the average parking needs with overflow areas in grass. When possible, it is best to eliminate curbs and gutters to allow runoff to flow off the street or parking lot in sheet flow. Protect open spaces and streamside buffers in and around urban areas. This will preserve recreational areas and significant natural resources near the town or city. Attend stormwater workshops for local government officials. Various agencies like DWQ offer workshops on stormwater management or reference materials. For more information, contact the DWQ stormwater group at (919)733-5083. Map the storm sewer system. If local governments map the inlets, pipes, and outlets that make up their storm drain system, they will be well equipped to identify the source of any observed stormwater problems. Offer hazardous waste collection days.
Citizens	Participate in stream clean-up programs. Clean-up programs remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. A Big Sweep event is held each year in September. Stream clean-up is a great service activity for groups such as Scouts, 4-H, Rotary Clubs, etc. Practice environmentally-friendly lawn care. Table 6.9 has a list of suggestions for keeping a green lawn while minimizing harm to the environment. When possible, use less-harmful substances in the home for cleaning or painting. Any time hazardous substances are used, there is a risk that they can enter the water by interfering with the proper functioning of septic tanks, leaking out of sanitary sewers, etc. When possible, use less hazardous substances such as latex instead of oil paint (see Table 6.10). Educate adults and children about how to protect water quality. Educational materials can be obtained from the NC Office of Environmental Education, (919)733-0711. Utilize hazardous waste collection centers for paints and most chemicals. Never dispose of oil, yard wastes, or other materials in storm drain inlets or dump these materials on lands. Storm drains connect directly to nearby streams without any treatment of the water. Maintain and protect riparian buffers on private property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove a wide array of pollutants, including sediment, nutrients, and toxic substances. They can also increase property value. Support your local government's land use planning initiatives.

Developers	Incorporate stormwater management in the planning of projects. Plan developments to reduce impervious areas (roads, driveways, and roofs). Do not build in environmentally sensitive areas such as floodplains and wetlands. (This is also a flood insurance policy.) Maintain natural drainageways and buffers along streams.
Businesses	Maintain and protect riparian buffers on commercial property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove sediment, nutrients, and toxic substances. Cover and contain waste materials. This will prevent runoff from the disposal area from becoming contaminated and polluting the receiving water. Practice good housekeeping. A clean and litter-free facility will promote good water quality. Institute hazardous waste collection sites. Automobile service centers, hardware stores, and other pertinent businesses can institute hazardous waste collection sites for used oil, antifreeze, paint, and solvents.
State and Federal Agencies	Provide technical information about urban stormwater. State and federal agencies should strive to increase their communication with local governments, businesses, and citizens. Create and maintain stormwater wetlands along streams. Like buffers, stormwater wetlands treat stormwater and reduce flows. Stormwater wetlands must be designed and maintained properly to be effective.

Table 6.10 How to Take Care of Your Lawn and Car and Protect Water Quality

If you are caring for...	This is the environmentally-friendly practice.
your lawn	• Use only fertilizers that are needed, based on soil tests and plant needs. • Keep fertilizers off driveways and sidewalks. • Avoid using fertilizers within 75 feet of any waterbody. • If you use a lawn service, request natural rather than chemical management. • Plant hardy, native species that do not require chemical inputs. • Contact your Cooperative Extension Agent for more information.
your vehicle	• Maintain motor vehicles and repair leaks promptly. • Dispose of used motor oil and antifreeze in recycling centers. • Avoid gas tank overflows during refueling.

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

Table 6.11 Substitutions for Household Hazardous Substances

Instead of...	Try...
• Ammonia-based Cleaners	• Vinegar + Salt + Water
• Abrasive Cleaners	• Lemon Dipped in Borax or Salt + Baking Soda
• Furniture Polish	• Lemon Juice + Olive Oil
• Toilet Cleaner	• Baking Soda + Toilet Brush
• Oven Cleaner	• Liquid Soap + Borax + Warm Water
• Drain Cleaners	• Boiling Water + Baking Soda + Vinegar
• Upholstery Cleaners	• Dry Cornstarch
• Mothballs	• Cedar Chips or Lavender Flowers
• Window Cleaner	• White Vinegar + Water
• Oil-Based Paints and Stains	• Water-based Paints and Stains

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

Recommendations for Controlling Industrial Stormwater

Throughout the Hiwassee River basin various types of industrial activities with point source discharges of stormwater are required to be permitted under the NPDES stormwater program. These include facilities engaged in industrial activities such as ready mixed concrete, asphalt, metal products and equipment, textiles, timber products, furniture and cabinet making, mining, and stone, clay, and glass manufacturing.

Surface waters can be significantly impacted by stormwater runoff from industrial facilities, particularly those that store or transfer materials out of doors. The types of chemicals, industrial operations and various ancillary sources influence the pollution potential of each individual facility. As such, industrial facilities can reduce stormwater impacts by developing a comprehensive site-specific Stormwater Pollution Prevention Plan (SPPP or Plan) which is based on an accurate understanding of the pollution potential of the site. The Plan provides a flexible basis for developing site-specific measures to minimize and control the amounts of pollutants in stormwater runoff by implementing best management practices (BMPs). With respect to stormwater, the ultimate BMP is the elimination of exposure of any significant materials to rainfall or runoff.

Facilities subject to NPDES stormwater permitting are required to develop and implement a SPPP. The SPPP approach focuses on two major objectives: 1) to identify sources of pollution potentially affecting the quality of stormwater discharges from the facility; and 2) to describe and ensure that practices are implemented to minimize and control pollutants in stormwater discharges from the facility. The basic components of a SPPP include a site plan detailing the facility layout and locations of potential pollutant sources, a stormwater management plan describing materials management practices and feasibility of employing best management practices, a spill prevention and response plan, a preventive maintenance and housekeeping plan, annual employee training and semi-annual facility inspections. The facility SPPP must be periodically reviewed and updated to reflect changes at the facility.

In addition to the SPPP, all permitted facilities are required to perform qualitative monitoring. This monitoring requires the periodic visual inspection of each stormwater outfall. Inspections are performed for parameters including color, odor, clarity, floating and suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution. Facilities with significant stormwater pollution potential are also required to perform quantitative analytical monitoring.

6.6.4 Management Strategies for Controlling Fecal Coliform Bacteria

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals and are widely used as an indicator of the potential presence of disease-causing bacteria and viruses. They enter surface waters from a number of sources including failing onsite wastewater systems, broken sewer lines, improperly treated discharges of domestic wastewater, pump station overflows, straight piping and runoff carrying livestock and wildlife wastes.

There are no monitored waterbodies in the Hiwassee River basin where fecal coliform bacteria standards have been exceeded in at least 25% of the samples taken by DWQ. However, Brasstown Creek has had some problems with elevated fecal coliform bacteria due to effluent form the Young Harris Water Pollution Control Plant. The Hiwassee River and the Valley River have had occasional elevated levels of fecal coliform bacteria.

Several general management strategies for addressing fecal coliform contamination include:

- Proper maintenance and periodic inspections of onsite waste disposal systems such as septic tanks.
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Elimination of direct unpermitted discharges of domestic waste (also known as "straight piping").
- Proper management of livestock to keep wastes from reaching surface waters.
- Encouragement of local health departments to routinely monitor waters known to be used for body contact recreation (e.g., swimming and tubing).

The 1996 General Assembly established a program designed to eliminate domestic sewage or wastewater discharges from both direct (straight pipe) and from overland flow of failing septic systems. The focus of the program contains three components:

1) the identification and elimination of domestic sewage discharges into streams proposed or currently used for public water supplies,
2) an amnesty period to end December 31, 1997 during which time violations for identification of domestic dischargers will not be incurred, and
3) a public education program about the amnesty period will be implemented. The majority of the funds allocated to this program are recurring funds.

Septic tanks are used widely throughout this basin, particularly since many citizens live outside of the service area of a regional wastewater treatment plant. Unfortunately, many citizens are not aware of how to care for their septic tanks. Some of the actions that homeowners, local governments, and state and federal agencies can take to reduce pollution from septic tanks are listed in Table 6.12.

Table 6.12 Recommended Actions for Proper Maintenance of Septic Tanks

Homeowners	Do not put harmful substances in your septic tank. These substances include: cooking grease, oils, fats, pesticides, paints, solvents, disinfectants, and other household chemicals. These substances can kill the microorganisms that help purify the groundwater and can themselves pollute groundwater. Know the location of your system and keep heavy vehicles and plant roots away from drain field pipes. These things can compact soils and inhibit the proper functioning of the system. Conserve water and stagger intensive uses. Some intensive water uses include showers, laundry, dishwasher, etc. Look for ways to reduce (e.g., full loads) and to not use all at once. Have your septic tank pumped out every three to five years. This will ensure that your household has a functioning wastewater treatment system. Look for "greener grass over the septic tank." This could be a sign that the septic tank is failing. Divert overland runoff from your property away from the drainfield area. This will reduce the likelihood of saturating the soil and causing malfunctions.
County Health Departments	Require regular inspections of septic systems. Enforce severe penalties for uncorrected septic system malfunctions. Ensure that citizens understand how to maintain their septic tank when they first obtain property in the county.
NC Div. of Environmental Health	Provide leadership to county health offices. Encourage county health offices to require regular inspections. Provide public education materials.

References/Resources:

Please contact the local county heath department for more specific advice.

6.6.5 Management Strategies For Controlling Toxic Substances

Toxic substances, or toxicants, routinely regulated by DWQ include metals, organics, chlorine, and ammonia, as described in Chapter 3.

The waters of the Hiwassee River basin need to be protected from immediate acute effects and the residual chronic effects of toxic substances. Toxic limitations for point source discharges are based on the volume of the effluent released and the 7Q10 flow condition of the receiving stream. In the Hiwassee River basin, four point source discharges are required to conduct whole effluent toxicity testing (The Towns of Hayesville, Andrews, and Murphy and Clifton Precision South Division). Violations have occurred for the Towns of Hayesville and Andrews, as well as Clifton Precision. Refer to Section 6.3 for recommended control strategies for these NPDES permit holders.

Toxics from nonpoint sources of pollution typically enter streams during storm events through runoff from roads, parking lots, agricultural lands or golf courses. In the Little Tennessee River basin, low pH levels have been observed in many high elevation streams. These low pH levels have been attributed to chronic acid deposition and the low buffering capacity of high elevation streams in the basin. With continued chronic input of acid deposition over the mountain region, there is also the potential for acid deposition to degrade surface water in the Hiwassee River basin. This issue is discussed further in Chapter 4. Continued research and monitoring will be important to fully understand the relationship between acid deposition and water quality and for furthering the development of policies to reduce impacts to surface waters from the chronic introduction of atmospheric pollution.

Residents can also do their part in managing toxic substances at home. Recommendations are included in Table 6.10 for environmentally friendly methods of caring for your lawn and car. Table 6.11 presents substitutions for household hazardous substances.

6.6.6 Management Strategies For Oxygen-Consuming Wastes

Maintenance of dissolved oxygen (DO) is critical to the survival of aquatic life and to the general health of surface waters. The daily average dissolved oxygen standard for most waters in the state, except for waters classified as trout and swamp waters is 5.0 mg/l. The trout waters so prevalent in the Hiwassee River basin have a daily average standard for dissolved oxygen of 6.0 mg/l. The major threat to oxygen levels is from point sources. Discharge permits must include limits that protect standards.

While the impact of point source discharges on dissolved oxygen is relatively low in this basin because of the naturally high reaeration rates of mountain streams, special precautions have been taken to protect HQW, ORW and trout waters from the potential impacts of point source discharges. Refer to Section 6.5 for strategies used to protect Highly Valued Resource Waters, such as HQWs and ORWs, in the basin.

REFERENCES - CHAPTER 6

Decker, Mike. October 1996. Macon County Planner, Franklin, NC. Personal Communication.

NC Department of Transportation. June 1996. Transportation Improvement Program, 1997 - 2003.

Willett, Geoffrey and Steve Eller. 1995. A Perspective Study of Gambling in Western North Carolina. N.C. Department of Commerce, Division of Community Assistance, Asheville Regional Office.

Willett, Geoffrey. October 1996. Division of Community Assistance, Asheville Regional Office. Personal communication.

CHAPTER 7

FUTURE INITIATIVES

7.1 OVERVIEW OF HIWASSEE RIVER BASINWIDE GOALS AND OBJECTIVES

Near-term objectives, or those achievable at least in part during the next five years, include coordinating with various agencies to implement the control strategies outlined in Chapter 6 to reduce point and nonpoint source loadings of sedimentation, nutrients and other pollutants. These steps are necessary to progress towards restoring impaired waters, protecting threatened waters from further degradation, protecting high resource value and biologically sensitive waters and maintaining the quality of other waters currently supporting their uses.

The long-term goal of basinwide management is to protect the water quality standards and uses of the basin's surface waters 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 parts of all involved. However, with the needed support and cooperation, DWQ believes that these goals are attainable through the basinwide water quality management approach.

7.2 FUTURE ACTIVITIES IN THE HIWASSEE RIVER BASIN

7.2.1 Nonpoint Source Control Strategies and Priorities/Nutrient Reduction Efforts

Improving our knowledge of and controlling nonpoint source pollution will be a high priority over the next five years. Nonpoint source pollution accounts for the some of the threatened waters in the Hiwassee River Basin. The following initiatives (described in Section 7.2.2, 7.2.3 and 7.2.4) are underway to address the protection of surface waters from nonpoint sources of pollution.

7.2.2 The Hiwassee River Basin Nonpoint Source Team

In early 1996, DWQ contacted potential team members for the Hiwassee Basin NPS Team. Potential NPS team members met in April 1996 to describe what is known about nonpoint sources in the basin and to obtain local input on issues and recommendations for addressing nonpoint source pollution. The team will develop Action Plans consisting of voluntary commitments made by the various agencies and individuals to address nonpoint source pollution.

The Action Plans will be evaluated and updated every five years as part of the basinwide planning process. The responsibilities of the NPS Team members can be summarized as follows. A complete description of the NPS Team process can be found in Appendix VI.

- Describe existing programs for nonpoint source pollutant control.
- Prioritize impaired waters for development and implementation of restoration strategies.
- Prioritize NPS issues for remedial action.
- Develop five-year Action Plan for improving water quality in targeted watersheds.
- Determine what is needed to address the priority waters and NPS issues.

- Implement Action Plans.
- Monitor effectiveness of management strategies.

The team has submitted a proposal for Section 319 funding for two watersheds in the basin, Town Creek and Little Brasstown Creek. These watersheds are the focus of the Action Plan for this planning cycle. Town Creek is a predominantly urban stream and Little Brasstown Creek is predominantly rural. A primary objective of the proposal is to involve many local individuals and agencies to promote effective and permanent conservation solutions for these watersheds of the Hiwassee River. A whole watershed approach for implementing Best Management Practices (BMPs) aimed at minimizing erosion and the resulting sedimentation will be used. BMPs will include various streambank stabilization efforts, livestock exclusion and urban runoff control structures. Given the high visibility of the Town Creek watershed, education and increased awareness are expected to be an outcome of the project. A list of agencies which are currently active in the NPS Team is presented in Table 7.1.

Table 7.1 Current Hiwassee River Basin NPS Team Members

Category	Agency/Group
Agriculture	Clay Soil and Water Conservation District Cherokee Soil and Water Conservation District Farm Services Agency USDA - Natural Resources Conservation Service NC Division of Soil and Water Conservation
Construction/Mining	NC Division of Land Resources
Forestry	NC Division of Forest Resources
Surface water	NC Division of Water Quality NC Wildlife Resources Commission
Urban	NC Division of Water Quality NC Department of Transportation
Local Government	Town of Hayesville Clay County
Additional	Tri-County Community College Tennessee Valley Authority
	Hayesville Merchants Hiawassee River Watershed Coalition Clay County Schools Clay County Water & Sewer Authority

7.2.3 Improved Monitoring Coverage and Coordination with Other Agencies

Monitoring of the chemical and biological status of receiving waters will provide critical feedback on the success of the basin management strategy. As discussed in Chapter 4, monitoring data will be collected from (1) ambient water chemistry, (2) sediment chemistry, (3) biological communities, (4) contaminant concentrations in fish and other biota, (5) ambient toxicity, and (6) facility self-monitoring data. The specific parameters measured will relate directly to the long-term water quality goals and objectives defined within the basinwide management strategy.

In addition to this, DWQ and other environmental agencies have been discussing the potential for coordination of field resources. If individuals from another environmental agency are visiting certain waterbodies to investigate fish populations or wetland areas, they could also collect water quality data from these areas. The coordination of these activities should help to better blend the activities of the various agencies.

7.2.4 Use Restoration Waters (URW) Program

Throughout North Carolina, there are waters that have pollution problems that prevent them from supporting their designated uses. Designated uses include aquatic life support, swimming and commercial shellfish harvest. These waters are often very difficult to restore due to the multitude of nonpoint sources contributing pollutants to the waterbody. Point source dischargers may also be a source of the impairment.

To address waters that have a persistent loss (full or partial) of designated uses, the Division of Water Quality is developing a Use Restoration Waters (URW) Program. If approved, this program would include voluntary and regulatory management strategies to control the specific parameters of concern in selected impaired watersheds. These voluntary and mandatory management strategies could include:

- site-specific best management practices for nonpoint sources,
- source reduction strategies such as education and land use planning,
- ecosystem restoration,
- wastewater treatment requirements, and
- other waste treatment management requirements.

The restoration strategies developed under the URW program would be site-specific to the watershed of the impaired waterbody. DWQ and stakeholders would coordinate each URW strategy with other agencies' programs to create a holistic approach to address the array of pollution problems in the watersheds

7.3 PROGRAMMATIC INITIATIVES

7.3.1 NPDES Program Initiatives

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

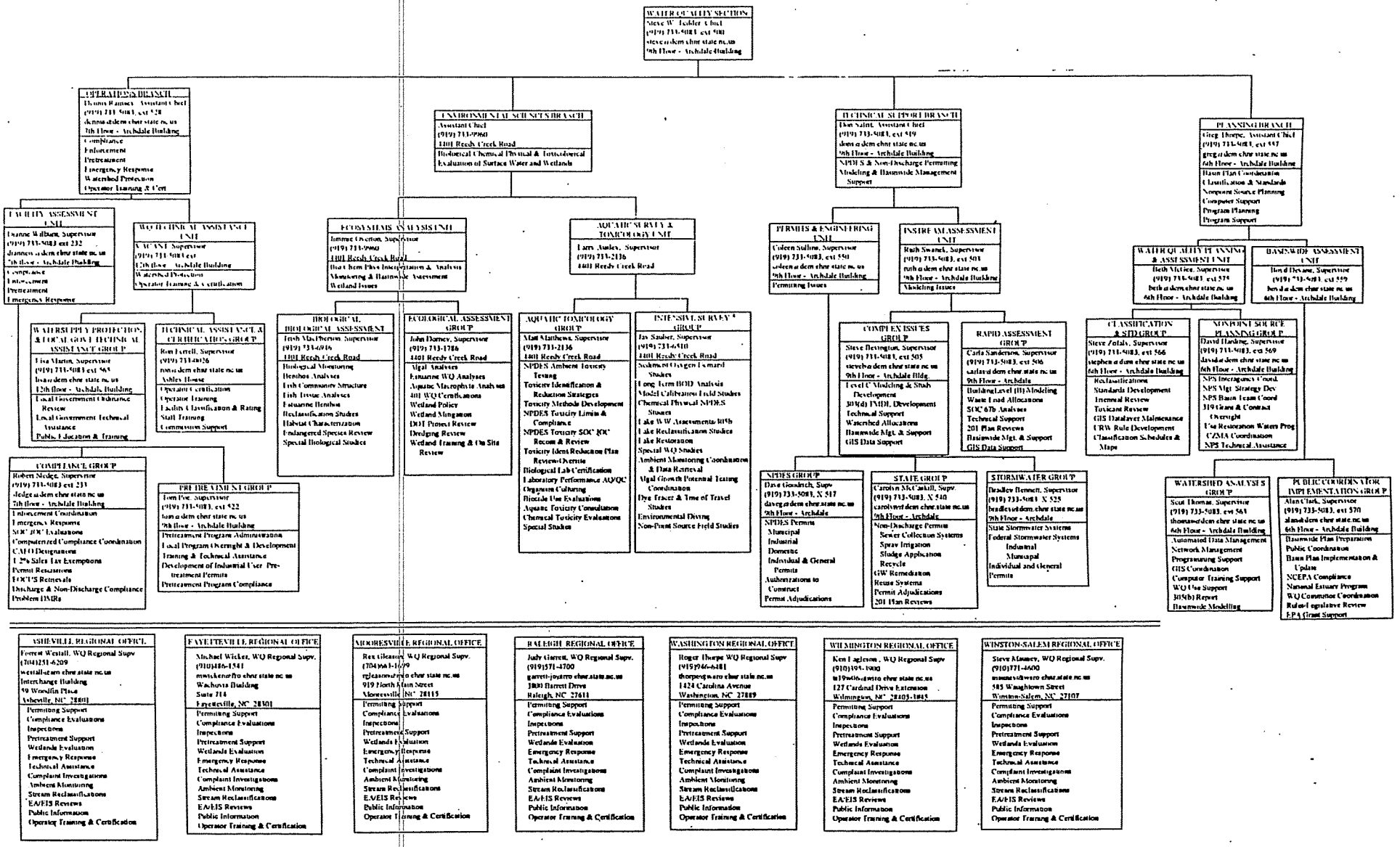
- improve compliance with permitted limits;
- improve pretreatment of industrial wastes to municipal wastewater treatment plants so as to reduce the toxicity in effluent wastes;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination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

Longer-term objectives will include refining overall management strategies after obtaining feedback on current management efforts during the next round of water quality monitoring. Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling byproducts of the treatment process (including nonpotable reuse of treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

WATER QUALITY SECTION

ORGANIZATIONAL DUTIES CHART

Date: December 27, 1995



APPENDIX II

- Summary of North Carolina's Water Quality Classifications and Standards
- Antidegradation Policy
- High Quality Waters
- Outstanding Resource Waters
- Classifications and Water Quality Standards Assigned to the Waters of the Hiwassee River Basin

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS

PRIMARY CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS[1]	STORMWATER MANAGEMENT	OTHER REQUIREMENTS[2]
Freshwater:				
C (standards apply to all freshwaters, unless pre-empted by more stringent standard for more protective classification)	Secondary recreation (including swimming on an unorganized or infrequent basis); wildlife; fish and other aquatic life propagation and survival; agriculture and any other usage, except for primary recreation, water supply or other food-related ruses	Domestic and industrial wastewater dischargers allowed	Stormwater Management Rules apply in the 20 coastal counties as described in 15A NCAC 2H .1000	
B	Primary recreation (swimming on an organized or frequent basis) and all uses specified for Class C (and not water supply or other food-related uses)	Same as for Class C; wastewater treatment reliability requirements (dual train design; backup power capability) may apply to protect swimming uses (15A NCAC 2H .0124)	Same as for Class C	
WS-I Water Supply	Water supplies in natural and undeveloped watersheds	No point source discharges	Not applicable since watershed is undeveloped	No landfills; residual or petroleum contaminated soils application not allowed in the watershed
WS-II Water Supply	Water supplies in predominantly undeveloped watersheds	Only general permit wastewater discharges allowed in watershed	Local land management program required as per 15A NCAC 2B .0214; 6% built upon area in Critical Area; 12% built upon area in the Balance of the Watershed; up to 24% built upon area in the Critical Area and 30% in the Balance of the Watershed allowed with engineered stormwater controls for the 1" storm[3]	Buffers required along perennial waters; no new landfills allowed in the Critical Area and no new discharging landfills outside of Critical Area; no new residual or petroleum contaminated soils application allowed in the Critical Area
WS-III Water Supply	Water supplies in low to moderately developed watersheds	General permits allowed throughout watershed; domestic and non-process industrial discharges allowed outside of the Critical Area	Local land management program required as per 15A NCAC 2B .0215; 12% built upon area in Critical Area; 24% built upon area outside of Critical Area; up to 30% in Critical Area and 50% built upon area outside Critical Area allowed with engineered stormwater controls for the 1" storm[3]	Buffers required along perennial waters; no new landfills allowed in the Critical Area and no new discharging landfills outside of the Critical Area; no new residual or petroleum contaminated soils application allowed in the Critical Area

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (continued)

PRIMARY CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS[1]	STORMWATER MANAGEMENT	OTHER REQUIREMENTS[2]
WS-IV Water Supply	Water supplies in moderately to highly developed watersheds	General permits, domestic and industrial discharges allowed throughout watershed[4]	Local land management program required as per 15A NCAC 2B .0216: 24% built upon area in Critical Area and Protected Area [5,6]; up to 50% in Critical Area and 70% built upon area outside Critical Area with engineered stormwater controls for the 1" storm[3]	Buffers required along perennial waters; no new landfills allowed in the Critical Area; no new residual or petroleum contaminated soils application allowed in the Critical Area
WS-V Water Supply	Former or industrial use water supplies	No categorical restrictions on development or wastewater dischargers	Stormwater Management Rules apply in the 20 coastal counties as described in 15A NCAC 2H .1000	Instream water quality standards for water supply waters are applicable

NOTES: Please refer to 15A NCAC 2B .0101, .0104, .0202, .0211 and .0301 for more specific requirements for surface water supply protection.

1 Groundwater remediation discharges allowed when no alternative exists.

2 See attached tables: *Water Quality Standards for Freshwater Classes* and *Water Quality Standards for Saltwater Classes* for numeric standards associated with specific classes.

3 If the high density option is utilized engineered stormwater control systems must be designed for 85% TSS removal. Refer to Stormwater Management Rules (15 A NCAC 2H .1000) for specific design information.

4 New industrial process wastewater discharges in the Critical Area are allowed but must meet additional treatment requirements.

5 Applies to projects requiring an Erosion/Sedimentation Control Plan.

6 36% built-upon area is allowed for projects without a curb and gutter street system in the Protected Area.

- Critical area is 1/2 mile and draining to water supplies from normal pool elevation of reservoirs, or 1/2 mile and draining to a river intake.
- Protected Area is 5 miles and draining to water supplies from normal pool elevation of reservoirs, or 10 miles upstream of and draining to a river intake.
- Agricultural activities are subject to provisions of the Food Security Act of 1985 and the Food, Agriculture, Conservation and Trade Act of 1990. In WS-I watersheds and Critical Areas of WS-II, WS-III and WS-IV areas, agricultural activities must maintain a 10 foot vegetated buffer or equivalent control as determined by the Soil and Water Conservation Commission.
- Silviculture activities are subject to the provisions of the Forest Practices Guidelines Related to Water Quality (15A NCAC 1I .0101-.0209).
- The Department of Transportation must use BMPs as described in their document, "Best Management Practices for Protection of Surface Waters".

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (continued)

PRIMARY CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS	STORMWATER MANAGEMENT	OTHER REQUIREMENTS
Saltwater:				
SC	Saltwaters protected for secondary recreation, aquatic life propagation and survival and other uses as described for Class C	Domestic and industrial wastewater discharges allowed	Stormwater Management Rules (15A NCAC 2H .1000) apply to all waters in the 20 coastal counties; low density option: 30% built upon area or structural stormwater controls with higher density, as specified	
SB	Saltwaters protected for primary recreation and all Class SC uses (similar to Class B)	Same as Class SC; wastewater treatment reliability requirements (dual train design; backup power capability) may apply to protect swimming uses (15A NCAC 2H .0124)	Same as for Class SC	
SA	Shellfishing and all Class SC and SB uses	No domestic discharges and only non-process industrial discharges such as seafood packing houses or cooling water discharges	Same as for Class SC except low density option is 25% built upon area	

Supplemental Classifications are added to the primary classifications as appropriate (Examples include Class C-NSW, Class SA-ORW, Class B-Trout, etc.) and impose additional requirements.

SUPPLEMENTAL CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS	STORMWATER MANAGEMENT	OTHER REQUIREMENTS
HQW High Quality Waters	Waters rated as Excellent by DEM; Primary Nursery Areas; Native or Special Native Trout Waters; WS-I, WS-II and SA waters are HQW by definition	For new or expanded discharges advanced treatment requirements are: BOD_5=5 mg/l; NH_3-N= 2 mg/l; DO=6 mg/l	For projects requiring Erosion/ Sedimentation Control Plan and that are within 1 mile and draining to HQW waters: 12% built upon area or higher density with engineered structural controls allowed; WS-I, WS-II and 20 coastal counties exempt since stormwater control requirements already apply	Other treatment requirements may apply, dependent upon type of discharge and characteristics of receiving waters (see Antidegradation Policy: Rule 15A: NCAC 2B .0201)

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (continued)

SUPPLEMENTAL CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS	STORMWATER MANAGEMENT	OTHER REQUIREMENTS
ORW Outstanding Resource Waters	Unique and special waters having exceptional water quality and being of an exceptional state or national ecological or recreational significance; must meet other conditions and have 1 or more of 5 outstanding resource value criteria as described in Rule 15A NCAC 2B .0225	Water quality must clearly maintain and protect uses, including outstanding resource values; management strategies must include at a minimum: no new or expanded discharges to freshwater ORWs; some discharges may be allowed in coastal areas	Same as for High Quality Waters for Freshwater ORWs; for Saltwater ORWs, development activities within a 575' buffer must comply with the low density option of the Stormwater Management Rules (generally 25% built upon area around SA waters and 30% around other waters)	Other management strategy components as described in 15A NCAC 2B .0225
TR Trout Waters	Protected for natural trout propagation and survival of stocked trout	Domestic and industrial wastewater discharges allowed with stricter treatment requirements		More protective standards for cadmium, total residual chlorine, chlorophyll-a, dissolved oxygen, turbidity and toluene to protect these sensitive species
NSW Nutrient Sensitive Waters	Waters needing additional nutrient management due to their being subject to excessive growth of microscopic and macroscopic vegetation	No increase of nutrients over background levels permitted; domestic and industrial wastewater discharges allowed	Nutrient management strategies developed on a case-by-case basis	Nutrient management strategies developed on a case-by-case basis
SW Swamp Waters	Waters with low velocities and other characteristics different from other waterbodies (generally, low pH, DO, high organic content)			pH as low as 4.3 and DO less than 5 mg/l allowed if due to natural conditions
FWS Future Water Supply	Waters designated for future water supply use	Discharge restrictions will be reflective of those of primary water supply classification	Stormwater management options will be reflective of those of primary water supply classification; not required until after FWS supplemental classification is removed	Requirements for landfill permits, NPDES wastewater discharges, land application of residuals and road construction activities in Critical Area and Balance of Watershed or Protected Area as appropriate (15A NCAC 2H .0101)

Water Quality Standards For Freshwater Classifications

April 1, 1996

Parameters (ug/l unless noted)	Standards for All Freshwater * Aquatic Life	Human Health[1]	Standards to Support Additional Uses WS Classes[2]	Trout Waters	HQW	Swamp Waters
Arsenic	50					
Barium			1000			
Benzene		71.4	1.19			
Beryllium	6.5	0.117	0.0068			
Cadmium	2.0			0.4		
Carbon tetrachloride		4.42	0.254			
Chloride	230000 (AL)		250000			
Chlorinated benzenes			488 (N)			
Chlorine, total residual	17 (AL)			17		
Chlorophyll a, corrected	40 (N)			15 (N)		
Chromium, total	50					
Coliform, total (MFTCC/100ml)[3]			50 (N)[4]			
Coliform, fecal (MFFCC/100ml)[3]		200 (N)				
Copper, total	7 (AL)					
Cyanide	5.0					
Dioxin		0.000000014	0.000000013			
Dissolved gases	(N)					
Dissolved oxygen (mg/l)	5.0[5]			6.0		(N)[6]
Fluoride	1800					
Hardness, total (mg/l)			100			
Hexachlorobutadiene		49.7	0.445			
Iron (mg/l)	1 (AL)					
Lead	25 (N)					
Manganese			200			
MBAS (Methylene-Blue-Active-Substances)	500					
Mercury	0.012					
Nickel	88		25			
Nitrate nitrogen			10			
Pesticides						
Aldrin	0.002	0.000136	0.000127			
Chlordane	0.004	0.000588	0.000575			
DDT	0.001	0.000591	0.000588			
Demeton	0.1					
Dieldrin	0.002	0.000144	0.000135			
Endosulfan	0.05					
Endrin	0.002					
Guthion	0.01					
Heptachlor	0.004	0.000214	0.000208			
Lindane	0.01					
Methoxychlor	0.03					
Mirex	0.001					
Parathion	0.013					
Toxaphene	0.0002					
2,4-D			100			
2,4,5-TP (Silvex)			10			
pH (units)	6.0-9.0					(N)[6]
Phenolic compounds		(N)	1.0 (N)			
Polychlorinated biphenyls[7]	0.001	0.000079				
Polynuclear aromatic hydrocarbons [8]		0.0311	0.0028			
Radioactive substances		(N)				
Selenium	5					
Silver	0.06 (AL)					
Solids, total dissolved (mg/l)			500			
Solids, total suspended (mg/l)					10 Tr, 20 other	
Solids, settleable	(N)					
Sulfates			250000			
Temperature	(N)					
Tetrachloroethane (1,1,2,2)		10.8	0.172			
Tetrachloroethylene			0.8			
Toluene	11			0.36		
Toxic substances	(N)				(N)	
Trialkyltin	0.008					
Trichloroethylene		92.4	3.08			
Turbidity (NTU)	50; 25 (N)			10 (N)		
Vinyl chloride		525	2.0			
Zinc	50 (AL)					

* These standards apply to all freshwater classifications. For the protection of WS and supplemental classifications, standards listed under Standards to Support Additional Uses should be used unless standards for aquatic life or human health are listed and are more stringent.

(AL) Values represent action levels as specified in 2B .0211. WS Classes - Water Supply Classifications, same standards for all WS Classes.

(N) See 2B .0211 for narrative description of limits. HQW - High Quality Waters, standards for HQW areas only. Tr - Trout Waters.

1 Human health standards are based on consumption of fish only unless dermal contact studies available. See 2B .0208 for equation.

2 Water Supply standards are based on consumption of fish and water. See 2B .0208 for equation.

3 MFTCC/100ml means membrane filter total coliform count per 100 ml of sample. MFFCC/100ml means membrane filter fecal coliform count per 100 ml of sample.

4 Applies only to unfiltered water supplies.

5 An instantaneous reading may be as low as 4.0 mg/l, but the daily average must be 5.0 mg/l or more.

6 Designated swamp waters may have a dissolved oxygen less than 5.0 mg/l and a pH as low as 4.3, if due to natural conditions.

7 Applies to total PCBs present and includes PCB 1242, 1254, 1221, 1232, 1248, 1260, and 1016. See 2B .0208 & .0211.

8 Applies to total PAHs present and includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. See 2B .0208, .0212, .0214, .0215, .0216, & .0218.

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Water Quality Standards For Saltwater Classifications

April 1, 1996

Parameters (ug/l unless noted)	Standards for All Saltwater: Aquatic Life	Standards for All Saltwater: Human Health[1]	Standards to Support Additional Uses: Class SA	Standards to Support Additional Uses: HQW	Standards to Support Additional Uses: Swamp Waters
Arsenic	50				
Benzene		71.4			
Beryllium		0.117			
Cadmium	5.0				
Carbon tetrachloride		4.42			
Chlorophyll *a*	40 (N)				
Chromium, total	20				
Coliform, fecal (MFFCC/100ml)[2]		200 (N)	14 (N)		
Copper	3 (AL)				
Cyanide	1.0				
Dioxin		0.000000014			
Dissolved gases	(N)				
Dissolved oxygen (mg/l)	5.0			6.0	(N)[3]
Hexachlorobutadiene		49.7			
Lead	25 (N)				
Mercury	0.025				
Nickel	8.3				
Pesticides					
Aldrin	0.003	0.000136			
Chlordane	0.004	0.000588			
DDT	0.001	0.000591			
Demeton	0.1				
Dieldrin	0.0002	0.000144			
Endosulfan	0.009				
Endrin	0.002				
Guthion	0.01				
Heptachlor	0.004	0.000214			
Lindane	0.004				
Methoxychlor	0.03				
Mirex	0.001				
Parathion	0.178				
Toxaphene	0.0002				
pH (units)	6.8-8.5				(N)[3]
Phenolic compounds		(N)			
Polychlorinated biphenyls[4]	0.001	0.000079			
Polynuclear aromatic hydrocarbons[5]	0.0311				
Radioactive substances		(N)			
Salinity	(N)				
Selenium	71				
Silver	0.1 (AL)				
Solids, total suspended (mg/l)				10 PNA, 20 other	
Solids, settleable (mg/l)	(N)				
Temperature	(N)				
Tetrachloroethane (1,1,2,2)		10.8			
Toxic substances	(N)			(N)	
Trialkyltin	0.002				
Trichloroethylene		92.4			
Turbidity (NTU)	25 (N)				
Vinyl chloride		525			
Zinc	86 (AL)				

(AL) Values represent action levels as specified in 2B .0220.
(N) See 2B .0220 for narrative description of limits.
HQW - High Quality Waters, standards for HQW areas only.
Class SA - shellfishing waters see 2B .0101 for description.
PNA - Primary Nursery Areas

1 Human health standards are based on consumption of fish only unless dermal contact studies are available. See 2B .0208 for equation.
2 MFFCC/100ml means membrane filter fecal coliform count per 100 ml of sample.
3 Designated swamp waters may have a dissolved oxygen less than 5.0 mg/l and a pH as low as 4.3, if due to natural conditions.
4 Applies to total PCBs present and includes PCB 1242, 1254, 1221, 1232, 1248, 1260, and 1016. See 2B .0208 & .0220.
5 Applies to total PAHs present and includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. See 2B .0208.

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Classification		Dischargers	Allowable Development W/O Stormwater, Low Density Opt.	Allowable Development W/ Stormwater, High Density Opt.	Required Control with High Density Opt.	10%/70% (5) Provision	Residuals Appl.	Landfills	Agriculture BMPs
WS-I	Watershed	None	None	None	None	None	None	None	(6) Required
WS-II	Critical Area	General Permits	(2) 1du/2ac or 6% built upon	6-24% built upon area	Control the 1" storm	Not allowed	No new sites	No new landfills	(6) Required
	Watershed	General Permits	1du/ac or 12% built upon	12-30% built upon area	Control the 1" storm	Allowed	Allowed	No new discharging landfills	(6) Not Required
WS-III	Critical Area	General Permits	1du/ac or 12% built upon	12-30% built upon area	Control the 1" storm	Not allowed	No new sites	No new landfills	(6) Required
	Watershed	Domestic & non-process industrial	2du/ac or 24% built upon	24-50% built upon area	Control the 1" storm	Allowed	Allowed	No new discharging landfills	(6) Not Required
WS-IV	Critical Area	Domestic & (1) industrial	(3) 2du/ac or 24% built upon	(3) 24-50% built upon area	Control the 1" storm	Not allowed	No new sites	No new landfills	(6) Required
	Protected Area	Domestic & industrial	(3,4) 2du/ac or 24% built upon	(3,4) 24-70% built upon area	Control the 1" storm	Allowed	Allowed	Allowed	(6) Not Required
WS-V	Watershed or River Segment	Domestic, Industrial	No categorical restrictions other than instream water quality standards applicable to all surface water supply waters.						

NOTE: Critical area is one-half mile and draining to water supplies from the normal pool elevation of reservoirs, or one-half mile and draining to a river intake.
Protected area is five miles and draining to water supplies from the normal pool elevation of reservoirs, or ten miles upstream of and draining to a river intake.
Municipal with pretreatment program (2H .0904) is considered industrial discharge.
Discharges qualifying for a General Permit pursuant to 2H .0127 will also be allowed in all areas of WS-III and WS-IV watersheds along with the allowed discharges noted in the table.
Buffers will be maintained around all perennial waters with a minimum width of thirty feet for low density development and a minimum one hundred foot buffer for high density development.
Groundwater remediation discharges may be allowed when no other practicable alternative exists.
Local governments will assume ultimate responsibility for operation and maintenance of stormwater controls.
(1) New industrial process wastewater discharges are allowed but will require additional treatment requirements.
(2) Residential development may apply dwelling units per acre or use percent built-upon surface area. Non-residential development must use percent built-upon surface area.
(3) Applies only to projects requiring a Sedimentation/Erosion Control Permit.
(4) One third acre lot or 36% built-upon area is allowed for projects without curb and gutter street systems.
(5) Allowed; can use 10% of jurisdiction for new development and expansions to existing development up to 70% built-upon area, without stormwater controls, if using low density option throughout remainder of water supply.
(6) In WS-I watersheds and critical areas of WS-II, WS-III and WS-IV watersheds, agricultural operations must maintain a 10 foot vegetated buffer, or equivalent control along all perennial streams. Animal operations deemed permitted and permitted are allowed in all water supply watersheds.

.0201 ANTIDEGRADATION POLICY

(a) It is the policy of the Environmental Management Commission to maintain, protect, and enhance water quality within the State of North Carolina. Pursuant to this policy, the requirements of 40 CFR 131.12 are hereby incorporated by reference including any subsequent amendments and editions. This material is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Water Quality, Water Quality Section, 512 North Salisbury Street, Raleigh, North Carolina. Copies may be obtained from the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402-9325 at a cost of thirteen dollars ($13.00). These requirements shall be implemented in North Carolina as set forth in Paragraphs (b), (c), (d), (e) and (f) of this Rule.

(b) Existing uses, as defined by Rule .0202 of this Section, and the water quality to protect such uses shall be protected by properly classifying surface waters and having standards sufficient to protect these uses. In cases where the Commission or its designee determines that an existing use is not included in the classification of waters, a project which shall affect these waters shall not be permitted unless the existing uses are protected.

(c) The Commission shall consider the present and anticipated usage of waters with quality higher than the standards, including any uses not specified by the assigned classification (such as outstanding national resource waters or waters of exceptional water quality) and shall not allow degradation of the quality of waters with quality higher than the standards below the water quality necessary to maintain existing and anticipated uses of those waters. Waters with quality higher than the standards are defined by Rule .0202 of this Section. The following procedures shall be implemented in order to meet these requirements:

(1) Each applicant for an NPDES permit or NPDES permit expansion to discharge treated waste shall document an effort to consider non-discharge alternatives pursuant to 15A NCAC 2H .0105(c)(2).

(2) Public Notices for NPDES permits shall list parameters that would be water quality limited and state whether or not the discharge shall use the entire available load capacity of the receiving waters and may cause more stringent water quality based effluent limitations to be established for dischargers downstream.

(3) The Division may require supplemental documentation from the affected local government that a proposed project or parts of the project are necessary for important economic and social development.

(4) The Commission and Division shall work with local governments on a voluntary basis to identify and develop appropriate management strategies or classifications for waters with unused pollutant loading capacity to accommodate future economic growth.

Waters with quality higher than the standards shall be identified by the Division on a case-by-case basis through the NPDES permitting and waste load allocation processes (pursuant to the provisions of 15A NCAC 2H .0100). Dischargers affected by the requirements of Paragraphs (c)(1) through (c)(4) of this Rule and the public at large shall be notified according to the provisions described herein, and all other appropriate provisions pursuant to 15A NCAC 2H .0109. If an applicant objects to the requirements to protect waters with quality higher than the standards and believes degradation is necessary to accommodate important social and economic development, the applicant may contest these requirements according to the provisions of General Statute 143-215.1(e) and 150B-23.

(d) The Commission shall consider the present and anticipated usage of High Quality Waters (HQW), including any uses not specified by the assigned classification (such as outstanding national resource waters or waters of exceptional water quality) and shall not allow degradation of the quality of High Quality Waters below the water quality necessary to maintain existing and anticipated uses of those waters. High Quality Waters are a subset of waters with quality higher than the standards and are as described by 15A NCAC 2B .0101(e)(5). The procedures described in Rule .0224 of this Section shall be implemented in order to meet the requirements of this part.

(e) Outstanding Resource Waters (ORW) are a special subset of High Quality Waters with unique and special characteristics as described in Rule .0225 of this Section. The water quality of waters classified as ORW shall be maintained such that existing uses, including the outstanding resource values of said Outstanding Resource Waters, shall be maintained and protected.

(f) Activities regulated under Section 404 of the Clean Water Act (33 U.S.C. 1344) which require a water quality certification as described in Section 401 of the Clean Water Act (33 U.S.C. 1341) shall be evaluated according to the procedures outlined in 15A NCAC 2H .0500. Activities which receive a water quality certification pursuant to these procedures shall not be considered to remove existing uses. The evaluation of permits issued pursuant to G.S. 143-215.1 that involve the assimilation of wastewater or stormwater by wetlands shall incorporate the criteria found in 15A NCAC 2H .0506(c) (1)-(5) in determining the potential impact of the proposed activity on the existing uses of the wetland per 15A NCAC 2H .0231.

History Note: *Authority G.S. 143-214.1; 143-215.1; 143-215.3(a)(1);*
Eff. February 1, 1976;

Amended Eff. October 1, 1995; February 1, 1993; April 1,1991; August 1, 1990; RRC Objection Eff. July 18, 1996 due to lack of statutory authority and ambiguity; Amended Eff. October 1, 1996.

.0223 NUTRIENT SENSITIVE WATERS

(a) In addition to existing classifications, the Commission may classify any surface waters of the state as nutrient sensitive waters (NSW) upon a finding that such waters are experiencing or are subject to excessive growths of microscopic or macroscopic vegetation. Excessive growths are growths which the Commission in its discretion finds to substantially impair the use of the water for its best usage as determined by the classification applied to such waters.

(b) NSW may include any or all waters within a particular river basin as the Commission deems necessary to effectively control excessive growths of microscopic or macroscopic vegetation.

(c) For the purpose of this Rule, the term "nutrients" shall mean phosphorous or nitrogen. When considering the assignment of this classification, the Commission may specify as a "nutrient" any other chemical parameter or combination of parameters which it determines to be essential for the growth of microscopic and macroscopic vegetation.

(d) Those waters additionally classified as nutrient sensitive shall be identified in the appropriate schedule of classifications as referenced in Section .0300 of this Subchapter.

(e) For the purpose of this Rule, the term "background levels" shall mean the concentration(s), taking into account seasonal variations, of the specific nutrient or nutrients upstream of a nutrient source.

(f) Quality standards applicable to NSW: no increase in nutrients over background levels unless it is shown to the satisfaction of the Director that the increase:

(1) is the result of natural variations; or

(2) will not endanger human health, safety or welfare and that preventing the increase would cause a serious economic hardship without equal or greater benefit to the public.

History Note: Authority G.S. 143-214.1; Eff. October 1, 1995.

.0224 HIGH QUALITY WATERS

High Quality Waters (HQW) are a subset of waters with quality higher than the standards and are as described by 15A NCAC 2B .0101(e)(5). The following procedures shall be implemented in order to implement the requirements of Rule .0201(d) of this Section.

(1) New or expanded wastewater discharges in High Quality Waters shall comply with the following:

(a) Discharges from new single family residences shall be prohibited. Those existing subsurface systems for single family residences which fail and must discharge shall install a septic tank, dual or recirculating sand filters, disinfection and step aeration.

(b) All new NPDES wastewater discharges (except single family residences) shall be required to provide the treatment described below:

(i) Oxygen Consuming Wastes: Effluent limitations shall be as follows: BOD_5= 5 mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l. More stringent limitations shall be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen-consuming wastes shall not cause the DO of the receiving water to drop more than 0.5 mg/l below background levels, and in no case below the standard. Where background information is not readily available, evaluations shall assume a percent saturation determined by staff to be generally applicable to that hydroenvironment.

(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) shall be limited to effluent concentrations of 10 mg/l for trout waters and PNA's, and to 20 mg/l for all other High Quality Waters.

(iii) Disinfection: Alternative methods to chlorination shall be required for discharges to trout streams, except that single family residences may use chlorination if other options are not economically feasible. Domestic discharges are prohibited to SA waters.

(iv) Emergency Requirements: Failsafe treatment designs shall be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or

equivalent failsafe treatment designs.

(v) Volume: The total volume of treated wastewater for all discharges combined shall not exceed 50 percent of the total instream flow under 7Q10 conditions.

(vi) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorus or nitrogen, or both.

(vii) Toxic substances: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor shall be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent shall be allocated at one-half of the normal standard at design conditions. Whole effluent toxicity shall be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration of 90 percent. Ammonia toxicity shall be evaluated according to EPA guidelines promulgated in "Ambient Water Quality Criteria for Ammonia - 1984"; EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784) or "Ambient Water Quality Criteria for Ammonia (Saltwater) - 1989"; EPA document number 440/5-88-004; NTIS number PB89-169825. This material related to ammonia toxicity is hereby incorporated by reference including any subsequent amendments and editions and is available for inspection at the Department of Environment, Health, and Natural Resources Library, 512 North Salisbury Street, Raleigh, North Carolina. Copies may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 at a cost of forty-seven dollars ($47.00).

(c) All expanded NPDES wastewater discharges in High Quality Waters shall be required to provide the treatment described in Sub-Item (1)(b) of this Rule, except for those existing discharges which expand with no increase in permitted pollutant loading.

(2) Development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control program approved in accordance with 15A NCAC 4B .0218, and which drain to and are within one mile of High Quality Waters (HQW) shall be required to follow the stormwater management rules as specified in 15A NCAC 2H .1000. Stormwater management requirements specific to HQW are described in 15A NCAC 2H .1006.

If an applicant objects to the requirements to protect high quality waters and believes degradation is necessary to accommodate important social and economic development, the applicant may contest these requirements according to the provisions of G.S. 143-215.1(e) and 150B-23.

History Note: *Authority G.S. 143-214.1; 143-215.1; 143-215.3(a)(1);*
Eff. October 1, 1995;
Amended Eff. April 1, 1996.

.0225 OUTSTANDING RESOURCE WATERS

(a) General. In addition to the existing classifications, the Commission may classify certain unique and special surface waters of the state as outstanding resource waters (ORW) upon finding that such waters are of exceptional state or national recreational or ecological significance and that the waters have exceptional water quality while meeting the following conditions:

(1) there are no significant impacts from pollution with the water quality rated as excellent based on physical, chemical or biological information;

(2) the characteristics which make these waters unique and special may not be protected by the assigned narrative and numerical water quality standards.

(b) Outstanding Resource Values. In order to be classified as ORW, a water body must exhibit one or more of the following values or uses to demonstrate it is of exceptional state or national recreational or ecological significance:

(1) there are outstanding fish (or commercially important aquatic species) habitat and fisheries;

(2) there is an unusually high level of water-based recreation or the potential for such recreation;

(3) the waters have already received some special designation such as a North Carolina or National Wild and Scenic River, Native or Special Native Trout Waters, National Wildlife Refuge, etc, which do not provide any

water quality protection;

(4) the waters represent an important component of a state or national park or forest; or

(5) the waters are of special ecological or scientific significance such as habitat for rare or endangered species or as areas for research and education.

(c) Quality Standards for ORW.

(1) Freshwater: Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified ORW. Management strategies to protect resource values shall be developed on a site specific basis during the proceedings to classify waters as ORW. At a minimum, no new discharges or expansions of existing discharges shall be permitted, and stormwater controls for all new development activities requiring an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or an appropriate local erosion and sedimentation control program shall be required to follow the stormwater provisions as specified in 15A NCAC 2H .1000. Specific stormwater requirements for ORW areas are described in 15A NCAC 2H .1007.

(2) Saltwater: Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified ORW. Management strategies to protect resource values shall be developed on a site-specific basis during the proceedings to classify waters as ORW. At a minimum, new development shall comply with the stormwater provisions as specified in 15A NCAC 2H .1000. Specific stormwater management requirements for saltwater ORWs are described in 15A NCAC 2H .1007. New non-discharge permits shall meet reduced loading rates and increased buffer zones, to be determined on a case-by-case basis. No dredge or fill activities shall be allowed where significant shellfish or submerged aquatic vegetation bed resources occur, except for maintenance dredging, such as that required to maintain access to existing channels and facilities located within the designated areas or maintenance dredging for activities such as agriculture. A public hearing is mandatory for any proposed permits to discharge to waters classified as ORW.

Additional actions to protect resource values shall be considered on a site specific basis during the proceedings to classify waters as ORW and shall be specified in Paragraph (e) of this Rule. These actions may include anything within the powers of the commission. The commission shall also consider local actions which have been taken to protect a water body in determining the appropriate state protection options. Descriptions of boundaries of waters classified as ORW are included in Paragraph (e) of this Rule and in the Schedule of Classifications (15A NCAC 2B .0302 through .0317) as specified for the appropriate river basin and shall also be described on maps maintained by the Division of Environmental Management.

(d) Petition Process. Any person may petition the Commission to classify a surface water of the state as an ORW. The petition shall identify the exceptional resource value to be protected, address how the water body meets the general criteria in Paragraph (a) of this Rule, and the suggested actions to protect the resource values. The Commission may request additional supporting information from the petitioner. The Commission or its designee shall initiate public proceedings to classify waters as ORW or shall inform the petitioner that the waters do not meet the criteria for ORW with an explanation of the basis for this decision. The petition shall be sent to:

Director
DEHNR/Division of Environmental Management
~~P.O. Box 29535~~
Raleigh, North Carolina 27626-0535

The envelope containing the petition shall clearly bear the notation: RULE-MAKING PETITION FOR ORW CLASSIFICATION.

(e) Listing of Waters Classified ORW with Specific Actions. Waters classified as ORW with specific actions to protect exceptional resource values are listed as follows:

(1) Roosevelt Natural Area [White Oak River Basin, Index Nos. 20-36-9.5-(1) and 20-36-9.5-(2)] including all fresh and saline waters within the property boundaries of the natural area shall have only new development which complies with the low density option in the stormwater rules as specified in 15A NCAC 2H .1005(2)(a) within 575 feet of the Roosevelt Natural Area (if the development site naturally drains to the Roosevelt Natural Area).

(2) Chattooga River ORW Area (Little Tennessee River Basin and Savannah River Drainage Area): the following undesignated waterbodies that are tributary to ORW designated segments shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section. However, expansions of existing discharges to these segments shall be allowed if there is no increase in pollutant loading:

(A) North and South Fowler Creeks,
(B) Green and Norton Mill Creeks,
(C) Cane Creek,
(D) Ammons Branch,
(E) Glade Creek, and
(F) Associated tributaries.

(3) Henry Fork ORW Area (Catawba River Basin): the following undesignated waterbodies that are tributary to ORW designated segments shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section:
(A) Ivy Creek,
(B) Rock Creek, and
(C) Associated tributaries.

(4) South Fork New and New Rivers ORW Area [New River Basin (Index Nos. 10-1-33.5 and 10)]: the following management strategies, in addition to the discharge requirements specified in Subparagraph (c)(1) of this Rule, shall be applied to protect the designated ORW areas:
(A) Stormwater controls described in Subparagraph (c)(1) of this Rule shall apply within one mile and draining to the designated ORW areas;
(B) New or expanded NPDES permitted wastewater discharges located upstream of the designated ORW shall be permitted such that the following water quality standards are maintained in the ORW segment:
(i) the total volume of treated wastewater for all upstream discharges combined shall not exceed 50 percent of the total instream flow in the designated ORW under 7Q10 conditions;
(ii) a safety factor shall be applied to any chemical allocation such that the effluent limitation for a specific chemical constituent shall be the more stringent of either the limitation allocated under design conditions (pursuant to 15A NCAC 2B .0206) for the normal standard at the point of discharge, or the limitation allocated under design conditions for one-half the normal standard at the upstream border of the ORW segment;
(iii) a safety factor shall be applied to any discharge of complex wastewater (those containing or potentially containing toxicants) to protect for chronic toxicity in the ORW segment by setting the whole effluent toxicity limitation at the higher (more stringent) percentage effluent determined under design conditions (pursuant to 15A NCAC 2B .0206) for either the instream effluent concentration at the point of discharge or twice the effluent concentration calculated as if the discharge were at the upstream border of the ORW segment;
(C) New or expanded NPDES permitted wastewater discharges located upstream of the designated ORW shall comply with the following:
(i) Oxygen Consuming Wastes: Effluent limitations shall be as follows: BOD = 5 mg/l, and NH3-N = 2 mg/l;
(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) shall be limited to effluent concentrations of 10 mg/l for trout waters and to 20 mg/l for all other waters;
(iii) Emergency Requirements: Failsafe treatment designs shall be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs;
(iv) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorus or nitrogen, or both.

(5) Old Field Creek (New River Basin): the undesignated portion of Old Field Creek (from its source to Call Creek) shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section.

(6) In the following designated waterbodies, no additional restrictions shall be placed on new or expanded marinas. The only new or expanded NPDES permitted discharges that shall be allowed shall be non-domestic, non-process industrial discharges. The Alligator River Area (Pasquotank River Basin) extending from the source of the Alligator River to the U.S. Highway 64 bridge including New Lake Fork, North West Fork Alligator River, Juniper Creek, Southwest Fork Alligator River, Scouts Bay, Gum Neck Creek, Georgia Bay, Winn Bay, Stumpy Creek Bay, Stumpy Creek, Swann Creek (Swann Creek Lake), Whipping Creek (Whipping Creek Lake), Grapevine Bay, Rattlesnake Bay, The Straits, The Frying Pan, Coopers Creek, Babbitt Bay, Goose Creek, Milltail Creek, Boat Bay, Sandy Ridge Gut (Sawyer Lake) and Second Creek, but excluding the Intracoastal Waterway (Pungo River-Alligator River Canal) and all other

tributary streams and canals.

(7) In the following designated waterbodies, the only type of new or expanded marina that shall be allowed shall be those marinas located in upland basin areas, or those with less than 30 slips, having no boats over 21 feet in length and no boats with heads. The only new or expanded NPDES permitted discharges that shall be allowed shall be non-domestic, non-process industrial discharges.

(A) The Northeast Swanquarter Bay Area including all waters northeast of a line from a point at Lat. 35° 23' 51" and Long. 76° 21' 02" thence southeast along the Swanquarter National Wildlife Refuge hunting closure boundary (as defined by the 1935 Presidential Proclamation) to Drum Point.

(B) The Neuse-Southeast Pamlico Sound Area (Southeast Pamlico Sound Section of the Southeast Pamlico, Core and Back Sound Area); (Neuse River Basin) including all waters within an area defined by a line extending from the southern shore of Ocracoke Inlet northwest to the Tar-Pamlico River and Neuse River basin boundary, then southwest to Ship Point.

(C) The Core Sound Section of the Southeast Pamlico, Core and Back Sound Area (White Oak River Basin), including all waters of Core Sound and its tributaries, but excluding Nelson Bay, Little Port Branch and Atlantic Harbor at its mouth, and those tributaries of Jarrett Bay that are closed to shellfishing.

(D) The Western Bogue Sound Section of the Western Bogue Sound and Bear Island Area (White Oak River Basin) including all waters within an area defined by a line from Bogue Inlet to the mainland at SR 1117 to a line across Bogue Sound from the southwest side of Gales Creek to Rock Point, including Taylor Bay and the Intracoastal Waterway.

(E) The Stump Sound Area (Cape Fear River Basin) including all waters of Stump Sound and Alligator Bay from marker Number 17 to the western end of Permuda Island, but excluding Rogers Bay, the Kings Creek Restricted Area and Mill Creek.

(F) The Topsail Sound and Middle Sound Area (Cape Fear River Basin) including all estuarine waters from New Topsail Inlet to Mason Inlet, including the Intracoastal Waterway and Howe Creek, but excluding Pages Creek and Futch Creek.

(8) In the following designated waterbodies, no new or expanded NPDES permitted discharges and only new or expanded marinas with less than 30 slips, having no boats over 21 feet in length and no boats with heads shall be allowed.

(A) The Swanquarter Bay and Juniper Bay Area (Tar-Pamlico River Basin) including all waters within a line beginning at Juniper Bay Point and running south and then west below Great Island, then northwest to Shell Point and including Shell Bay, Swanquarter and Juniper Bays and their tributaries, but excluding all waters northeast of a line from a point at Lat. 35° 23' 51" and Long. 76° 21' 02" thence southeast along the Swanquarter National Wildlife Refuge hunting closure boundary (as defined by the 1935 Presidential Proclamation) to Drum Point and also excluding the Blowout Canal, Hydeland Canal, Juniper Canal and Quarter Canal.

(B) The Back Sound Section of the Southeast Pamlico, Core and Back Sound Area (White Oak River Basin) including that area of Back Sound extending from Core Sound west along Shackleford Banks, then north to the western most point of Middle Marshes and along the northwest shore of Middle Marshes (to include all of Middle Marshes), then west to Rush Point on Harker's Island, and along the southern shore of Harker's Island back to Core Sound.

(C) The Bear Island Section of the Western Bogue Sound and Bear Island Area (White Oak River Basin) including all waters within an area defined by a line from the western most point on Bear Island to the northeast mouth of Goose Creek on the mainland, east to the southwest mouth of Queen Creek, then south to green marker No. 49, then northeast to the northern most point on Huggins Island, then southeast along the shoreline of Huggins Island to the southeastern most point of Huggins Island, then south to the northeastern most point on Dudley Island, then southwest along the shoreline of Dudley Island to the eastern tip of Bear Island.

(D) The Masonboro Sound Area (Cape Fear River Basin) including all waters between the Barrier Islands and the mainland from Carolina Beach Inlet to Masonboro Inlet.

(9) Black and South Rivers ORW Area (Cape Fear River Basin) [Index Nos. 18-68-(0.5), 18-68-(3.5), 18-68-(11.5), 18-68-12-(0.5), 18-68-12-(11.5), and 18-68-2]: the following management strategies, in addition to the discharge requirements specified in Subparagraph (c)(1) of this Rule, shall be applied to protect the designated ORW areas:

(A) Stormwater controls described in Subparagraph (c)(1) of this Rule shall apply within one mile and

draining to the designated ORW areas;

(B) New or expanded NPDES permitted wastewater discharges located one mile upstream of the stream segments designated ORW (upstream on the designated mainstem and upstream into direct tributaries to the designated mainstem) shall comply with the following discharge restrictions:

(i) Oxygen Consuming Wastes: Effluent limitations shall be as follows: BOD = 5 mg/l and NH3-N = 2 mg/l;

(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) shall be limited to effluent concentrations of 20 mg/l;

(iii) Emergency Requirements: Failsafe treatment designs shall be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs;

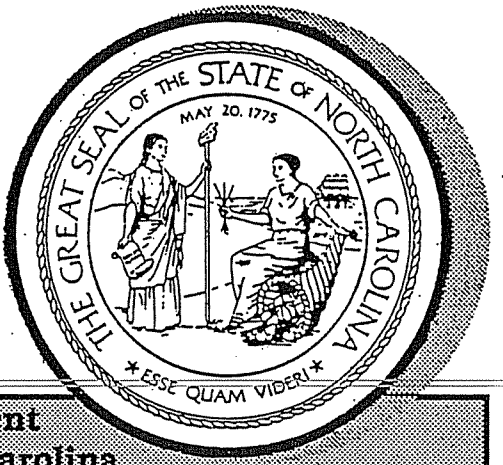
(iv) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorus or nitrogen, or both.

(v) Toxic substances: In cases where complex discharges (those containing or potentially containing toxicants) may be currently present in the discharge, a safety factor shall be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent shall be allocated at one-half of the normal standard at design conditions. Whole effluent toxicity shall be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under flow design criteria (pursuant to 15A NCAC 2B .0206).

History Note: *Authority G.S. 143-214.1;*
Eff. October 1, 1995;
Amended Eff. April 1, 1996; January 1, 1996.

STATE OF
NORTH CAROLINA
DEPARTMENT OF
ENVIRONMENT, HEALTH,
AND NATURAL RESOURCES

Classifications and Water Quality Standards Assigned to The Waters of the Hiwassee River Basin



Division of Environmental Management
Raleigh, North Carolina

Reprint from North Carolina Administrative Code: 15A NCAC 2B .0302
Current through: February 1, 1993

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
HIWASSEE RIVER (Chatuge Lake below elevation 1928)	From North Carolina-Georgia State line to Chatuge Dam	B	7/1/61	1-(1)
Bell Creek	From source to North Carolina-Georgia State Line	C Tr	3/1/77	1-2
Upper Bell Creek	From source to North Carolina-Georgia State Line	C	7/1/61	1-2-1
Wood Creek	From source to North Carolina-Georgia State Line	C	7/1/61	1-3
Sneaking Creek	From source to North Carolina-Georgia State Line	C	7/1/61	1-4
Shooting Creek	From source to Chatuge Lake	C Tr	7/1/61	1-5
Muskrat Branch	From source to Shooting Creek	C Tr	7/1/73	1-5-1
Jake Branch	From source to Muskrat Branch	C Tr	7/1/73	1-5-1-1
Thompson Creek	From source to Shooting Creek	C	7/1/61	1-5-2
Locust Log Branch	From source to Thompson Creek	C	7/1/61	1-5-2-1
Mill Creek	From source to Shooting Creek	C Tr	7/1/73	1-5-3
Lynch Branch	From source to Shooting Creek	C	7/1/61	1-5-4
Vineyard Creek	From source to Shooting Creek	C Tr	7/1/73	1-5-5
Eagle Fork Creek	From source to Shooting Creek	C Tr	7/1/73	1-5-6
Ledford Creek	From source to Eagle Fork Creek	C Tr	7/1/73	1-5-6-1
Dave Barrett Creek	From source to Eagle Fork Creek	C Tr	7/1/73	1-5-6-2
Barrett Branch	From source to Dave Barrett Creek	C	7/1/61	1-5-6-2-1
Loggy Branch	From source to Dave Barrett Creek	C	7/1/61	1-5-6-2-2
Thumping Creek	From source to Eagle Fork Creek	C Tr	7/1/73	1-5-6-3
Giesky Creek	From source to Shooting Creek	C Tr	7/1/73	1-5-7
Bethabara Creek	From source to Giesky Creek	C Tr	7/1/73	1-5-7-1
Stillhouse Branch	From North Carolina-Georgia State Line to Bethabara Creek	C Tr	7/1/73	1-5-7-1-0.5
Davenport Branch	From North Carolina-Georgia State Line to Bethabara Creek	C Tr	3/1/77	1-5-7-1-1
Lee Ledford Branch	From North Carolina-Georgia State Line to Davenport Branch	C Tr	3/1/77	1-5-7-1-1-1
Beech Flats Branch	From North Carolina-Georgia State Line to Davenport Branch	C Tr	3/1/77	1-5-7-1-1-2
Jane Rabun Branch	From North Carolina-Georgia State Line to Davenport Branch	C Tr	3/1/77	1-5-7-1-1-3
Nattie Branch	From source to Giesky Creek	C Tr	7/1/73	1-5-7-2
Burch Cove Branch	From source to Giesky Creek	C	7/1/61	1-5-7-3
Pounding Mill Creek	From source to Shooting Creek	C Tr	7/1/73	1-5-8
Copper Mine Branch	From source to Pounding Mill Creek	C	7/1/61	1-5-8-1
Hothouse Branch	From source to Shooting Creek	C Tr	7/1/73	1-5-9
Cherry Cove Branch	From source to Hothouse Branch	C	7/1/61	1-5-9-1
Rocking Chair Branch	From source to Chatuge Lake	C	7/1/61	1-6
Laurel Branch	From source to Chatuge Lake	C	7/1/61	1-7
Penland Branch	From source to Chatuge Lake	C	7/1/61	1-8
Needmore Branch	From source to Chatuge Lake	C	7/1/61	1-9
Licklog Creek	From source to Chatuge Lake	C	7/1/61	1-10

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Classification Date	Classification Index No.
Stillhouse Branch	From source to Chatuge Lake	C	7/1/61	1-11
Patterson Branch	From source to Chatuge Lake	C	7/1/61	1-12
Crawford Branch	From source to Chatuge Lake	C	7/1/61	1-13
Byers Branch	From source to Chatuge Lake	C	7/1/61	1-14
HIWASSEE RIVER	From Chatuge Dam to Hyatt Mill Creek	C	7/1/61	1-(15)
Hyatt Mill Creek	From source to Hiwassee River	C	7/1/61	1-16
Coleman Creek	From source to Hyatt Mill Creek	C	7/1/61	1-16-1
HIWASSEE RIVER (Mission Reservoir)	From Hyatt Mill Creek to a point 0.6 mile upstream of mouth of McComb Branch	WS-IV	8/3/92	1-(16.5)
Blair Creek	From source to Hiwassee River	WS-IV	8/3/92	1-17
North Fork Blair Creek	From source to Blair Creek	WS-IV	8/3/92	1-17-1
Kimsey Branch	From source to North Fork Blair Creek	WS-IV	8/3/92	1-17-1-1
Lovin Spring Branch	From source to North Fork Blair Creek	WS-IV	8/3/92	1-17-1-2
Carter Branch	From source to North Fork Blair Creek	WS-IV	8/3/92	1-17-1-3
South Fork Blair Creek	From source to Blair Creek	WS-IV	8/3/92	1-17-2
Drowning Creek	From source to Hiwassee River	C	7/1/61	1-18
Bob Prater Branch	From source to Drowning Creek	C	7/1/61	1-18-1
John Reese Branch	From source to Drowning Creek	C	7/1/61	1-18-2
Padgett Branch (Patterson Mill Creek)	From source to Drowning Creek	C	7/1/61	1-18-3
Town Creek	From source to Hiwassee River	WS-IV	8/3/92	1-19
Qually Creek	From source to Hiwassee River	WS-IV	8/3/92	1-20
Tusquitee Creek	From source to Big Tuni Creek	C Tr	8/1/90	1-21-(0.5)
Bluff Branch	From source to Tusquitee Creek	C Tr	7/1/73	1-21-1
Perry Creek	From source to Tusquitee Creek	C Tr	7/1/73	1-21-2
Mill Creek	From source to Perry Creek	C	7/1/61	1-21-2-1
Passmore Branch	From source to Perry Creek	C	7/1/61	1-21-2-2
Mull Branch	From source to Tusquitee Creek	C	7/1/61	1-21-3
Hurricane Creek	From source to Tusquitee Creek	C Tr	7/1/73	1-21-4
Tusquitee Creek	From Big Tuni Creek to Buckner Branch	C Tr HQW	7/1/61	1-21-(4.5)
Big Tuni Creek	From source to Tusquitee Creek	C Tr HQW	8/1/90	1-21-5
Chestnut Branch	From source to Big Tuni Creek	C Tr HQW	8/1/90	1-21-5-1
Boone Branch	From source to Big Tuni Creek	C HQW	8/1/90	1-21-5-2
Steve Branch	From source to Big Tuni Creek	C HQW	8/1/90	1-21-5-3
Long Branch	From source to Big Tuni Creek	C HQW	8/1/90	1-21-5-4
Little Tuni Creek	From source to Big Tuni Creek	C HQW	8/1/90	1-21-5-5
Chairmaker Branch	From source to Tusquitee Creek	C Tr	7/1/73	1-21-6
Compass Creek	From source to Tusquitee Creek	C Tr HQW	8/1/90	1-21-7
Matlock Creek	From source to Tusquitee Creek	C Tr HQW	8/1/90	1-21-8
Julie Branch	From source to Matlock Creek	C HQW	8/1/90	1-21-8-1
Cold Branch	From source to Tusquitee Creek	C	7/1/61	1-21-9
Nane Branch	From source to Cold Branch	C	7/1/61	1-21-9-1

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Morgan Branch	From source to Cold Branch	C	7/1/61	1-21-9-2
Sunday Branch	From source to Tusquitee Creek	C	7/1/61	1-21-10
Church Branch	From source to Tusquitee Creek	C	7/1/61	1-21-11
Moore Branch	From source to Church Branch	C	7/1/61	1-21-11-1
Moss Branch	From source to Church Branch	C	7/1/61	1-21-11-2
Peckerwood Branch	From source to Tusquitee Creek	C Tr	7/1/73	1-21-12
Sapsucker Branch	From source to Peckerwood Branch	C	7/1/61	1-21-12-1
Johnson Creek	From source to Tusquitee Creek	C HQW	8/1/90	1-21-13
Left Prong Johnson Creek	From source to Johnson Creek	C Tr HQW	8/1/90	1-21-13-1
Snake Branch	From source to Left Prong Johnson Creek	C HQW	8/1/90	1-21-13-1-1
Shoal Branch	From source to Johnson Creek	C HQW	8/1/90	1-21-13-2
Evans Branch	From source to Johnson Creek	C HQW	8/1/90	1-21-13-3
Shearer Creek	From source to Johnson Creek	C Tr HQW	8/1/90	1-21-13-4
Rocky Creek	From source to Shearer Creek	C Tr HQW	8/1/90	1-21-13-4-1
Pigpen Branch (Little Shearer Creek)	From source to Shearer Creek	C HQW	8/1/90	1-21-13-4-2
Boardtree Branch	From source to Pigpen Branch	C HQW	8/1/90	1-21-13-4-2-1
Dick Branch	From source to Tusquitee Creek	C Tr HQW	8/1/90	1-21-14
Schoolhouse Branch	From source to Tusquitee Creek	C HQW	8/1/90	1-21-15
Stable Branch	From source to Schoolhouse Branch	C HQW	8/1/90	1-21-15-1
Caesar Austin Branch	From source to Tusquitee Creek	C HQW	8/1/90	1-21-16
Tusquitee Creek	From Buckner Branch to Hiwassee River	WS-IV Tr HQW	8/3/92	1-21-(16.5)
Buckner Branch	From source to Tusquitee Creek	WS-IV HQW	8/3/92	1-21-17
Bristol Branch	From source to Tusquitee Creek	WS-IV Tr HQW	8/3/92	1-21-18
Lyon Branch	From source to Tusquitee Creek	WS-IV HQW	8/3/92	1-21-19
Greasy Creek	From source to a point 0.3 mile upstream of Clay County SR 1307	C	7/1/61	1-21-20-(1)
Greasy Creek	From a point 0.3 mile upstream of Clay County SR 1307 to Tusquitee Cr.	WS-IV	8/3/92	1-21-20-(2)
Carver Creek	From source to Hiwassee River	WS-IV	8/3/92	1-22
Bob Branch	From source to Hiwassee River	WS-IV	8/3/92	1-23
Allbone Branch	From source to Hiwassee River	WS-IV	8/3/92	1-24
Old House Branch	From source to Allbone Branch	WS-IV	8/3/92	1-24-1
Stillhouse Branch	From source to Old House Branch	WS-IV	8/3/92	1-24-1-1
Mob Branch	From source to Hiwassee River	WS-IV	8/3/92	1-25
Logan Cove Branch	From source to Hiwassee River	WS-IV	8/3/92	1-26
Fires Creek	From source to Rocky Cove Branch	C Tr ORW	3/1/89	1-27-(0.5)
Far Bald Spring Branch	From source to Fires Creek	C Tr ORW	3/1/89	1-27-1
Potrock Branch	From source to Fires Creek	C Tr ORW	3/1/89	1-27-2
Bald Springs Branch	From source to Fires Creek	C Tr ORW	3/1/89	1-27-3
Long Branch	From source to Fires Creek	C ORW	3/1/89	1-27-4
Short Branch	From source to Long Branch	C ORW	3/1/89	1-27-4-1
Collett Camp Branch	From source to Long Branch	C ORW	3/1/89	1-27-4-2
Coldspring Branch	From source to Long Branch	C ORW	3/1/89	1-27-4-3
Tatham Cabin Branch	From source to Coldspring Branch	C ORW	3/1/89	1-27-4-3-1
Flintspring Branch	From source to Fires Creek	C Tr ORW	3/1/89	1-27-5

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Ketron Camp Branch	From source to Flintspring Branch	C Tr ORW	3/1/89	1-27-5-1
Fires Creek	From Rocky Cove Branch to Hiwassee River	WS-IV Tr ORW	8/3/92	1-27-(5.5)
Rocky Cove Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-6
Little Fires Creek	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-7
Wheeler Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-8
Wolfpen Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-9
Bee Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-10
Rockhouse Creek	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-11
Game Branch	From source to Rockhouse Creek	WS-IV Tr ORW	8/3/92	1-27-11-1
Laurel Creek	From source to Rockhouse Creek	WS-IV Tr ORW	8/3/92	1-27-11-2
Rogues Branch	From source to Laurel Creek	WS-IV Tr ORW	8/3/92	1-27-11-2-1
Messer Branch	From source to Laurel Creek	WS-IV Tr ORW	8/3/92	1-27-11-2-2
Haigler Camp Branch	From source to Laurel Creek	WS-IV Tr ORW	8/3/92	1-27-11-2-3
Hickory Cove Creek	From source to Laurel Creek	WS-IV Tr ORW	8/3/92	1-27-11-2-4
Leatherwood Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-12
Huskins Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-13
Pendergrass Branch	From source to Huskins Branch	WS-IV Tr ORW	8/3/92	1-27-13-1
Ledford Branch	From source to Fires Creek	WS-IV Tr ORW	8/3/92	1-27-14
Passmore Branch	From source to Hiwassee River	WS-IV	8/3/92	1-28
Watson Branch	From source to Hiwassee River	WS-IV	8/3/92	1-29
Curtis Branch	From source to Hiwassee River	WS-IV	8/3/92	1-30
Betty Branch	From source to Curtis Branch	WS-IV	8/3/92	1-30-1
Carver Branch	From source to Hiwassee River	WS-IV	8/3/92	1-31
Sweetwater Creek	From source to Hiwassee River	WS-IV	8/3/92	1-32
Auberry Branch	From source to Hiwassee River	WS-IV	8/3/92	1-33
Anderson Branch	From source to Hiwassee River	WS-IV	8/3/92	1-34
Rocky Branch	From source to Hiwassee River	WS-IV	8/3/92	1-35
Carroll Branch (Carroll Lake)	From source to Hiwassee River	WS-IV	8/3/92	1-37
Calhoun Branch	From source to Hiwassee River	WS-IV	8/3/92	1-38
Sudderth Branch	From source to Hiwassee River	WS-IV	8/3/92	1-39
Suddawig Branch	From source to Hiwassee River	WS-IV	8/3/92	1-40
~~Mission Branch~~	~~From source to Hiwassee River~~	~~WS-IV~~	~~8/3/92~~	~~1-41~~
Brasstown Creek	From North Carolina-Georgia State Line to Hiwassee River	WS-IV	8/3/92	1-42
Crawford Creek	From source to Brasstown Creek	WS-IV	8/3/92	1-42-1
Webb Creek	From source to Crawford Creek	WS-IV	8/3/92	1-42-1-1
Long Branch	From source to Crawford Creek	WS-IV	8/3/92	1-42-1-2
Hall Branch	From source to Crawford Creek	WS-IV	8/3/92	1-42-1-2.5
Walker Branch	From source to Crawford Creek	WS-IV	8/3/92	1-42-1-3
Beach Creek	From source to Brasstown Creek	WS-IV	8/3/92	1-42-2
Winchester Creek	From North Carolina-Georgia State Line to Brasstown Creek	WS-IV	8/3/92	1-42-3
Gumlog Creek	From North Carolina-Georgia State Line to Brasstown Creek	WS-IV	8/3/92	1-42-4
Trout Cove Branch	From source to Brasstown Creek	WS-IV	8/3/92	1-42-5

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Classification Date	Classification Index No.
Pinelog Creek	From North Carolina-Georgia State Line to Brasstown Creek	WS-IV	8/3/92	1-42-6
Russell Branch	From North Carolina-Georgia State Line to Pinelog Creek	WS-IV	8/3/92	1-42-6-1
Clabber Branch	From source to Pinelog Creek	WS-IV	8/3/92	1-42-6-2
Payne Branch	From source to Brasstown Creek	WS-IV	8/3/92	1-42-7
Will Mason Branch	From source to Brasstown Creek	WS-IV	8/3/92	1-42-8
Greasy Creek	From source to Brasstown Creek	WS-IV	8/3/92	1-42-9
Buchanan Branch	From source to Brasstown Creek	WS-IV	8/3/92	1-42-10
Little Brasstown Creek	From source to Brasstown Creek	WS-IV	8/3/92	1-42-11
Pinhook Branch	From source to Little Brasstown Creek	WS-IV	8/3/92	1-42-11-1
Stamey Branch	From source to Pinhook Branch	WS-IV	8/3/92	1-42-11-1-1
John Mason Branch	From source to Pinhook Branch	WS-IV	8/3/92	1-42-11-1-2
Ricks Branch	From source to Little Brasstown Creek	WS-IV	8/3/92	1-42-11-2
Frankum Branch	From source to Ricks Branch	WS-IV	8/3/92	1-42-11-2-1
Tweed Branch	From source to Little Brasstown Creek	WS-IV	8/3/92	1-42-11-3
Clayton Branch	From source to Little Brasstown Creek	WS-IV	8/3/92	1-42-11-4
Garringer Branch	From source to Little Brasstown Creek	WS-IV	8/3/92	1-42-11-5
Brendle Branch	From source to Little Brasstown Creek	WS-IV	8/3/92	1-42-11-6
Bevins Branch	From source to Brendle Branch	WS-IV	8/3/92	1-42-11-6-1
Jenkins Branch	From source to Brasstown Creek	WS-IV	8/3/92	1-42-12
Donaldson Branch	From source to Brasstown Creek	WS-IV	8/3/92	1-42-13
HIWASSEE RIVER	From a point 0.6 mile upstream of McComb Branch to Town of Murphy water supply intake (located 0.1 mile downstream of McComb Branch)	WS-IV CA	7/1/95	1-(42.3)
McComb Branch	From source to a point 0.1 mile upstream of NC Hwy. 141	WS-IV	7/1/95	1-43-(1)
McComb Branch	From a point 0.1 mile upstream of NC Hwy. 141 to Hiwassee River	WS-IV CA	7/1/95	1-43-(2)
HIWASSEE RIVER	From Town of Murphy water supply intake to a point 0.3 mile downstream of Martin Creek	WS-V	7/1/95	1-(43.7)
Peachtree Creek	From source to Hiwassee River	C	7/1/95	1-44
Coldspring Branch	From source to Peachtree Creek	C	7/1/95	1-44-1
Panther Branch	From source to Peachtree Creek	C	7/1/95	1-44-2
Painter Branch	From source to Peachtree Creek	C	7/1/95	1-44-3
Fate Puett Cove Creek	From source to Peachtree Creek	C	7/1/95	1-44-4
Burl Branch	From source to Fate Puett Cove Creek	C	7/1/95	1-44-4-1
Truett Branch	From source to Fate Puett Cove Creek	C	7/1/95	1-44-4-2
Lamb Branch	From source to Peachtree Creek	C	7/1/95	1-44-5

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Classification Date	Classification Index No.
Elliott Branch	From source to Peachtree Creek	C	7/1/95	1-44-6
Pipes Branch	From source to Peachtree Creek	C	7/1/95	1-44-7
Mill Branch	From source to Pipes Branch	C	7/1/95	1-44-7-1
Gregory Branch	From source to Pipes Branch	C	7/1/95	1-44-7-2
Moody Branch	From source to Peachtree Creek	C	7/1/95	1-44-8
Slow Creek	From source to Peachtree Creek	C	7/1/95	1-44-9
Barnett Branch	From source to Slow Creek	C	7/1/95	1-44-9-1
Messer Branch	From source to Slow Creek	C	7/1/95	1-44-9-2
Graham Branch	From source to Slow Creek	C	7/1/95	1-44-9-3
Snead Branch	From source to Slow Creek	C	7/1/95	1-44-9-4
Cornwell Branch	From source to Snead Branch	C	7/1/95	1-44-9-4-1
Fall Branch	From source to Hiwassee River	C	7/1/95	1-45
Seibold Branch	From source to Fall Branch	C	7/1/95	1-45-1
Burnthouse Branch	From source to Hiwassee River	C	7/1/95	1-46
Will Scott Creek	From source to Hiwassee River	C	7/1/95	1-47
Hampton Creek	From source to Hiwassee River	C	7/1/95	1-48
Harshaw Branch	From source to Hampton Creek	C	7/1/95	1-48-1
Campground Branch	From source to Hampton Creek	C	7/1/95	1-48-2
Martin Creek	From source to Hiwassee River	C	7/1/95	1-49
Mag Ashe Branch	From source to Martin Creek	C	7/1/95	1-49-1
George Creek	From source to Martin Creek	C	7/1/95	1-49-2
Right Prong Martin Creek	From source to Martin Creek	C	7/1/95	1-49-3
HIWASSEE RIVER (Hiwassee Lake below elevation 1525)	From a point 0.3 mile downstream of Martin Creek to Laurel Creek	C	7/1/61	1-(50)
McColl Branch	From source to Hiwassee Lake	C	9/1/74	1-51
Valley River	From source to Hiwassee Lake	C Tr	7/1/61	1-52
Powder Burnt Branch	From source to Valley River	C Tr	7/1/73	1-52-1
Long Branch	From source to Valley River	C Tr	7/1/73	1-52-2
Wright Branch	From source to Valley River	C Tr	7/1/73	1-52-3
East Nelson Creek	From source to Valley River	C Tr	7/1/73	1-52-4
West Nelson Creek	From source to Valley River	C Tr	7/1/73	1-52-5
Watkins Creek	From source to Valley River	C Tr	7/1/73	1-52-6
Beetree Branch	From source to Watkins Creek	C	7/1/61	1-52-6-1
Millseat Branch	From source to Valley River	C	7/1/61	1-52-7
Bent Creek	From source to Valley River	C Tr	7/1/73	1-52-8
Bryson Branch	From source to Valley River	C Tr	7/1/73	1-52-9
Brady Branch	From source to Valley River	C Tr	7/1/73	1-52-10
Tank Branch	From source to Valley River	C Tr	7/1/73	1-52-11
Silvermine Branch	From source to Tank Branch	C	7/1/61	1-52-11-1
Mill Branch	From source to Valley River	C	7/1/61	1-52-12
Turnpike Creek	From source to Valley River	C Tr	7/1/73	1-52-13
Totherrow Branch	From source to Turnpike Creek	C	7/1/61	1-52-13-1
Harris Creek	From source to Valley River	C Tr	7/1/73	1-52-14
Granny Squirrel Branch	From source to Harris Creek	C	7/1/61	1-52-14-1
Melton Creek	From source to Valley River	C Tr	7/1/73	1-52-15
Fine Comb Branch	From source to Melton Creek	C	7/1/61	1-52-15-1
Doctor Branch	From source to Valley River	C	7/1/61	1-52-16

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Classification Date	Classification Index No.
Tom Thumb Creek	From source to Valley River	C	7/1/61	1-52-17
Puncheon Branch	From source to Valley River	C	7/1/61	1-52-18
Stillhouse Branch	From source to Valley River	C	7/1/61	1-52-19
Flat Branch	From source to Valley River	C	7/1/61	1-52-20
Mill Branch	From source to Valley River	C	7/1/61	1-52-21
Burnt Shanty Branch	From source to Valley River	C	7/1/61	1-52-22
Gipp Creek	From source to Valley River	C Tr ORW	3/1/89	1-52-23
Brokeleg Branch	From source to Gipp Creek	C ORW	3/1/89	1-52-23-1
Ash Cove Creek	From source to Gipp Creek	C ORW	3/1/89	1-52-23-2
Worm Creek	From source to Valley River	C Tr	7/1/73	1-52-24
Matherson Creek	From source to Worm Creek	C Tr	7/1/73	1-52-24-1
Radder Creek	From source to Worm Creek	C Tr	7/1/73	1-52-24-2
Nick Branch	From source to Radder Creek	C	7/1/61	1-52-24-2-1
Coefield Branch	From source to Radder Creek	C	7/1/61	1-52-24-2-2
Kennedy Creek	From source to Worm Creek	C Tr	7/1/73	1-52-24-3
Shop Branch	From source to Worm Creek	C	7/1/61	1-52-24-4
Ingram Branch	From source to Worm Creek	C	7/1/61	1-52-24-5
Rail Cove Branch	From source to Ingram Branch	C	7/1/61	1-52-24-5-1
Junaluska Creek	From source to Valley River	C Tr	7/1/61	1-52-25
Bob Allen Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-1
Hogan Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-2
White Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-3
Schoolhouse Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-4
Ashturn Creek	From source to Junaluska Creek	C	7/1/61	1-52-25-5
Catstair Branch	From source to Ashturn Creek	C	7/1/61	1-52-25-5-1
Hicks Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-6
Patterson Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-7
Culbert Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-8
Polecat Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-9
Bear Branch	From source to Junaluska Creek	C Tr	7/1/73	1-52-25-10
Right Fork Bear Branch	From source to Bear Branch	C	7/1/61	1-52-25-10-1
Weaver Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-11
Bolden Branch	From source to Junaluska Creek	C	7/1/61	1-52-25-12
Stewart Branch	From source to Valley River	C Tr	7/1/73	1-52-26
Mary Branch	From source to Stewart Branch	C	7/1/61	1-52-26-1
Pile Creek	From source to Valley River	C Tr	7/1/73	1-52-27
Turkeypen Branch	From source to Pile Creek	C	7/1/61	1-52-27-1
Spread Eagle Branch	From source to Pile Creek	C	7/1/61	1-52-27-2
Tatham Creek	From source to Valley River	C Tr	7/1/73	1-52-28
McClellan Creek	From source to Tatham Creek	C Tr	7/1/73	1-52-28-1
Trail Branch	From source to McClellan Creek	C	7/1/61	1-52-28-1-1
Polecat Branch	From source to Trail Branch	C	7/1/61	1-52-28-1-1-1
Coefield Branch	From source to Trail Branch	C	7/1/61	1-52-28-1-1-2
Snyder Creek	From source to McClellan Creek	C	7/1/61	1-52-28-1-2
Collett Creek	From source to Tatham Creek	C Tr	7/1/73	1-52-28-2
Flat Branch	From source to Collett Creek	C	7/1/61	1-52-28-2-1
Crawford Branch	From source to Collett Creek	C	7/1/61	1-52-28-2-2

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Phillips Creek	From source to Tatham Creek	C	7/1/61	1-52-28-3
Britton Creek	From source to a point 2.8 mile upstream of mouth (former Andrews Water Supply Intake	C HQW	8/3/92	1-52-29-(1)
Britton Creek	From a point 2.8 mile upstream of mouth to Valley River	C Tr	7/1/73	1-52-29-(2)
Beaver Creek	From source to a point 0.5 mile upstream of Andrews Water Supply Intake	WS-II Tr	8/3/92	1-52-30-(1)
Beaver Creek	From a point 0.5 mile upstream of Andrews Water Supply Intake to Andrews Water Supply Intake	WS-II Tr CA	8/3/92	1-52-30-(1.5)
Freeman Branch	From source to a point 0.5 mile upstream of mouth	WS-II Tr	8/3/92	1-52-30-2-(1)
Freeman Branch	From a point 0.5 mile upstream of mouth to to Beaver Creek	WS-II Tr CA	8/3/92	1-52-30-2-(2)
Beaver Creek	From Andrews Water Supply Intake to Valley River	C Tr	7/1/73	1-52-30-(3)
Bob Branch	From source to Beaver Creek	C	7/1/61	1-52-30-4
Dan Holland Creek	From source to a point 0.5 mile downstream of Sunk Branch	WS-II Tr	8/3/92	1-52-30-5-(1)
Sunk Branch	From source to Dan Holland Creek	WS-II Tr	8/3/92	1-52-30-5-2
Dan Holland Creek	From a point 0.5 mile downstream of Sunk Branch to dam at Andrews Water Supply Reservoir	WS-II Tr CA	8/3/92	1-52-30-5-(2.3)
Strange Branch	From source to a point 0.5 mile upstream of mouth	WS-II Tr	8/3/92	1-52-30-5-3-(1)
Strange Branch	From a point 0.5 mile upstream of mouth to Andrews Water Supply Reservoir, Dan Holland Creek	WS-II Tr CA	8/3/92	1-52-30-5-3-(2)
Big Cove Branch	From source to a point 0.5 mile upstream of mouth	WS-II Tr	8/3/92	1-52-30-5-4-(1)
Big Cove Branch	From a point 0.5 mile upstream of mouth to Andrews Water Supply Reservoir, Dan Holland Creek	WS-II Tr CA	8/3/92	1-52-30-5-4-(2)
Dan Holland Creek	From dam at Andrews Water Supply Reservoir to Beaver Creek	C Tr	8/3/92	1-52-30-5-(5)
Town Branch	From source to Valley River	C Tr	7/1/73	1-52-31
Webb Creek	From source to Valley River	C Tr	7/1/73	1-52-32
Left Fork Webb Creek	From source to Webb Creek	C	7/1/61	1-52-32-1
Right Fork Webb Creek	From source to Webb Creek	C	7/1/61	1-52-32-2
Beach Branch	From source to Right Fork Webb Creek	C	7/1/61	1-52-32-2-1
Moody Branch	From source to Webb Creek	C	7/1/61	1-52-32-3
Underwood Branch	From source to Webb Creek	C	7/1/61	1-52-32-4
Whitaker Creek	From source to Valley River	C	9/1/74	1-52-33
Brown Creek	From source to Valley River	C	7/1/61	1-52-34
Ricket Branch	From source to Valley River	C	7/1/61	1-52-35
Jones Branch	From source to Ricket Branch	C	7/1/61	1-52-35-1

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Morris Creek	From source to Valley River	C Tr	7/1/73	1-52-36
Cozad Branch	From source to Morris Creek	C	7/1/61	1-52-36-1
Mike Branch	From source to Morris Creek	C	7/1/61	1-52-36-2
Truett Branch	From source to Morris Creek	C	7/1/61	1-52-36-3
Allmon Branch	From source to Morris Creek	C	7/1/61	1-52-36-4
Bryson Branch	From source to Morris Creek	C	7/1/61	1-52-36-5
Sharp Branch	From source to Valley River	C Tr	7/1/73	1-52-37
Thrash Creek (Wood Lake)	From source to Valley River	C Tr	7/1/73	1-52-38
Taylor Creek	From source to Valley River	C Tr	7/1/73	1-52-39
Gumflats Creek	From source to Taylor Creek	C Tr	7/1/73	1-52-39-1
Colvard Creek	From source to Gumflats Creek	C	7/1/61	1-52-39-1-1
Alfred Creek	From source to Taylor Creek	C	7/1/61	1-52-39-2
Aaron Creek	From source to Taylor Creek	C Tr	7/1/73	1-52-39-3
Hogpen Branch	From source to Taylor Creek	C	7/1/61	1-52-39-4
Tom Branch	From source to Taylor Creek	C	7/1/61	1-52-39-5
Luther Branch	From source to Taylor Creek	C	7/1/61	1-52-39-6
Welch Mill Creek	From source to Valley River	C Tr	7/1/73	1-52-40
Hurricane Branch	From source to Welch Mill Creek	C	7/1/61	1-52-40-1
Griggs Branch	From source to Welch Mill Creek	C	7/1/61	1-52-40-2
Townhouse Creek	From source to Welch Mill Creek	C	7/1/61	1-52-40-3
Parker Branch	From source to Valley River	C	9/1/74	1-52-41
Laurel Branch	From source to Valley River	C Tr	7/1/73	1-52-42
Burnt Branch	From source to Laurel Branch	C Tr	7/1/73	1-52-42-1
Hyatt Creek	From source to Valley River	C	7/1/61	1-52-43
Little Dam Branch	From source to Hyatt Creek	C	7/1/61	1-52-43-1
Big Dam Branch	From source to Hyatt Creek	C	7/1/61	1-52-43-2
Pounding Mill Branch	From source to Big Dam Branch	C	7/1/61	1-52-43-2-1
Slickrock Branch	From source to Hyatt Creek	C Tr	7/1/61	1-52-43-3
Moss Branch	From source to Slickrock Branch	C	7/1/61	1-52-43-3-1
Fishermare Branch	From source to Hyatt Creek	C	7/1/61	1-52-43-4
Allmon Creek	From source to Hyatt Creek	C	7/1/61	1-52-43-5
Parsons Branch	From source to Valley River	C Tr	7/1/73	1-52-44
Ladd Branch	From source to Parsons Branch	C	7/1/61	1-52-44-1
Venegeance Creek	From source to Valley River	C Tr	7/1/73	1-52-45
Coldspring Branch	From source to Venegeance Creek	C Tr	7/1/73	1-52-45-1
Ramp Cove Branch	From source to Coldspring Branch	C	7/1/61	1-52-45-1-1
Buckhorn Branch	From source to Vengeance Creek	C	7/1/61	1-52-45-2
Graybeard Creek	From source to Vengeance Creek	C Tr	7/1/73	1-52-45-3
Nancy Hawkins Branch	From source to Greybeard Creek	C	7/1/61	1-52-45-3-1
Jenick Branch	From source to Greybeard Creek	C	7/1/61	1-52-45-3-2
Puett Creek	From source to Vengeance Creek	C Tr	7/1/73	1-52-45-4
Derreberry Branch	From source to Puett Creek	C	7/1/61	1-52-45-4-1
Highfalls Branch	From source to Valley River	C	7/1/61	1-52-46
Bettis Branch	From source to Valley River	C	7/1/61	1-52-47
Rhea Branch	From source to Valley River	C Tr	7/1/73	1-52-48
Magazine Branch	From source to Valley River	C	9/1/74	1-52-49
Mason Branch	From source to Valley River	C	9/1/74	1-52-50

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Classification Date	Classification Index No.
Sam Branch	From source to Valley River	C	9/1/74	1-52-51
Stillhouse Branch	From source to Valley River	C	9/1/74	1-52-52
Long Branch	From source to Valley River	C	7/1/61	1-52-53
Pole Bridge Branch	From source to Valley River	C	9/1/74	1-52-54
Sam Newton Branch	From source to Valley River	C	9/1/74	1-52-55
Morgan Creek	From source to Valley River	C	7/1/61	1-52-56
Highfall Branch	From source to Morgan Creek	C	7/1/61	1-52-56-1
Wilson Creek	From source to Morgan Creek	C	7/1/61	1-52-56-2
Cindy Branch	From source to Morgan Creek	C	7/1/61	1-52-56-3
Dick Branch	From source to Morgan Creek	C	7/1/61	1-52-56-4
Simon Branch	From source to Morgan Creek	C	7/1/61	1-52-56-5
Mary Branch	From source to Valley River	C	7/1/61	1-52-57
Colvard Creek	From source to Valley River	C Tr	7/1/73	1-52-58
Sassafras Branch	From source to Colvard Creek	C	7/1/61	1-52-58-1
Gabby Branch	From source to Colvard Creek	C	7/1/61	1-52-58-2
Sawmill Branch	From source to Colvard Creek	C	7/1/61	1-52-58-3
Wagon Timber Branch	From source to Colvard Creek	C	7/1/61	1-52-58-4
Jackson Branch	From source to Colvard Creek	C	7/1/61	1-52-58-5
Cowmire Branch	From source to Colvard Creek	C	7/1/61	1-52-58-6
Hayes Mill Creek	From source to Valley River	C Tr	7/1/73	1-52-59
Rogers Creek	From source to Valley River	C Tr	7/1/73	1-52-60
Pace Branch	From source to Rogers Creek	C	7/1/61	1-52-60-1
Chestnut Log Branch	From source to Pace Branch	C	7/1/61	1-52-60-1-1
John Newton Branch	From source to Rogers Creek	C	7/1/61	1-52-60-2
Keener Branch	From source to Valley River	C Tr	7/1/73	1-52-61
Schoolhouse Branch	From source to Keener Branch	C	7/1/61	1-52-61-1
Sales Branch	From source to Valley River	C	7/1/61	1-52-62
Rattler Branch	From source to Valley River	C	7/1/61	1-52-63
George Martin Branch	From source to Valley River	C	7/1/61	1-52-64
Wesley Martin Branch	From source to Valley River	C	7/1/61	1-52-65
Marble Creek	From source to Brittian Creek	WS-I	8/3/92	1-52-66-(1)
Marble Creek	From Murphy Water Supply Intake to Valley River	C	7/1/61	1-52-66-(2)
Brittian Creek	From source to Marble Creek	WS-I	8/3/92	1-52-66-3
Palmer Branch	From source to Valley River	C	7/1/61	1-52-67
Brittian Branch (Fain Mountain Reservoir)	From source to dam at Fain Mountain Reservoir	WS-I	8/3/92	1-52-68-(1)
Brittian Branch	From dam at Fain Mountain Reservoir to Valley River	C	9/1/61	1-52-68-(2)
HIWASSEE RIVER (Hiwassee Lake below elevation 1525)	From Laurel Creek to Hiwassee Dam	B	8/3/92	1-(53)
Laurel Creek	From source to Hiwassee Lake	C	7/1/61	1-54
Kirklin Creek	From source to Hiwassee Lake	C	7/1/61	1-55
Bates Creek	From source to Hiwassee Lake	C	7/1/61	1-56
Hanging Dog Creek	From source to Hiwassee Lake	C	7/1/61	1-57
Will Creek	From source to Hanging Dog Creek	C	7/1/61	1-57-1

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Woody Branch	From source to Will Creek	C	7/1/61	1-57-1-1
Augen Branch	From source to Hanging Dog Creek	C	7/1/61	1-57-2
Grindstone Branch	From source to Hanging Dog Creek	C	7/1/61	1-57-3
Davis Creek	From source to Hanging Dog Creek	C Tr	7/1/61	1-57-4
Dockery Creek	From source to Davis Creek	C Tr	7/1/73	1-57-4-1
Mose Creek	From source to Dockery Creek	C Tr	7/1/73	1-57-4-1-1
Gumlog Creek	From source to Dockery Creek	C Tr	7/1/73	1-57-4-1-2
Bald Creek	From source to Davis Creek	C Tr	7/1/61	1-57-4-2
Little Creek	From source to Davis Creek	C Tr	7/1/73	1-57-4-3
Rocky Knob Branch	From source to Little Creek	C	7/1/61	1-57-4-3-1
Snap Branch	From source to Davis Creek	C Tr	7/1/73	1-57-4-4
Cook Creek	From source to Hanging Dog Creek	C	7/1/61	1-57-5
Owl Creek	From source to Hanging Dog Creek	C	7/1/61	1-57-6
Dinkin Cove Creek (Dinkin Branch)	From source to Owl Creek	C Tr	7/1/73	1-57-6-1
Little Owl Creek	From source to Owl Creek	C Tr	7/1/73	1-57-6-2
Dockery Creek	From source to Hanging Dog Creek	C Tr	7/1/73	1-57-7
Rose Creek	From source to Dockery Creek	C	7/1/61	1-57-7-1
Nottely River	From North Carolina-Georgia State Line to Hiwassee Lake	C	7/1/61	1-58
Moccasin Creek	North Carolina portion	C	7/1/61	1-58-1
Butler Creek	From North Carolina-Georgia State Line to Nottely River	C	7/1/61	1-58-2
Cobb Creek	From source to Nottely River	C	7/1/61	1-58-3
Grape Thicket Branch	From source to Cobb Creek	C	7/1/61	1-58-3-1
Gold Branch	From source to Nottely River	C	9/1/74	1-58-4
Owenby Creek	From North Carolina-Georgia State Line to Nottely River	C	9/1/74	1-58-5
Rapier Mill Creek	From source to Nottely River	C	9/1/74	1-58-6
North Fork Rapier Mill Creek	From source to Rapier Mill Creek	C	7/1/61	1-58-6-1
Garland Branch	From source to Rapier Mill Creek	C	7/1/61	1-58-6-2
South Fork Rapier Mill Creek	North Carolina portion	C	7/1/61	1-58-6-3
Dickey Branch	From source to Nottely River	C	9/1/74	1-58-7
Walker Mill Creek	From source to Nottely River	C	9/1/74	1-58-8
Rominger Creek	From source to Nottely River	C	9/1/74	1-58-9
Cane Creek	From source to Nottely River	C	7/1/61	1-58-10
Lindsey Branch	From source to Cane Creek	C	7/1/61	1-58-10-1
Stillhouse Branch	From source to Lindsey Branch	C	7/1/61	1-58-10-1-1
Crane Creek	From source to Nottely River	C	7/1/61	1-58-11
Sneed Branch	From source to Nottely River	C	7/1/61	1-58-12
Laurel Branch	From source to Nottely River	C	7/1/61	1-58-13
Beech Creek	From source to Hiwassee Lake	C	7/1/61	1-59
Grape Creek	From source to Hiwassee Lake	C	7/1/61	1-60
West Prong Grape Creek	From source to Grape Creek	C	7/1/61	1-60-1
Song Branch	From source to Hiwassee Lake	C	7/1/61	1-61

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Jack Davis Branch	From source to Hiwassee Lake	C	7/1/61	1-62
Persimmon Creek (Lake Cherokee)	From source to Hiwassee Lake	C	7/1/61	1-63
Flax Creek	From source to Persimmon Creek	C	7/1/61	1-63-1
Hickey Branch	From source to Persimmon Creek	C	7/1/61	1-63-2
Hibbert Branch	From source to Hiwassee Lake	C	7/1/61	1-64
Bearpaw Creek	From source to Hiwassee Lake	C	7/1/61	1-66
Hyatt Mill Creek	From source to Hiwassee Lake	C	7/1/61	1-67
Taylor Creek	From source to Hiwassee Lake	C Tr	7/1/73	1-68
Johnson Creek	From source to Hiwassee Lake	C Tr	9/1/74	1-69
Chambers Creek	From source to Hiwassee Lake	C	7/1/61	1-70
Powell Branch	From source to Hiwassee Lake	C	7/1/61	1-71
Beaverdam Creek	From source to Hiwassee Lake	C Tr	7/1/73	1-72
Horton Branch	From source to Beaverdam Creek	C Tr	7/1/73	1-72-1
Radford Branch	From source to Beaverdam Creek	C Tr	7/1/73	1-72-2
Cook Creek	From source to Beaverdam Creek	C Tr	7/1/73	1-72-3
Farmer Branch	From source to Cook Creek	C Tr	7/1/73	1-72-3-1
Roberts Branch	From source to Farmer Branch	C	7/1/61	1-72-3-1-1
Garrett Creek	From source to Cook Creek	C Tr	7/1/73	1-72-3-2
Bell Creek	From source to Garrett Creek	C Tr	7/1/73	1-72-3-2-1
Copper Creek	From source to Beaverdam Creek	C Tr	7/1/61	1-72-4
Kilby Branch	From source to Copper Creek	C Tr	7/1/73	1-72-4-1
Miller Branch	From source to Kilby Branch	C	7/1/61	1-72-4-1-1
Groundhog Branch	From source to Copper Creek	C	7/1/61	1-72-4-2
Potlog Branch	From source to Copper Creek	C	7/1/61	1-72-4-3
Cindy Branch	From source to Copper Creek	C	7/1/61	1-72-4-4
Buckhorn Creek	From source to Copper Creek	C Tr	7/1/73	1-72-4-5
Bryson Branch	From source to Beaverdam Creek	C Tr	7/1/73	1-72-5
Bryson Creek	From source to Beaverdam Creek	C Tr	7/1/73	1-72-6
Moccasin Creek	From source to Hiwassee Lake	C Tr	7/1/73	1-73
HIWASSEE RIVER (Apalachia Lake below elevation 1281)	From Hiwassee Dam to River Mile 75, 0.8 mile downstream from Hiwassee Dam at Hiwassee Reservation Boundary	C	7/1/61	1-(74)
HIWASSEE RIVER (Apalachia Lake below elevation 1281)	From River Mile 75, 0.8 mile downstream from Hiwassee Dam at Hiwassee Reservation Boundary to Apalachia Dam	B	9/1/74	1-(75)
Anderson Creek	From source to Apalachia Lake	C Tr	7/1/73	1-76
South Shoal Creek	From source to Apalachia Lake	C Tr	7/1/73	1-77
Allen Branch	From source to South Shoal Creek	C	7/1/61	1-77-1
Thompson Branch	From source to South Shoal Creek	C	7/1/61	1-77-2
Quinn Creek	From source to South Shoal Creek	C Tr	7/1/73	1-77-3
Little Shoal Creek	From source to Apalachia Lake	C Tr	7/1/73	1-78
Beavers Branch	From source to Apalachia Lake	C	7/1/61	1-79
North Shoal Creek	From source to Apalachia Lake	C	7/1/61	1-80
Potter Branch	From source to North Shoal Creek	C	7/1/61	1-80-1

.0302 HIWASSEE RIVER BASIN

Name of Stream	Description	Classification Class	Classification Date	Classification Index No.
Baine Branch	From source to Apalachia Lake	C	7/1/61	1-81
Camp Creek	From source to Apalachia Lake	C	7/1/61	1-82
Adams Branch	From source to Apalachia Lake	C	7/1/61	1-83
Laurel Branch	From North Carolina-Tennessee State Line to Apalachia Lake	C Tr	7/1/73	1-84
HIWASSEE RIVER	From Apalachia Dam to North Carolina-Tennessee State Line	C	7/1/61	1-(85)
Shuler Creek	From source to Hiwassee River	C	7/1/61	1-86
Bear Branch	From source to Shuler Creek	C	7/1/61	1-86-1
Floyde Branch	From source to Shuler Creek	C Tr	7/1/73	1-86-2
Locust Gap Branch	From source to Shuler Creek	C Tr	7/1/73	1-86-3
Pretty Pine Branch	From source to Shuler Creek	C Tr	7/1/73	1-86-4
Buckberry Branch	From source to Shuler Creek	C Tr	7/1/73	1-86-5
Morrow Branch	From source to Shuler Creek	C Tr	7/1/73	1-86-6
Elbow Creek	From source to Shuler Creek	C Tr	7/1/73	1-86-7
Slate Creek	From source to Shuler Creek	C Tr	7/1/73	1-86-8
Flat Branch	From source to Shuler Creek	C Tr	7/1/73	1-86-9
Brushy Creek	From source to North Carolina-Tennessee State Line	C	7/1/61	1-88
Rocky Ford Creek	From source to North Carolina-Tennessee State Line	C	7/1/61	1-89
Hall Creek	From source to North Carolina-Tennessee State Line	C	7/1/61	1-90
Hothouse Creek	From source to North Carolina-Georgia State Line	C	7/1/61	1-91
Long Branch	From source to Hothouse Creek	C	7/1/61	1-91-1
Synacia Creek	From source to North Carolina-Georgia State Line	C	7/1/61	1-91-2
Wolf Creek	From source to North Carolina-Georgia State Line	C	7/1/61	1-92
Potato Creek	From source to North Carolina-Tennessee State Line	C	7/1/61	1-93
North Potato Creek	From source to North Carolina-Tennessee State Line	C	7/1/61	1-93-1

APPENDIX III

DWQ Water Quality Monitoring Programs
in the Hiwassee River Basin

- Benthic Macroinvertebrate Sampling
- Fisheries Studies
- Lakes Assessment Program
- Aquatic Toxicity Monitoring

A - III.1 BENTHIC MACROINVERTEBRATES

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 benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since many taxa in a community have life cycles of six months to 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 bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPT S). Likewise, ratings can be assigned with a Biotic Index. This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis. Different criteria have been developed for the major ecoregions (mountains, piedmont and coastal) within North Carolina.

Classification Criteria by Ecoregion*

A. EPT taxa richness values

	10-sample Qualitative Samples			4-sample EPT Samples		
	Mountains	Piedmont	Coastal	Mountains	Piedmont	Coastal
Excellent	>41	>31	>27	>35	>27	>23
Good	32-41	24-31	21-27	28-35	21-27	18-23
Good-Fair	22-31	16-23	14-20	19-27	14-20	12-17
Fair	12-21	8-15	7-13	11-18	7-13	6-11
Poor	0-11	0-7	0-6	0-10	0-6	0-5

B. Biotic Index Values (Range = 0-10)

	Mountains	Piedmont	Coastal A
Excellent	<4.05	<5.19	<5.47
Good	4.06-4.88	5.19-5.78	5.47-6.05
Good-Fair	4.89-5.74	5.79-6.48	6.06-6.72
Fair	5.75-7.00	6.49-7.48	6.73-7.73
Poor	>7.00	>7.48	>7.73

*These criteria apply to flowing water systems only. Biotic index criteria are only used for full-scale (10-sample) qualitative samples.

Appendix A - III.1 lists all the benthic macroinvertebrate collections in the Hiwassee River basin between 1983 and 1994, giving site location, DEM classification schedule index number, collection date, taxa richness and biotic index values, and bioclassifications. Final bioclassifications assigned may take into account seasonal correction of both EPT taxa richness and Biotic Index value if the sample was collected outside of summer. Bioclassifications listed in this report may differ from older reports because evaluation criteria have changed since 1983. Originally, total taxa richness and EPT taxa richness criteria were used to assign rating, then just EPT taxa richness. Currently BI as well as EPT taxa richness criteria are used to assign bioclassification. Refinements of the criteria continue to occur as more data is gathered.

Benthos data were collected at 15 basin assessment sites during 1994, and a total of 37 sites (73 samples) have been rated using benthic macroinvertebrate data since 1983. Overall water quality

Table A - III.1 Benthic Macroinvertebrate Data Collected from 1983 through 1994 in the Hiwassee River Basin

HIW 01

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Shooting Cr, SR 1349, ab poultry farm, Clay	/B-1	1-5	08/94	68/37	2.68/2.03	Excellent
Shooting Cr, SR 1168, be poultry UT, Clay	/B-2	1-5	08/94	59/28	2.99/2.60	Good
Shooting Cr, SR 1347, Clay	/B-3	1-5	07/94	-/32	-/2.36	Good
Tusquitee Cr, off SR 1307 ab trout farm, Clay	16/B-4	1-21-(0.5)	03/89	-/35	-/2.13	Good
Tusquitee Cr, SR 1307, ab Big Tuni Cr, Clay	15/B-5	1-21-(0.5)	03/89	-/49	-/2.49	Excellent
Tusquitee Cr, SR 1330, Clay	4/B-6	1-21-(4.5)	07/94	69/34	3.60/2.67	Excellent
			03/89	-/45	-/2.25	Excellent
			04/87	95/53	3.57/2.32	Excellent
			05/87	101/51	3.59/2.23	Excellent
Big Tuni Cr, FS Rd 440 (headwaters) Clay	3,20/B-7	1-21-5	03/89	-/46	-/1.46	Excellent*
			06/88	-/41	-/1.24	Excellent
			04/88	-/39	-/1.37	Excellent
			05/87	90/46	2.58/1.24	Excellent
			04/87	77/38	2.48/1.35	Excellent
Big Tuni Cr, SR 1311, Clay	19/B-8	1-21-5	07/94	63/38	2.03/1.53	Excellent
			03/89	83/45	3.26/2.10	Excellent
Johnson (Mill) Cr, SR 1307, Clay	18/B-9	1-21-13	03/89	-/42	-/1.71	Excellent
Tusquitee Cr, SR 1300, Clay	/B-10	1-21-(16.5)	03/89	90/47	3.43/2.22	Excellent
Greasy Cr, SR 1318, Clay	17/B-11	1-21-20-(1)	03/89	-/38	-/2.38	Good
Albone Cr, SR 1300, Clay	5/B-12	1-21-24	05/87	79/37	3.32/1.70	Excellent*
			04/87	77/38	3.54/2.08	Excellent*
Fires Cr, FS Rd"C" (headwaters), Clay	10/B-13	1-27-(0.5)	06/88	-/35	-/1.15	Excellent*
			04/88	-/39	-/1.19	Excellent*
Coldspring Br, FS Rd, Clay	/B14	1-27-4-3	06/88	-/39	-/1.90	Excellent
			04/88	-/37	-/1.33	Excellent
Fires Cr, Bristol Camp, Clay	6/B-15	1-27-(5.5)	07/94	80/43	2.50/1.54	Excellent
			06/88	102/47	3.01/1.67	Excellent
			04/88	103/54	3.17/1.68	Excellent
			05/87	95/52	3.29/1.86	Excellent
Fires Cr, at Picnic Area, Clay	A,8/B-16	1-27-(5.5)	08/94	81/38	3.39/2.19	Excellent
			07/94	-/35	-/1.78	Excellent
			08/88	107/54	3.40/2.43	Excellent
			04/88	-/48	-/1.47	Excellent
			05/87	113/58	3.23/1.89	Excellent
			04/87	101/54	2.98/1.85	Excellent
			08/85	111/50	3.95/2.25	Excellent
Fires Cr, SR 1300, Clay	B-17	1-27-(5.5)	05/87	-/40	-/2.16	Excellent
			04/87	-/43	-/2.27	Excellent
Little Fires Cr, FS Rd nr mouth, Clay	12/B-18	1-27-7	12/91	-/34	-/1.75	Excellent
			06/88	-/38	-/1.46	Excellent
			04/88	-/37	-/1.43	Excellent
Leatherwood Br, FS Rd, Clay	7/B-19	1-27-12	06/88	-/30	-/2.25	Excellent*
			04/88	-/34	-/1.78	Excellent*
			05/87	60/30	3.20/1.66	Excellent*
			04/87	58/34	2.56/1.44	Excellent*
Brasstown Cr, SR 1104, Clay	/B-20	1-42	07/94	-/18	-/4.41	Fair

HIW 02

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Hiwassee R, US 64, nr Murphy, Cherokee	B-1	1-(42.7)	08/90	78/38	4.29/3.25	Good
			08/87	78/35	4.61/3.29	Good
			07/86	65/32	4.94/3.92	Good-Fair
			08/85	56/26	4.37/3.57	Good
			08/84	67/29	4.50/3.35	Good
			08/83	62/23	4.67/3.43	Good-Fair
Peachtree Cr, SR 1537, Cherokee	B-2	1-44	07/94	-/37	-/2.42	Excellent
Valley R, off US 19, nr Rhodo, Cherokee	B-3	1-52	8/94	-/23	-/2.84	Good-Fair
Valley R, Stewart Rd, ab Andrews, Cherokee	B-4	1-52	8/94	-/15	-/3.30	Fair

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Valley R, Main St, Andrews, ab WWTP, Cherokee	B-5	1-52	8/94	40/6	5.84/2.47	Fair
Valley R, ab landfill, off US 19, Cherokee	B-6	1-52	8/94	57/13	5.30/3.56	Fair
Valley R, ab Andrews WWTP, Cherokee	1/B-7	1-52	08/85	76/33	5.19/3.70	Good-Fair
Valley R, be Andrews WWTP, Cherokee	2/B-8	1-52	08/85	75/30	5.52/3.52	Good-Fair
Valley R , SR 1554 nr Tomatla, Cherokee	C/B-9	1-52	07/94	77/29	4.84/4.11	Good-Fair
			08/90	87/33	4.58/3.63	Good
			08/88	91/33	4.99/4.20	Good-Fair
			07/86	71/28	5.51/3.83	Good-Fair
			08/84	70/26	4.93/3.88	Good-Fair
Junaluska Cr, SR 1505, Cherokee	B-10	1-52-25	07/94	-/25	-/2.11	Good-Fair
			08/94	-/22	-/2.50	Good-Fair
Britton Cr, off FS Rd nr SR 1339, Cherokee	B-11	1-52-29-(1)	12/91	-/35	-/1.54	Excellent
Hanging Dog Cr, SR 1331, Cherokee	B-12	1-57	7/94	-/46	-/2.49	Excellent
Nottely R, SR 1596,Cherokee	B-13	1-58	7/94	-/36	-/2.83	Excellent
Persimmon Cr, SR 1127, Cherokee	B-14	1-63	7/94	-/42	-/2.97	Excellent
Beaverdam Cr, SR 1326, Cherokee	B-15	1-72	8/94	-/39	-/2.45	Excellent
South Shoal Cr, SR 1314,Cherokee	B-16	1-77	8/94	-/30	-/2.40	Good
Shuler Cr, SR 1323, Cherokee	B-17	1-86	8/94	-/35	-/2.42	Good

*Small stream criteria

Benthos data were collected at 15 basin assessment sites during 1994, and a total of 37 sites (73 samples) have been rated using benthic macroinvertebrate data since 1983. Overall water quality is Excellent in the Hiwassee basin. The fifteen 1994 sites resulted in a bioclassification of Excellent at 9 sites, Good at 3 sites, Good-Fair at 2 sites, and Fair at one site, Brasstown Creek. Of the 73 samples collected since 1983, 66% were given an Excellent bioclassification.

A - III.II FISHERIES

Fish Tissue

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species, have been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be available for bioaccumulation either directly or through aquatic food webs and may accumulate in fish and shellfish tissues. Results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water. Fish tissue analysis results are used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with Federal Food and Drug Administration (FDA) action levels, U. S. Environmental Protection Agency (EPA) recommended screening values, and criteria adopted by the North Carolina Health Department. Only metals were evaluated in the Hiwassee samples, and the metals screening values are listed below. The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs and thus employ a "safe level" approach to fish tissue consumption. At present, the FDA has only developed metals criteria for mercury. The North Carolina Health Department has adopted a selenium limit of 5 ppm for issuing fish consumption advisories.

Food and Drug Administration (FDA) Action Levels

Metals		
Mercury	1.0	ppm

Environmental Protection Agency (EPA) Screening Values

Metals		
Cadmium	10.0	ppm
Mercury	0.6	ppm
Selenium	50.0	ppm

Hiwassee Fish Tissue Overview

Fish samples collected within the Hiwassee drainage were analyzed for metals contaminants only. Fish tissue samples were collected at 2 sites (Hiwassee River and Hiwassee Lake) from 1981 to 1986, consisting of 13 observations. Samples were collected as part of the DEM's ambient fish tissue monitoring program. Fish species collected for analyses included catfish, walleye and bass. Results of fish tissue analyses indicated that mean levels of metals

contaminants in Hiwassee samples were non-detectable or present at levels below FDA and EPA criteria.

A - III.III LAKES ASSESSMENT PROGRAM

Lakes are valued for the multiple benefits they provide to the public, including recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lake Assessment Program seeks to protect these waters through monitoring; pollution prevention and control, and restoration activities. Assessments have been made at publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine the trophic state of each lake, a relative measure of nutrient enrichment and productivity, and whether the designated uses of the lake have been threatened or impaired by pollution.

Tables presented in each subbasin summarize data used to determine the trophic state and use support status of each lake. These determinations are based on information from the most recent summertime sampling (date listed). The most recent North Carolina Trophic State Index (NCTSI) value is shown, followed by the descriptive trophic state classification (O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic, D=dystrophic).

Numerical indices are often used to evaluate the trophic state of lakes. An index was developed specifically for North Carolina lakes as part of the state's original Clean Lakes Classification Survey (NCDNRCD 1982). The North Carolina Trophic State Index (NCTSI) is based on total phosphorus (TP in mg/l), total organic nitrogen (TON in mg/l), Secchi depth (SD in inches), and chlorophyll-a (CHL in µg/l). Lakewide means for these parameters are manipulated to produce a NCTSI score for each lake, using the following equations:

$$TON_{Score} = \frac{Log(TON) + 0.45}{0.24} \times 0.90$$

$$TP_{Score} = \frac{Log(TP) + 1.55}{0.35} \times 0.92$$

$$SD_{Score} = \frac{Log(SD) - 1.73}{0.35} \times -0.82$$

$$CHL_{Score} = \frac{Log(CHL) - 1.00}{0.48} \times 0.83$$

$$NCTSI = TON_{Score} + TP_{Score} + SD_{Score} + CHL_{Score}$$

In general, NCTSI scores relate to trophic classifications as follows: less than -2.0 is oligotrophic, -2.0 to 0.0 is mesotrophic, 0.0 to 5.0 is eutrophic, and greater than 5.0 is hypereutrophic. When scores border between classes, best professional judgment is used to assign an appropriate classification. NCTSI scores may be skewed by highly colored water typical of dystrophic lakes.

Some variation in the trophic state of a lake between years is not unusual due to the potential variability of data collections which usually involve sampling on a single day during the growing season. This survey methodology does not adequately evaluate changes which might occur throughout the year between lake samplings. More intensive (monthly) monitoring is required to identify lake specific variability. However, monitoring a lake once per growing season does provide a relatively valuable assessment of water quality conditions on a large number of lakes. Lakes are classified for their "best usage" and are subject to the state's water quality standards. Primary classifications are C (suited for aquatic life propagation/protection and secondary recreation such as wading), B (primary recreation, such as swimming, and all class C uses), and WS-I through WS-V(water supply source ranging from highest watershed protection level I to lowest watershed protection V, and all class C uses). Lakes with a CA designation represent water supplies with watersheds that are considered to be Critical Areas (i.e., an area within 1/2 mile and draining to water supplies from the normal pool elevation of reservoirs, or within 1/2 mile and draining to a river intake). Supplemental classifications in the Cape Fear River basin may include SW (slow moving Swamp Waters where certain water quality standards may not be applicable), NSW (Nutrient Sensitive Waters subject to excessive algal or other plant growth where nutrient controls are required), HQW (High Quality Waters which are rated excellent based on biological and physical/chemical characteristics), and ORW (Outstanding Resource Waters which are unique and special waters of exceptional state or national recreational or ecological value). A complete listing of these water classifications and standards can be found in Title 15 North Carolina Administrative Code, Chapter 2B, Section .0100 and .0200.

Phytoplankton are microscopic algae found in the water column of lakes, rivers, streams, and estuaries. Phytoplankton populations respond to nutrient availability and other environmental factors such as light, temperature, pH, salinity, water velocity, and grazing by organisms in higher trophic levels. Phytoplankton may be useful as indicators of eutrophication and are often collected with ambient water quality samples from lakes. Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of algae may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. The Algal Bloom Program was initiated in 1984 to document suspected algal blooms with species identification, quantitative biovolume, and density estimates. Usually, an algal sample with a biovolume larger than 5000 mm^3/m^3, density greater than 10,000 units/ml, or chlorophyll *a* concentration approaching or exceeding 40 µg/l (the North Carolina state standard) constitutes a bloom. Bloom samples may be collected as a result of complaint investigations, fish kills, or during routine monitoring if a bloom is suspected.

The summary tables presented within the body of this document list lakewide averages of total phosphorus (TP in mg/l), total organic nitrogen (TON in mg/l), chlorophyll *a* (CHLA in µg/l), and Secchi depth, followed by surface water classification. Causes of use impairment are explained below each table.

There were three lakes in the Hiwassee River Basin sampled as part of the Lakes Assessment Program. These lakes, by river subbasin, are presented below.

SUBBASIN 040501	SUBBASIN 040502
Chatuge Lake (NC portion)	Apalachia Lake
	Hiwassee Lake

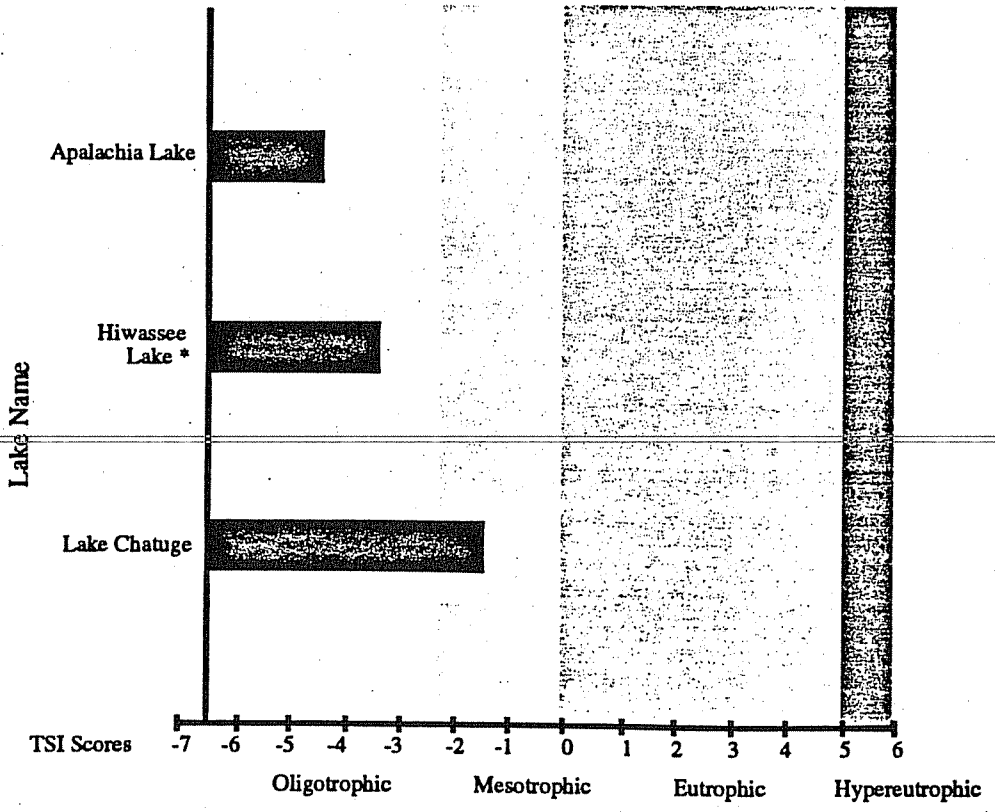
Only Hiwassee Lake has been sampled for the potential of supporting algal growth with the Algal Growth Potential Test (AGPT). The results of the Algal Growth Potential Test are mentioned in the appropriate subbasin discussion. The objective of the Algal Growth Potential Test is to assess a waterbody's potential for supporting algal biomass and to determine whether algal growth is limited by nitrogen, by phosphorus, or co-limited by both nutrients. When a

waterbody supports excessive algal growth without additional increases in nitrogen or phosphorus, the system may be subject to frequent nuisance algal blooms. The test exposes a standard alga, Selenastrum capricornutum, to the test water (this constitutes the control). Additional test samples are enriched with nitrogen or phosphorus. When one of these nutrients is added to a water sample which is growth limiting to that nutrient, the resulting mean standing crop (MSC) will generally reflect the level of the added nutrient. In some cases, the bioavailable nitrogen and phosphorus in a sample may approach their optimum ratio for growth of the test alga and the addition of nutrients may not clearly identify the limiting nutrient. A waterbody may be considered protected from nuisance algal blooms if an AGPT value is consistently less than or equal to 5 mg/l.

Hiwassee Lake was the only lake intensively monitored during the growing seasons of 1991 through 1993 as part of the reference lake program. The purpose of this program was to identify lakes in each of the four regions of the state (Mountain, Piedmont, Sandhills and Coastal Plains) which were representative of minimally impacted lakes by which similar lakes in the same region could be compared.

Each lake is individually discussed in the appropriate subbasin section with a focus on the most recent available data. Figure A - III.1 shows the most recent NCTSI scores for the three lakes of the Hiwassee River basin. All of the lakes were sampled most recently in 1994 and all of these lakes are fully supporting their designated uses.

Figure A - III.1 Hiwassee Basin - TSI Scores (Last Assessment Date)



All lakes sampled in 1994.
* Reference Lake

A - III.IV 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 DEM'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 DEM administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

APPENDIX IV

NPDES Permit Requirements for Trout Farms

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT

GENERAL PERMIT NO. NCG0000

TO DISCHARGE SEAFOOD PACKING AND RINSING, FISH FARMS AND SIMILIAR WASTEWATERS UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provision of North Carolina General Statute 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission, and the Federal Water Pollution Control Act, as amended, this permit is hereby issued to all owners or operators, hereafter permittees, which are covered by this permit as evidenced by receipt of a Certificate of Coverage by the Environmental Management Commission to allow the discharge of treated wastewater in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in Parts I, II, III and IV hereof.

This permit shall become effective August 1, 1992

This permit shall expire at midnight on July 31, 1997

Date: 7-31-92

A. Preston Howard, Jr., P.E., Acting Director
Division of Environmental Management
By Authority of the Environmental Management Commission

A. Effluent Limitations and Monitoring Requirements Final

NPDES Permit No. NCG 0000

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge from outfall(s) serial number 001. Such discharges shall be limited and monitored by the Permittee as specified below:

Effluent Characteristics	Discharge Limitation		Monitoring Requirements		
	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow			Annually	Estimate	Effluent
Total Suspended Solids	30.0 mg/l	60.0 mg/l	Annually	Grab	Effluent
Settleable Solids	5.0 ml/l	10.0 ml/l	Annually	Grab	Effluent
Dissolved Oxygen	*	*	Annually	Grab	Effluent

* The daily average dissolved oxygen effluent concentration shall not be less than 6.0 mg/l.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units for fresh surface water classifications. The pH shall not be less than 6.8 standard units nor greater than 8.5 standard units for tidal salt water classifications.

There shall be no discharge of fish parts, floating solids, or visible foam except in other than trace amounts.

PART I

SECTION B. SCHEDULE OF COMPLIANCE

1. The permittee shall comply with Final Effluent Limitations specified for discharges in accordance with the following schedule:

   Permittee shall comply with Final Effluent Limitations by the effective date of the permit unless specified below.

2. Permittee shall at all times provide the operation and maintenance necessary to operate the existing facilities at optimum efficiency.

3. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next schedule requirements.

PART II
STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. DEFINITIONS

1. Permit Issuing Authority

   The Director of the Division of Environmental Management.

2. DEM or Division

   Means the Division of Environmental Management, Department of Environment, Health and Natural Resources.

3. EMC

   Used herein means the North Carolina Environmental Management Commission.

4. Permittee

   Used herein means the entity who obtains coverage under this general permit by subsequent issuance of a "Certificate of Coverage" by the Division of Environmental Management.

5. Act or "the Act"

   The Federal Water Pollution Control Act, also known as the Clean Water Act, as amended, 33 USC 1251, et. seq.

6. Mass/Day Measurements

   a. The "monthly average discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month. It is therefore, an arithmetic mean found by adding the weights of the pollutant found each day of the month and then dividing this sum by the number of days the tests were reported. The limitation is identified as "Monthly Average" in Part I of the permit.

   b. The "weekly average discharge" is defined as the total mass of all daily discharges sampled and/or measured during the calendar week (Sunday - Saturday) on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such week. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the week and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Weekly Average" in Part I of the permit.

   c. The "maximum daily discharge" is the total mass (weight) of a pollutant discharged during a calendar day. If only one sample is taken during any calendar day the weight of pollutant calculated from it is the "maximum daily discharge." This limitation is identified as "Daily Maximum," in Part I of the permit.

Part II

d. The "average annual discharge" is defined as the total mass of all daily discharges sampled and/or measured during the calendar year on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such year. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the year and then dividing this sum by the number of days the tests were reported. This limitation is defined as "Annual Average" in Part I of the permit.

7. Concentration Measurement

a. The "average monthly concentration," other than for fecal coliform bacteria, is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average monthly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar month. This limitation is identified as "Monthly Average" under "Other Units" in Part I of the permit.

b. The "average weekly concentration," other than for fecal coliform bacteria, is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar week (Sunday/Saturday) on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such week (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average weekly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar week. This limitation is identified as "Weekly Average" under "Other Units" in Part I of the permit.

c. The "maximum daily concentration" is the concentration of a pollutant discharge during a calendar day. If only one sample is taken during any calendar day the concentration of pollutant calculated from it is the "Maximum Daily Concentration". It is identified as "Daily Maximum" under "Other Units" in Part I of the permit.

d. The "average annual concentration," other than for fecal coliform bacteria, is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar year on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such year (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day . The average yearly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar year.

Part II

e. The "daily average concentration" (for dissolved oxygen) is the minimum allowable amount of dissolved oxygen required to be available in the effluent prior to discharge averaged over a calendar day. If only one dissolved oxygen sample is taken over a calendar day, the sample is considered to be the "daily average concentration" for the discharge. It is identified as "daily average" in the text of Part I.

f. The "quarterly average concentration" is the average of all samples taken over a calendar quarter. It is identified as "Quarterly Average Limitation" in the text of Part I of the permit.

g. A calendar quarter is defined as one of the following distinct periods: January through March, April through June, July through September, and October through December.

8. Other Measurements

a. Flow, (MGD): The flow limit expressed in this permit is the 24 hours average flow, averaged monthly. It is determined as the arithmetic mean of the total daily flows recorded during the calendar month.

b. An "instantaneous flow measurement" is a measure of flow taken at the time of sampling, when both the sample and flow will be representative of the total discharge.

c. A "continuous flow measurement" is a measure of discharge flow from the facility which occurs continually without interruption throughout the operating hours of the facility. Flow shall be monitored continually except for the infrequent times when there may be no flow or for infrequent maintenance activities on the flow device.

9. Types of Samples

a. Composite Sample: A composite sample shall consist of:

(1) a series of grab samples collected at equal time intervals over a 24 hour period of discharge and combined proportional to the rate of flow measured at the time of individual sample collection, or

(2) a series of grab samples of equal volume collected over a 24 hour period with the time intervals between samples determined by a preset number of gallons passing the sampling point. Flow measurement between sample intervals shall be determined by use of a flow recorder and totalizer, and the present gallon interval between sample collection fixed at no greater than 1/24 of the expected total daily flow at the treatment system, or

(3) a single, continuous sample collected over a 24 hour period proportional to the rate of flow.

In accordance with (1) above, the time interval between influent grab samples shall be no greater than once per hour, and the time interval between effluent grab

samples shall be no greater than once per hour except at wastewater treatment systems having a detention time of greater than 24 hours. In such cases, effluent grab samples may be collected at time intervals evenly spaced over the 24 hour period which are equal in number of hours to the detention time of the system in number of days. However, in no case may the time interval between effluent grab samples be greater than six (6) hours nor the number of samples less than four (4) during a 24 hour sampling period.

b. Grab Sample: Grab samples are individual samples collected over a period of time not exceeding 15 minutes; the grab sample can be taken manually.

10. Calculation of Means

a Arithmetic Mean: The arithmetic mean of any set of values is the summation of the individual values divided by the number of individual values.

b. Geometric Mean: The geometric mean of any set of values is the Nth root of the product of the individual values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

c. Weighted by Flow Value: Weighted by flow value means the summation of each concentration times its respective flow divided by the summation of the respective flows.

11. Calendar Day

A calendar day is defined as the period from midnight of one day until midnight of the next day. However, for purposes of this permit, any consecutive 24-hour period that reasonably represents the calendar day may be used for sampling.

11. Hazardous Substance

A hazardous substance means any substance designated under 40 CFR Part 116 pursuant to Section 311 of the Clean Water Act.

13. Toxic Pollutant

A toxic pollutant is any pollutant listed as toxic under Section 307(a)(1) of the Clean Water Act.

SECTION B. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

Part II

a. The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the Clean Water Act within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

b. The Clean Water Act provides that any person who violates a permit condition is subject to a civil penalty not to exceed $25,000 per day for each violation. Any person who negligently violates any permit condition is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment for not more than 1 year, or both. Any person who knowingly violates permit conditions is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than 3 years, or both. Also, any person who violates a permit condition may be assessed an administrative penalty not to exceed $10,000 per violation with the maximum amount not to exceed $125,000. [Ref: Section 309 of the Federal Act 33 U.S.C. 1319 and 40 CFR 122.41 (a)].

c. Under state law, a daily civil penalty of not more than ten thousand dollars ($10,000) per violation may be assessed against any person who violates or fails to act in accordance with the terms, conditions, or requirements of a permit. [Ref: North Carolina General Statutes § 143-215.6 (A)].

2. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Part II, C.4.) and "Power Failures" (Part II, C.7.), nothing in this permit shall be construed to relieve the permittee from any responsibilities, liabilities, or penalties for noncompliance pursuant to NCGS 143-215.3, 143-215.6 or Section 309 of the Federal Act, 33 USC 1319. Furthermore, the permittee is responsible for consequential damages, such as fish kills, even though the responsibility for effective compliance may be temporarily suspended.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under NCGS 143-215.75 et seq. or Section 311 of the Federal Act, 33 USG 1321. Furthermore, the permittee is responsible for consequential damages, such as fish kills, even though the responsibility for effective compliance may be temporarily suspended.

5. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

Part II

6. Onshore or Offshore Construction

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.

7. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

8. Duty to Provide Information

The permittee shall furnish to the Permit Issuing Authority, within a reasonable time, any information which the Permit Issuing Authority may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Permit Issuing Authority upon request, copies of records required to be kept by this permit.

9. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

10. Permit Termination

After public notice and opportunity for a hearing, the general permit and Certificates of Coverage issued under this general permit may be terminated for cause.

11. When an Individual Permit may be Required

The Division may require any owner authorized to discharge under this permit to apply for and obtain an individual permit. Cases where an individual permit may be required include, but are not limited to, the following:

(a) The discharger is a significant contributor of pollution.

(b) Conditions at the operating facility change altering the constituents and/or characteristics of the discharge such that the discharge no longer qualifies for a General Permit.

(c) The discharge violates the terms or conditions of this permit.

(d) A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source.

(e) Effluent limitation guidelines are promulgated for the point sources covered by this permit.

(f) A water quality management plan containing requirements applicable to such point sources is approved after the issuance of this permit.

This permit may be terminated as to an individual owner for any of the reasons set forth above after appropriate notice in accordance with N.C.G.S. 143-215.1.

12. When an Individual Permit may be Requested

Any permittee operating under this permit may request to be excluded from the coverage of this permit by applying for an individual permit. When an individual permit is issued to an owner the applicability of this general permit is automatically terminated on the effective date of the individual permit. When a General Permit is issued which applies to an owner already covered by an individual permit, such permittee may request exclusion from the provisions of the General Permit and subsequent coverage under an individual permit.

13. Signatory Requirements

All applications, reports, or information submitted to the Permit Issuing Authority shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (a) a president, secretary, treasurer or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or (b) the manager of one or more manufacturing production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding 25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Permit Issuing Authority shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above;

(2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or well field, superintendent, a position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized

representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Permit Issuing Authority.

c. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

14. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

15. Permit Modification, Revocation and Reissuance, or Termination

The issuance of this permit does not prohibit the permit issuing authority from reopening and modifying the permit, revoking and reissuing the permit, or terminating the permit as allowed by the laws, rules, and regulations contained in Title 40, Code of Federal Regulations, Parts 122 and 123; Title 15A of the North Carolina Administrative Code, Subchapter 2H .0100; and North Carolina General Statute 143-215.1 et. al.

SECTION C. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Certified Operator

Pursuant to Chapter 90A-44 of North Carolina General Statutes, the permittee shall employ a certified wastewater treatment plant operator in responsible charge (ORC) of the wastewater treatment facilities. Such operator must hold a certification of the grade equivalent to or greater than the classification assigned to the wastewater treatment facilities. The permittee shall notify the Division's Operator Training and Certification Unit within thirty days of any change in the ORC status.

2. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit.

Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

3. Need to Halt or Reduce not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the condition of this permit.

4. Bypassing of Treatment Facilities

a. Definitions

(1) "Bypass" means the known diversion of waste streams from any portion of a treatment facility including the collection system, which is not a designed or established or operating mode for the facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations.

The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Paragraphs c. and d. of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass; including an evaluation of the anticipated quality and affect of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II, E. 6. of this permit. (24-hour notice).

d. Prohibition of Bypass

(1) Bypass is prohibited and the Permit Issuing Authority may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes or maintenance during normal

periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under Paragraph c. of this section.

(2) The Permit Issuing Authority may approve an anticipated bypass, after considering its adverse affects, if the Permit Issuing Authority determines that it will meet the three conditions listed above in Paragraph d. (1) of this section.

5. Upsets

a. Definition.

"Upset " means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph c. of this condition are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset.

A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in Part II, E. 6. (b) (B) of this permit.

(4) The permittee complied with any remedial measures required under Part II, B. 2. of this permit.

d. Burden of proof.

In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

Part II

6. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in accordance with NCGS 143-215.1 and in a manner such as to prevent any pollutant from such materials from entering waters of the State or navigable waters of the United States. The permittee shall comply with all existing federal regulations governing the disposal of sewage sludge. Upon promulgation of 40 CFR Part 503, any permit issued by the Permit Issuing Authority for the disposal of sludge may be reopened and modified, or revoked and reissued, to incorporate applicable requirements at 40 CFR Part 503. The permittee shall comply with applicable 40 CFR Part 503 Standards for the Use and Disposal of Sewage Sludge (when promulgated) within the time provided in the regulation, even if the permit is not modified to incorporate the requirement. The permittee shall notify the Permit Issuing Authority of any significant change in its sludge use or disposal practices.

7. Power Failures

The permittee is responsible for maintaining adequate safeguards as required by DEM Regulation, Title 15A, North Carolina Administrative Code, Subchapter 2H, .0124 Reliability, to prevent the discharge of untreated or inadequately treated wastes during electrical power failures either by means of alternate power sources, standby generators or retention of inadequately treated effluent.

SECTION D. MONITORING AND RECORDS

1. Representative Sampling

Samples collected and measurements taken, as required herein, shall be characteristic of the volume and nature of the permitted discharge. Samples collected at a frequency less than daily shall be taken on a day and time that is characteristic of the discharge over the entire period which the sample represents. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Permit Issuing Authority.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to ensure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than 10% from the true discharge rates throughout the range of expected discharge volumes. Once-through condenser cooling water flow which is monitored by pump logs, or pump hour meters as specified in Part I of this permit and based on the manufacturer's pump curves shall not be subject to this requirement.

3. Test Procedures

Test procedures for the analysis of pollutants shall conform to the EMC regulations published pursuant to NCGS 143-215.63 et. seq., the Water and Air Quality Reporting Acts, and to regulations published pursuant to Section 304(g), 33 USC 1314, of the Federal Water Pollution Control Act, as Amended, and Regulation 40 CFR 136. To meet the intent of the monitoring required by this permit, all test procedures must produce minimum detection and reporting levels that are below

the permit discharge requirements and all data generated must be reported down to the minimum detection or lower reporting level of the procedure. If no approved methods are determined capable of achieving minimum detection and reporting levels below permit discharge requirements, then the most sensitive (method with the lowest possible detection and reporting level) approved method must be used.

4. Penalties for Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both.

5. Records Retention

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

6. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The date, exact place, and time of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

7. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to;

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION E. REPORTING REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

2. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR Part 122.29 (b); or

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR Part 122.42 (a) (1).

3. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

4. Transfers

This permit is not transferable to any person except after notice to and approval by the Director. The Director may require modification or revocation and reissuance of the permit and incorporating such other requirements as may be necessary under the Clean Water Act.

5. Twenty-four Hour Reporting

a. The permittee shall report to the central office or the appropriate regional office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee became aware of the circumstances. A written submission shall also be provided

within 5 days of the time the permittee becomes aware of the circumstances.

The written submission shall contain a description of the noncompliance, and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

b. The following shall be included as information which must be reported within 24 hours under this paragraph.

(A) Any unanticipated bypass which exceeds any effluent limitation in the permit.

(B) Any upset which exceeds any effluent limitation in the permit.

(C) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in the permit to be reported within 24 hours.

c. The Director may waive the written report on a case-by-case basis for reports under paragraph b. above of this condition if the oral report has been received within 24 hours.

6. Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

7. Noncompliance Notification

The permittee shall report by telephone to either the central office or the appropriate regional office of the Division as soon as possible, but in no case more than 24 hours or on the next working day following the occurrence or first knowledge of the occurrence of any of the following:

a. Any occurrence at the water pollution control facility which results in the discharge of significant amounts of wastes which are abnormal in quantity or characteristic, such as the dumping of the contents of a sludge digester; the known passage of a slug of hazardous substance through the facility; or any other unusual circumstances.

b. Any process unit failure, due to known or unknown reasons, that render the facility incapable of adequate wastewater treatment such as mechanical or electrical failures of pumps, aerators, compressors, etc.

c. Any failure of a pumping station, sewer line, or treatment facility resulting in a by-pass directly to receiving waters without treatment of all or any portion of the influent to such station or facility.

Persons reporting such occurrences by telephone shall also file a written report in letter form within 5 days following first knowledge of the occurrence.

Part II

8. Availability of Reports

Except for data determined to be confidential under NCGS 143-215.3(a)(2) or Section 308 of the Federal Act, 33 USC 1318, all reports prepared in accordance with the terms shall be made available for public inspection at the offices of the Division of Environmental Management or at the site of the discharge within a reasonable time period, not to exceed five (5) days. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such
report may result in the imposition of criminal penalties as provided for in NCGS 143-215.1(b)(2) or in Section 309 of the Federal Act.

9. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both.

PART III
OTHER REQUIREMENTS

1. Previous Permits

All previous State water quality permits issued to this facility for this particular discharge, whether for construction or operation or discharge, are hereby revoked by issuance of this permit and subsequent issuance of a Certificate of Coverage. The conditions, requirements, terms, and provisions of this permit authorizing discharge under the National Pollutant Discharge Elimination System govern discharges from this facility.

2. Construction

No construction of wastewater treatment facilities or additions thereto shall be begun until Final Plans and Specifications have been submitted to the Division of Environmental Management and approval has been granted by the Division. Design and operation of facilities and/or treatment works shall be in accordance with the application and supporting information. If facility deficiencies, design and/or operational, are identified in the future which could affect the facility performance or reliability, it is the responsibility of the permittee to correct such deficiencies.

3. Certified Operator

Pursuant to Chapter 90A-44 of North Carolina General Statutes, the permittee shall employ a certified wastewater treatment plant operator in responsible charge (ORC) of the wastewater treatment facilities. Such operator must hold a certification of the grade equivalent to or greater than the classification assigned to the wastewater treatment facilities. The permittee shall notify the Division's Operator Training and Certification Unit within five days of any change in the ORC status.

4. Groundwater Monitoring

The permittee shall, upon written notice from the Director of the Division of Environmental Management, conduct groundwater monitoring as may be required to determine the compliance of this NPDES permitted facility with the current groundwater standards.

5. Limitations Reopener

This permit shall be modified or alternatively, revoked and reissued, to comply with any applicable effluent guideline or water quality standard issued or approved under Sections 302(b) (2) (c), and (d), 304(b) (2), and 307(a) (2) of the Clean Water Act, if the effluent guideline or water quality standard so issued or approved:

a. contains different conditions or is otherwise more stringent than any effluent limitation in the permit; except for, if a water quality standard for Dioxin is modified and approved, this permit will be reopened or modified to reflect such changes as provided by 40 CFR 122.62 (c) (3)(i)(B); or

b. controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements in the Act then applicable.

PART IV
ANNUAL ADMINISTERING AND COMPLIANCE MONITORING FEE REQUIREMENTS

1. The permittee must pay the annual administering and compliance monitoring fee within 30 (thirty) days after being billed by the Division. Failure to pay the fee in a timely manner in accordance with 15A NCAC 2H .0105(b)(4) may cause this Division to initiate action to revoke the Certificate of Coverage.

APPENDIX V

Lists of Best Management Practices (BMPs) For:

- Agriculture
- Urban Runoff
- Erosion and Sedimentation Control
- Onsite Wastewater Disposal
- Solid Waste Disposal
- Forestry
- Mining
  - Hydrologic Modifications

BMPs FOR AGRICULTURE

Detailed Implementation Plan*
September 1996 (Revised)

Definition of Practices

(1) An agrichemical handling facility means a permanent structure that provides an environmentally safe means of mixing agrichemicals and filling tanks with agrichemicals for the application and storage of agrichemicals to prevent accidental degradation of surface and ground water.

(2) A conservation tillage system means any tillage and planting system in which at least (30) thirty percent of the soil surface is covered by plant residue to reduce soil erosion and improve the quality of surface water.

(3) A critical area planting means an area of highly erodible land which can not be stabilized by ordinary conservation treatment on which permanent perennial vegetative cover is established and protected to reduce soil erosion and sedimentation and to improve the quality of surface water.

(4) A cropland conversion practice means to establish and maintain a conservation cover of grasses, trees, or wildlife plantings on fields previously used for crop production to reduce soil erosion and sedimentation and to improve the quality of surface water.

(5) A diversion means a channel constructed across a slope with a supporting ridge on the lower side to control drainage by diverting excess water from an area to reduce soil erosion and sedimentation and to improve the quality of surface water.

(6) A field border means a strip of perennial vegetation established at the edge of the field that provides a stabilized outlet for row water to reduce erosion, sedimentation and nutrient pollution to improve the quality of surface water.

(7) A filter strip means an area of permanent perennial vegetation for removing sediment, organic matter, and other pollutants from runoff and waste water to reduce erosion, sedimentation and nutrient pollution to improve the quality of surface water.

(8) A grade stabilization structure means a structure (earth embankment, mechanical spillway, detention-type, etc.) used to control the grade and head cutting in natural or artificial channels to reduce erosion and sedimentation and to improve the quality of surface water.

(9) A grassed waterway means a natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff to reduce erosion and sedimentation and to improve the quality of surface water.

(10) A heavy use protection area means an area used frequently and intensively by animals which must be stabilized by surfacing with suitable materials to reduce erosion, sedimentation and nutrient pollution to improve the quality of surface water.

(11) A livestock exclusion system means a system of permanent fencing (board, barbed, high tensile or electric wire) installed to exclude livestock from streams and critical areas not intended for grazing to reduce erosion, sedimentation and to improve the quality of surface water.

(12) A long term no-till practice means planting all crops for five consecutive years in at least 80 percent plant residue from preceding crops to reduce soil erosion and sedimentation and improve the quality of surface water.

(13) A pastureland conversion practice means establishing trees or perennial wildlife plantings on excessively eroding Class VII land being used for pasture that is too steep to mow or maintain with conventional equipment to reduce soil erosion and sedimentation and to improve the quality of surface water.

(14) A nutrient management practice means a definitive plan to manage the amount, form, placement, and timing of applications nutrients to minimize entry of nutrient to surface and groundwater and to improve water quality.

(15) A rock-lined outlet means a waterway having an erosionresistant lining of concrete, stone or other permanent material where an unlined or grassed waterways would be inadequate to provide safe disposal of runoff, reduce erosion and sedimentation and to improve the quality of surface water.

(16) A sediment basin means a basin constructed to trap and store waterborne sediment where physical conditions or land ownership preclude treatment of a sediment source by the installation of other erosion control measures to improve the quality of surface water.

(17) A sod-based rotation practice means an adapted sequence of crops and grasses established and maintained for a definite number of years which is designed to provide adequate organic residue for maintenance or improvement of soil filth to help reduce erosion and improve surface water quality.

(18) A stock trail or walkway means to provide a stable area used frequently and intensively for livestock movement by surfacing with suitable material to reduce erosion sedimentation and nutrient pollution to improve the quality of surface water.

(19) A stream protection system means a planned system for protecting streams and streambanks which eliminates the need for livestock to be in streams by providing an alternative watering source for livestock to reduce erosion and sedimentation and to improve the quality of surface water. System components may include:

(A) A spring development means improving springs and seeps by excavating, cleaning, capping or providing collection and storage facilities.

(B) A trough or tank means devices installed to provide drinking water for livestock at a stabilized location.

(C) A well means constructing a drilled, driven or dug well to supply water from an underground source.

(D) A windmill means erecting or constructing a mill operated by the wind's rotation of large vanes and is used as a source of power for pumping water.

(E) A stream crossing means a trail constructed across a stream to allow livestock to cross without disturbing the bottom or causing erosion on the banks.

(20) A stripcropping practice means to grow crops and sod in a systematic arrangement of alternating strips on the contour to reduce soil erosion and sedimentation and to improve the quality of surface water.

(21) A terrace means an earth embankment, a channel, or a combination ridge and channel constructed across the slope to reduce erosion, reduce sediment content in runoff water, and to improve the quality of surface water.

(22) A waste management system means a planned system in which all necessary components are installed for managing liquid and solid waste to prevent or minimize degradation of soil and water resources. System components may include:

(A) A waste storage pond means an impoundment made by excavation or earthfill for temporary storage of animal waste, waste water and polluted runoff.

(B) A drystack means a fabricated structure for temporary storage of animal waste.

(C) A composter/storage structure means a facility for the biological treatment, stabilization and environmentally safe storage of organic waste material (such as livestock and poultry manure and dead animal carcasses) to produce a material that can be recycled as a soil amendment and fertilizer substitute.

(D) A waste treatment lagoon means an impoundment made by excavation or earthfill for biological treatment and storage of animal waste.

(E) A waste application system means an environmentally safe system (such as solid set, dry hydrant, mobile irrigation equipment, etc.) for the conveyance and distribution of animal wastes from waste treatment and storage structures to agricultural field as part of an irrigation and nutrient management plan.

(F) A constructed wetlands for land application practice means an artificial wetland area into which liquid animal waste from a waste storage pond or lagoon is dispersed over time to lower the nutrient content of the liquid animal waste.

(G) A controlled livestock lounging area means a planned, stabilized and vegetated area in which livestock are kept for a short duration.

(H) A closure of abandoned waste treatment lagoons and waste storage ponds practice means the safe removal of existing waste and waste water and the application of this waste on land in an environmentally safe manner.

(I) A storm water management system means a system of collection and diversion practices (buttering, collection boxes, diversions, etc.) to prevent unpolluted storm water from flowing across concentrated waste area on animal operations.

(23) A water control structure means to provide control of surface and subsurface water through the use of permanent structures which increase infiltration and reduce runoff to improve the quality of surface and ground water.

(24) A waste utilization plan means a plan of using animal waste on land in an environmentally acceptable manner while maintaining or improving soil and plant resources to safeguard water resources.

(25) An insect control practice means an method of pest management used in an integrated pest management program to control target organisms and minimize contamination of soil, water, and

air, and minimize impacts to non-target organisms through cultural, biological and physical practices including safe and prudent use of pesticides.

(26) A riparian buffer means an area adjacent to solid blue line streams as shown on 7.5 minute USGS maps where a permanent, long-lived vegetative cover (sod, shrubs, trees, or a combination of vegetation types) is established to reduce soil erosion, sedimentation, nutrient and pesticide pollution, and to improve the quality of surface water and shallow ground water.

(27) An odor control management system means a practice or combination of practices (planting windbreaks, precharging structures, incorporation of waste into soil, etc.) which manages or controls odors from confined animal operations, waste treatment and storage structures and waste applied to agricultural land.

*To be used in conjunction with the most recent version of the APA Rules for the North Carolina Agriculture Cost Share Program for Nonpoint Source Pollution Control and the NCACSP Manual.

Best Management Practices Eligible for Cost Share Payments

Best Management Practices eligible for cost sharing include the following practices and any approved District BMPs. District BMPs shall be reviewed by the Division for technical merit in achieving the goals of this program. Upon approval by the Division, the District BMPs will be eligible to receive cost share funding.

The minimum life expectancy of the BMPs is listed below. Practices designated by a District shall meet the life expectancy requirement established by the Division for that District BMP. The list of BMPs eligible for cost sharing may be revised by the Commission as deemed appropriate in order to meet program purpose and goals.

Practice	Minimum Life Expectancy (years)
Agrichemical Handling Facility	10
Conservation Tillage System	10
Critical Area Planting	10
Cropland Conversion	10
Diversion	10
Field Border	10
Filter Strip	10
Grade Stabilization Structure	10
Grassed Waterway	10
Heavy Use Area Protection	10
Insect Control	5
Livestock Exclusion	10
Long Term No-Till	5
Mobile Irrigation Equipment	10
Pastureland Conversion	10
Nutrient Reduction Management System	3
Rock-lined Waterway or Outlet	10
Sediment Control Structure	10
Sod-based Rotation	4 or 5
Stock Trail and Walkway	10
Stream Protection System	
Spring Development	10
Trough or Tank	10
Well	10
Windmills	10
Stream Crossing	10
Stripcropping	5
Riparian Buffer	10
Terrace	10

Best Management Practices Eligible for Cost Share Payments (continued)

Waste Management System	
Waste Storage Pond	10
Waste Storage Structure	10
Waste Treatment Lagoon	10
System for Land Application of Animal Waste	10
Wetlands Development for Land Application	10
Controlled Livestock Lounging Area	10
To-Be-Abandoned or Abandoned Confined	
Animal Operation (CAO)	5
Odor Control	1 to 10
Water Control Structure	10

Agricultural Best Management Practices

I. Crop and Pasture Lands

A. BMPs for Sediment Control
- Conservation Tillage System
- Critical Area Planting
- Cropland Conversion
- Diversion
- Field Border
- Filter Strip
- Grade Stabilization Structure
- Grassed Waterway
- Rock-lined Waterways or Outlets
- Sediment Control Structure
- Sod-based Rotation
- Stripcropping
- Terrace
- Water Control Structure
- Pastureland Conversion

B. BMPs for Nutrient Control
- Legumes in Rotation
- Soil Testing
- Liming
- Setting Realistic Crop Yield Goals (determines fertilization rates)
- Fertilizer Waste Application (method, rate, and timing)
- Sediment Control BMPs

C. BMPs for pesticide control
- Alternative Pesticides
- Optimize Pesticide Formulation, Amount, Placement Timing, Frequency
- Crop Rotation
- Resistant Crop Varieties
- Other Cultural or Biological Controls
- Optimize Crop Planting Time
- Plant Pest Quarantines
- Proper Disposal of Obsolete Pesticides and Containers
- Certification of Applicators
- Sediment Control BMP's

II. Animal Production (esp. Confined Animal Operations)
- BMPs for bacteria and nutrient control
- Grade Stabilization Structures
- Heavy Use Area Protection
- Livestock Exclusion
- Spring Development
- Stock Trails and Walkways
- Trough or Tank
- Waste Management System
- Waste Storage Pond
- Waste Storage Structure
- Waste Treatment Lagoon
- Land Application of Waste
- Water Control Structure

BMPs FOR URBAN STORMWATER

Structural Best Management Practices for urban runoff control are typically designed to reduce sediment, its attached pollutants, and nutrients. In addition, other BMPs protect the riparian ecosystem, provide streambank stabilization, provide shade to water bodies and reduce the likelihood of excessive water temperatures. Non-structural BMPs, such as a design manual or a public education program, encourage the comprehensive and effective implementation of structural BMPs. The table below contains a list of both structural and non-structural BMPs. This list is taken from the *Stormwater Management Guidance Manual*, published by DWQ's Water Quality Planning Branch in 1995. The *Manual* provides a detailed discussion of each of the BMPs, including its characteristics, pollutant-specific effectiveness, reliability, feasibility, costs, unknown use factors, design considerations, and references for further information.

STRUCTURAL BMPs
I. Wet Detention Basin
II. Constructed Wetlands
• Wet Retention Basin
• Dry Detention Basin
• Infiltration Basin
• Vegetative Practices
◊ Filter Strips
◊ Grassed Swales with Check Dams
• Sand Filter
• Oil and Grease Separator
• Rollover-Type Curbing
NON-STRUCTURAL BMPs
I. Preventive Measures
II. Pollutant Minimization
• Exposure Reduction (proper scheduling, etc. - see Manual)
• Landscaping and Lawn Maintenance Controls
• Animal Waste Collection
• Curb Elimination
• Parking Lot and Street Cleaning
• Road Salt Application Control
• Catch Basin Cleaning
III. Riparian area protection
IV. Design Manual for Urban BMPs
V. Public Education
VI. Identification and Enforcement of Illegal Discharges
VII. Land-Use Control
• Low-Density Development
• Comprehensive Site Planning
• Buffer Zone
• Sanitary Waste Management
VIII. Conservation Easement

Structural BMPs may affect groundwater quality in certain situations. Devices that recharge groundwater pose the risk of passing soluble pollutants into groundwater systems. It is not currently known whether pollutant concentrations in recharged groundwater areas pose a significant environmental or health risk. USGS is presently studying groundwater quality effects of urban BMPs. In addition, if funds are made available, DWQ may conduct a similar study in North Carolina.

BMPs FOR EROSION AND SEDIMENTATION CONTROL

Best Management Practices suggested pursuant to the NC Sedimentation Pollution Control Act of 1973 are selected on the basis of performance in providing protection from the maximum peak rate of runoff from a 10-year storm. This allows the developer/designer of the control measures, structures, or devices to determine and submit for approval the most economical and effective means of controlling erosion and preventing sedimentation damage. Practices are therefore reviewed for acceptability based upon the characteristics of each individual site and its erosion potential. Ideally, the erosion control plan will employ both practices and construction management techniques which will provide the most effective and reasonable means of controlling erosion while considering the uniqueness of each site. The following table provides a list of practices commonly used in sedimentation and erosion control plans across North Carolina.

Check Dam	Sand Fence (Wind Fence)
Construction Road Stabilization	Sediment Basin
Dust Control	Sediment Fence
Grade Stabilization Structure	Sod Drop Inlet Protection
Grass-lined Channels	Sodding
Grass Channels with Liner	Structural Streambank Stabilization
Land Grading	Subsurface Drain
Level Spreader	Surface Roughening
Mulching	Temporary Block & Gravel Inlet Protection
Outlet Stabilization Structure	Temporary Diversions
Paved Channels	Temporary Excavated Drop Inlet Protection Fabric Drop Inlet Protection
Paved Flume (Chutes)	Temporary Gravel Construction Entrance/Exit
Perimeter Dike	Temporary Sediment Trap
Permanent Diversions	Temporary Seeding
Permanent Seeding	Temporary Slope Drains
Permanent Stream Crossing	Temporary Stream Crossing
Right-Of-Way Diversions	Topsoiling
Riprap	Tree Preservation & Protection
Riprap-lined Channels	Trees, Shrubs, Vines & Ground Covers
Rock Dam	Vegetative Dune Stabilization
	Vegetative Streambank Stabilization

BMPs FOR ON-SITE WASTEWATER DISPOSAL

To protect public health and water quality, best management practices (BMPs) need to be implemented throughout the life cycle of an on-site wastewater disposal system. Life-cycle management problems can be addressed in three phases (Steinbeck, 1984). The first phase includes system siting, design, and installation. The second phase involves the operation of the system and phase three involves maintenance and repair when the system malfunctions or fails. As BMPs are applied in each life-cycle phase, the primary factor the success of the system is the participation of the local influencing health department and the cooperation of the developer, owner, design engineer, system operator, and the state. The table that follows gives a summary of the current life-cycle management practices and penalties utilized in North Carolina to implement the on-site sewage systems program (Steinbeck, 1984).

1. Application -- The developer or property owner meets with the staff of the local health department to review the project proposal and submits an application to the local health department that contains information regarding ownership, plat of property, site plan, type of facility, estimated sewage flow, and proposed method of sewage collection, treatment, and disposal.
2. Site Evaluation -- The local health department, with technical assistance from the state, evaluates the proposed sewage effluent disposal site for several factors, including slope, landscape position, soil morphology, soil drainage, soil depth, and space requirements. Next, the local health department will assign a site suitability classification, establish the design sewage flow, and the design loading rate for the soil disposal system.
3. Design Review --The applicant is required to submit plans and specifications for the sewage collection, treatment, and disposal system prepared by a professional engineer, for complex systems, or for systems exceeding 3,000 gal/day. Reviews are made by both state and local health departments. The designer must also include in the plans and specifications, installation procedures, phasing schedules, operation and maintenance procedures, monitoring requirements, and designate the responsible agents for operation and maintenance.
4. Legal Document Review -- For systems with multiple ownership or off-site disposal, the applicant must prepare and submit to state and local health departments for their legal review documents applicable to the project.
5. Improvement Permit -- Issued only after a successful review of the proposed project, including each of the items discussed above and allows construction to begin for the on-site sewage system. The improvement permit must be issued prior to other construction permits and allows only temporary electrical power to the site. This permit contains the necessary conditions for construction of the projects with the plans, specifications, and legal documentation appended to it.
6. Operation Permit -- Issued to the owner of the on-site sewage system by the local health department when it determines that all the requirements in the rules, plans and specifications are met; all conditions on the improvement permit are met; and the design engineer for the sewage collection, treatment, and disposal system certifies in writing to the local health department that the on-site system has been installed in accordance with the approved plans and specifications. The operation permit is also conditioned to establish performance requirements and may be issued for a specific period of time. It allows the on-site sewage system to be placed into use, prevents permanent electrical service to the project and prevents occupancy of the facilities until issued. The operation permit applies to systems larger than 480 gallons per day. A certificate of completion is required for conventional septic tank systems when the design sewage flow is less than 480 gal/day.

On-Site Wastewater Disposal BMPs (continued)

7. Surveillance -- Once an on-site sewage system is placed into operation the local health department must make routine inspections at least annually for large systems to determine that the system is performing satisfactorily and not creating a public health nuisance or hazard. Additionally, required monitoring reports are routinely submitted to the local health department as required in the permits. The state provides technical assistance to the local health department and the system operator in assuring adequate performance. While annual inspections are required, frequent performance checks must be made by the local health department.
8. Remedies -- When voluntary compliance with the performance requirements for the on-site system is unsuccessful, the General Statutes (1983) provide for the following remedies:
a) Right of Entry -- Allows the state or local health department to enter the premises to determine compliance with the laws and rules and provides for an administrative search and inspection warrant when entry is denied.
b) Injunction -- The state or local health department may institute an action for injunctive relief against the owner to bring the on-site sewage system into compliance.
c) Order of Abatement -- The state or local health department is empowered to issue an order of abatement directing the owner to take any necessary action to bring the system into compliance. However, if the on-site system is determined to be creating an imminent health hazard, the state or local health department may, after previous unsuccessful attempts at correction, take the necessary action to correct the problem and recover any costs for abatement from the owner. This is the least frequently applied remedy.
d) Administrative Penalties -- The state may impose administrative penalties up to $300 per day for violation of the laws, rules, or any permit condition for on-site sewage systems serving multi-family residences with a flow greater than 480 gal/day. A penalty of up to $50 per day can be assessed for malfunctioning systems where the flow is less than or equal to 480 gal/day.
e) Suspension and Revocation of Permits -- The state may suspend or revoke a permit for violations of the laws, rules, or permit conditions upon a finding that a violation has occurred.
f) Misdemeanor -- The owner who violates the sewage laws or rules shall be guilty of a misdemeanor and punishable by a fine or imprisonment as determined by the courts. This is the most frequently used remedy.

BMPs FOR SOLID WASTE MANAGEMENT

Best Management Practices for solid waste management address the water quality impacts of leachate migration and surface erosion. A list of BMPs for controlling solid waste impacts on water quality can be found in the table below.

The BMPs offer significant benefits for groundwater quality. Landfill liners will prohibit or greatly decrease the volume of leachate entering groundwater. In turn, leachate collection systems capture leachate for subsequent treatment rather than groundwater disposal. For even greater protection, groundwater and surface water monitoring should detect failures in the liner or collection system.

Reduce, Recover, and Recycle Solid Waste to Maximum Extent
North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities, 1987
Liners (Clay or Synthetic) for All New Landfills
Leachate Collection Systems
Erosion Control Plan
Operation and Maintenance Plan
Buffers Between Landfill and Streams, Property Lines and Dwellings
Groundwater Quality Monitoring
Surface Water Quality Monitoring
Public Education
Stormwater Runoff Control
Sedimentation Control

BMPs FOR FORESTRY

A. General BMPs for Forestry Operations in North Carolina

Forest Practices Guidelines Related to Water Quality (15A NCAC 1I.0101-.0209) have been adopted as published in the NCR, Volume 4, Issue 11, pages 601-604, and were effective January 1, 1990. These guidelines are summarized below.

Streamside Management Zone(SMZ)
• Must establish SMZ along natural, intermittent and perennial streams and water bodies. (Not required along man-made ditches and canals, although erosion protection is needed).
• Must have sufficient width and adequate ground cover to confine visible sediment (usually best to protect existing ground cover).
• Place roads, trails and decks outside of SMZ.
• Limited cutting(harvesting) is permitted within the SMZ.
Prohibition of Debris Entering Streams
• Prevent debris(logging slash, soil) of all types that can cause stream flow impediment or water quality degradation from entering intermittent and perennial streams and water bodies.
• Remove debris that accidentally enters streams.
Access Road and Skid Trail Stream Crossing
• Avoid crossing streams where possible.
• Avoid using stream channels as roads or trails.
• Construct crossings to minimize sediment entering streams.
• Protect stream banks and channels from damage.
• Provide water control devices and/or structures and, within 10 working days of initial disturbance provide ground cover sufficient to restrain accelerated erosion and prevent stream sedimentation.
Access Road Entrance
• Prevent soil and debris from being deposited on public highways which may result in stream sedimentation.
Keep Waste from Entering Streams, Water bodies and Groundwater
• Prevent oil, fuels, fertilizer and other chemical waste from entering streams, water bodies and groundwater.
Pesticide Application
• Application must follow labeling and N.C. Pesticides Board rules. Includes insecticides, fungicides, herbicides, and rodenticides.
Fertilizer Application
• Apply in a manner to prevent adverse impacts on water quality.
Stream Temperature
• Retain shade sufficient to prevent temperature fluctuations which result in a violation.
Rehabilitation of Project Site
• Within 30 working days after ceasing operations, provide sedimentation control measures to prevent water quality damage.
• Permanently stabilize SMZ areas and other areas that may directly contribute visible sediment to streams.

B. BMPs for Forestry Operations in Wetlands

The Division of Forest Resources is in the process of developing BMPs for forested wetlands. Economic pressure to expand forestry activities in wetlands continues to increase. This expansion will require a sound strategy to protect these environmentally sensitive areas.

A Forested Wetlands BMP Committee was established in the winter of 1987. Committee members represent federal and state agencies, industry, education, and environmental groups who have a role in the fate of wetlands.

In the absence of state standards, federal BMPs for forested wetlands are implemented. The table below identifies these federally mandated BMPs for Waters of the United States and wetlands adjacent to such Waters (Fed. Register 53(108): 207775, June 6, 1988). The Clean Water Act Section 404 Permit Exemption for forest roads applies only where the following BMP standards are fully met.

• Permanent roads (for forestry), temporary access roads (for forestry), and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with silvicultural and local topographic and climatic conditions;
• All roads shall be located sufficiently far from streams or other water bodies (except for portions of such roads that must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;
• Road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;
• Fill shall be properly stabilized and maintained to prevent erosion during and following construction;
• Discharges of dredged or fill material into waters of the U.S. to construct road fills shall be made in a manner that minimizes encroachment of trucks, tractors, bulldozers, and other heavy equipment into waters of the U.S. (including adjacent wetlands that lie outside the lateral boundaries of the fill itself);
• In designing, constructing, an maintaining roads, vegetative disturbance in waters of the U.S. shall be kept to a minimum;
• Design, construction and maintenance of road crossings shall not disrupt the migration or other movement of those aquatic species inhabiting the water body;
• Borrow material shall be taken from upland sources whenever feasible;
• The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;
• Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;
• Discharge shall not be located in proximity to a public water supply intake;
• The discharge shall not occur in areas of concentrated shellfish production;
• Discharge shall not occur in a designated National Wild and Scenic River;
• Discharge shall be of suitable material free from toxic pollutants in toxic amounts; and
• All temporary fills shall be removed in their entirety and the area restored to its original elevation.

BMPs FOR MINING OPERATIONS

Significant environmental damage can and often times does occur during land-disturbing activities of mining operations, especially during the initial stages. The potential for such damage can be substantially reduced with the installation of BMPs. Once the mining has terminated, BMPs are used to reclaim or reasonably rehabilitate the site (for mined lands after June 11, 1971). The basic objective of the reclamation is to establish on a continuing basis the vegetative cover, soil stability, and water and safety conditions appropriate to the area. The BMPs are performance-oriented, allowing a mining permit applicant to design and propose the most economical and effective means of a) controlling erosion and preventing off-site sedimentation damage; b) preventing contamination of surface waters and groundwater; and, c) preventing any condition that will have unduly adverse effects on wildlife or freshwater, estuarine, or marine fisheries. BMP selection is site-specific and controlled in part by the pre- and post-mining land use(s). The acceptability of a BMP is therefore based upon the characteristics of the individual site and its potential for off-site damage.

The table which follows provides a list of BMPs used for activities associated with mining activities in North Carolina. This list is essentially the same as that provided for Sedimentation and Erosion Control, due to the similar nature of activities in both programs.

Check Dam	Sediment Basin
Construction Road Stabilization	Sediment Fence
Dust Control	Sod Drop Inlet Protection
Grade Stabilization Structure	Sodding
Grass-lined Channel	Structural Streambank Stabilization
Grass Channels with Liner	Subsurface Drain
Groundwater Monitoring Wells	Surface Roughening
Land Grading	Temporary Block and Gravel Inlet Protection
Level Spreader	Temporary Diversions
Mulching	Temporary Excavated Drop Inlet Protection
Outlet Stabilization Structure	Temporary Fabric Drop Inlet Protection
Paved Flume (Chutes)	Temporary Gravel Construction Entrance/Exit
Perimeter Dike	Temporary Sediment Trap
Permanent Diversions	Temporary Seeding
Permanent Seeding	Temporary Slope Drains
Permanent Stream Crossing	Temporary Stream Crossing
Right-of-Way Diversions	Topsoiling
Riprap	Tree Preservation and Protection
Riprap-lined Channels	Trees, Shrubs, Vines & Ground Covers
Rock Dam	Vegetative Dune Stabilization
Sand Fence (Wind Fence)	Vegetative Streambank Stabilization

BMPs FOR HYDROLOGIC MODIFICATION (related to mining operations)

BMPs for Discharges of Dredged or Fill Material (Adapted from 40 CFR 230 - Guidelines for Specification of Disposal Sites for Dredged or Fill Material)

1. Actions concerning the location of the discharge.
a) Minimize smothering of organisms;
b) Avoid disruption of periodic water inundation patterns;
c) Select a previously used disposal site;
d) Select a disposal site with substrate similar in composition to the material being disposed;
e) Minimize extent of any plume; and
f) Minimize or prevent creation of standing bodies of waters in areas of normally fluctuating water levels.
2. Actions concerning the material to be discharged.
a) Maintain physiochemical conditions and reduce potency and availability of pollutants;
b) Limit solid, liquid and gaseous components;
c) Add treatment substances; and
d) Utilize chemical flocculants in diked disposal areas.
3. Actions controlling the materials after discharge.
a) Reduce potential for erosion, slumping or leaching by
i) using containment levees, sediment basins and cover crops to reduce erosion; and
ii) using lined containment areas to reduce leaching.
b) Cap in-place contaminated material with clean material;
c) Prevent point and nonpoint sources of pollution; and
d) Time the discharge to minimize impact, especially during unusual high water flows, wind, wave and tidal actions.
4. Actions affecting the method of dispersion.
a) Maintain natural substrate contours and elevation;
b) Minimize undesirable obstruction to the water current or circulation pattern;
c) Confine suspended particulate/turbidity to a small area where settling can occur;
d) Mix, dilute and disperse the discharge;
e) Minimize water column turbidity;
f) Maintain light penetration for organisms; and
g) Set limitations on the amount of material to be discharged per unit of time or volume of receiving water.
5. Actions related to technology.
a) Use appropriate equipment and machinery, including protective devices;
b) Employ appropriate operation and maintenance of machinery, including training, staffing and working procedures;
c) Use machinery and techniques designed to reduce damage to wetlands, including devices that scatter rather than mound excavated materials, machines with specially designed wheels or tracks, and the use of mats under heavy machinery to reduce compaction and rutting; and
d) Design access roads and channel spanning structures to accommodate fluctuating water levels and circulation patterns.

BMPs for Hydrologic Modification (continued)

6. Actions affecting plant and animal populations.
a) Avoid changes in water current and circulation patterns;
b) Prevent or avoid creating habitat conducive to the development of undesirable predators or species;
c) Avoid sites having unique habitat or other value, including endangered or threatened species;
d) Institute habitat development and restoration;
e) Avoid spawning or migration seasons and other biologically critical time periods; and
f) Avoid destruction of remnant natural sites within areas already affected by development.
7. Actions affecting human use.
a) Prevent or minimize damage to the aesthetically pleasing features of an aquatic site, including water quality;
b) Avoid disposal sites valuable as natural aquatic areas;
c) Avoid seasons or periods when human recreational activity associated with the aquatic site is most important;
d) Avoid sites which will increase incompatible human activity or require frequent dredge or fill maintenance in remote fish and wildlife areas; and
e) Locate disposal site outside of the vicinity of a public water supply intake.

APPENDIX VI

Existing Point And Nonpoint Source Water Quality Programs

APPENDIX VI

EXISTING POINT AND NONPOINT SOURCE POLLUTION CONTROL PROGRAMS

NORTH CAROLINA'S POINT SOURCE CONTROL PROGRAMS

Discharge permits are issued under the authority of North Carolina General Statute (NCGS) 143.215.1 and the National Pollutant Discharge Elimination System (NPDES) program. NPDES permits establish effluent limitations on the maximum level of wastes or pollutants, that may be discharged into surface waters. North Carolina has a very comprehensive NPDES program that includes the following major components:

1. NPDES Permit Review and Processing,
2. Wasteload Allocation Modeling,
3. Compliance Monitoring and Enforcement,
4. Aquatic Toxicity Testing,
5. Pretreatment,
6. Operator Certification and Training and
7. Nondischarge and Regional Wastewater Treatment Alternatives.

Below is a brief summary of key components of North Carolina's NPDES program

NPDES Permit Review and Processing

In North Carolina, the issuance of discharge permits is coordinated with the basinwide planning process. Thus, DWQ issues all discharge permits within a given basin at approximately the same time. These permits are valid for five years. New discharge permits issued during an interim period between cycles will have a shorter expiration period in order to coincide with the next basin permitting cycle. Thus, DWQ can more effectively monitor and modify its permitting system consistently across the river basins.

DWQ will not process a permit application until the application is complete. The requirements for discharge permit application and processing are outlined in Administrative Code Section: 15A NCAC 2H .0100 - Wastewater Discharges to Surface Waters. Under this rule, all applications must include a feasibility analysis on alternative disposal options, such as spray irrigation, and justification for the selection of the discharge option.

Applications for new discharges greater than 500,000 gallons per day of wastewater, 10 million gallons per day (MGD) of cooling water, or 1 MGD of any other type of effluent must include an *assessment* report in addition to the normal permit application. The assessment is to provide sufficient information to describe the impact of the proposed action on the waters in the area. DWQ may also require an Environmental Impact Statement or Environmental Assessment, under the NC Environmental Policy Act for certain publicly funded projects.

DWQ staff establish waste limits for permit applications based on a wasteload allocation process (described in the following section). The staff review also includes a site inspection (for existing facilities up for renewal, the inspection may be conducted prior to submittal of a complete application). If DWQ finds the application acceptable, it will issue a public notice (called a Notice of Intent to Issue) in newspapers having wide circulation in the local area. The Notice of Intent includes all of the permit applications for a particular subbasin (or subbasins) that will be issued

within a given month. The public then has a 30-day period to comment on the proposed permit. If the public expresses sufficient interest in one or more of the applications, DWQ may hold a public hearing.

DWQ also sends copies of the Notice of Intent to a number of state and federal agencies for comment. For example, the Division of Environmental Health reviews the applications for their potential impact on surface water sources of drinking water. Once DWQ received and evaluates the comments, the Director of DWQ decides whether to issue or deny the permit. The final permit will include recommended waste limits and other special conditions that may be necessary to ensure protection of water quality standards.

Establishing Discharge Permit Effluent Limitations/Wasteload Allocations

Effluent limitations, also called waste limits, dictate the amounts of wastes (pollutants), that the permittee is allowed to discharge into surface waters under an NPDES permit. Before DWQ issues a discharge permit, it evaluates the projected impact of the discharge on the receiving waters. This determination, called a wasteload allocation (WLA), is usually based on a computer model which considers many factors, including the characteristics of the waste (e.g., flow and type) and the characteristics of the receiving waters (e.g., flow, waste assimilative capacity, channel configuration, rate of reaeration, water quality classification). DWQ determines permit limits using models called water quality-based limits. DWQ also bases some permit limits based on federal effluent guidelines established by the USEPA.

DWQ performs wasteload allocations by using various models, depending on the parameter (type of pollutant) of interest and the characteristics of the receiving waters. Model frameworks (discussed in more detail in Appendix IV) can range from simple mass balance analyses to 3-dimensional dynamic water quality models. Modeling fits into the basin plan by drawing on the current conditions within the basin and evaluating the effects of various management strategies. DWQ uses models for a number of objectives, including determining the fate and transport of pollutants, setting reduction goals for point and nonpoint sources, and to derive effluent limits for NPDES permits. For example, models can be used to predict concentrations of a parameter at a given site, such as instream DO or chlorophyll *a* in a lake.

Models can also be a tool for determining the level of pollutant reductions needed to protect instream standards. In addition, DWQ performs uncertainty analyses of water quality models to expand their predictive capabilities and increase confidence in results. Waste limits may vary from summer to winter for some parameters, such as nutrients and ammonia, with winter limits being somewhat less stringent than summer limits due to higher instream flows during the winter months.

When point sources are responsible for water quality problems, WLAs can yield appropriate permit limits that offer adequate water quality protection. Where a sole discharge is responsible for the water quality impacts, DWQ can perform a simple WLA without considering other discharges. In this case, DWQ will establish limits in accordance with the state's Standard Operating Procedures (SOP) for Wasteload Allocations manual. The SOP manual has been developed to support State and Federal regulations and guidelines and has been approved by the EPA.

A critical factor in determining the wasteload for an individual discharge is whether the receiving waters have a flow during 7Q10 or 30Q2 conditions. DWQ's policy prohibits new or expanded discharges into "no flow" streams that have a 7Q10 and a 30Q2 equal to zero. In addition, DWQ will look for ways to remove existing discharges on such streams unless it is determined that there are no reasonable alternatives. If it is not feasible to remove the discharge, then the facility will be

required to meet limits of 5 mg/l BOD_5 and 2 mg/l NH_3N in summer (and 10 mg/l BOD_5 and 4 mg/l NH_3N in winter).

When numerous discharges affect water quality, the Environmental Management Commission is required to consider the cumulative impacts of all of the permitted discharges to a water body (pursuant to NCGS 143-215.1(b)(2)). Such areas are identified and discussed in Chapter 6. Generally, these are areas where the SOP alone does not provide adequate guidance. Since the SOP addresses mostly single discharge or relatively simple interaction of multiple discharges, WLA procedures outside the realm of the SOP represent the larger, basinwide strategy that DWQ is implementing.

Compliance Monitoring and Enforcement

Most dischargers are required to periodically sample the treated effluent from their discharge pipes. Also, many larger and more complex dischargers are required to sample points in the receiving waters both up and downstream from the discharge point. This process is called self-monitoring and it is typically required five days a week for some parameters (Monday through Friday) for major facilities. The sampling results (contained in a daily monitoring report or DMR) are then submitted each month to DWQ for compliance evaluations.

If a plant does not meet its permitted limits, DWQ may take one or more of the following actions: issue a notice of violation, initiate enforcement action, place the facility on moratorium, and/or enter into a Special Order by Consent (SOC). An SOC is a legal commitment entered into by the state and the discharger that establishes a time schedule for bringing the wastewater treatment plant back into compliance. During this time period, interim waste limits may be assigned to the facility until the improvements can be made. These interim limits may be less stringent than those in the permit although they are still required to protect water quality in the receiving waters.

In addition to the DMR data, illegal or improperly treated discharges may be identified in other ways including through third party reports, routine DWQ site inspections, and water quality monitoring conducted by DWQ staff.

Aquatic Toxicity Testing

There are thousands of chemicals and compounds that can enter wastewater systems and potentially be discharged to surface waters. Treatment plants are unable to monitor each of these chemicals individually due to limited funds and time, and limits in the ability of current analytical techniques to detect some pollutants. Even if the existence and potential effects of every constituent of a wastewater were known, the combined effects of these constituents could not be predicted.

North Carolina uses an integrated approach to aquatic toxicity testing that includes monitoring specific chemicals, assessing resident aquatic populations, and analyzing whole effluent toxicity (WET). Whole effluent toxicity limits predict the impacts of toxicants by measuring those impacts in a laboratory setting. It is from this same foundation of aquatic toxicity laboratory tests that chemical specific limits and criteria are derived for the majority of chemical toxicants.

In February 1987, North Carolina implemented a policy to incorporate WET limits for all major and complex minor permits. As of June 1996, 567 permitted NPDES discharges were required to perform WET monitoring, and over 15,000 individual toxicity analyses had been performed for plants across the state. WET limits were developed to protect aquatic life from the discharge of substances in toxic amounts as prescribed by 15 NCAC 2B. 0208 (i.e. so as not to result in chronic toxicity at permitted discharge flow and 7Q10 receiving flow volumes). Since the

inception of the program, a change in WET limitations has been observed. Previously, DWQ had predicted that approximately 25% of the facilities tested to be acutely toxic instream; however, DWQ has lowered that prediction to ten percent.

Aquatic toxicity testing, like other complex analytical techniques, requires a great deal of quality assurance and control to achieve reliable results. In 1988, North Carolina initiated a program that requires all laboratories performing NPDES analyses in North Carolina to be certified by the state as a biological laboratory. As of June 1996, 22 commercial, municipal, and industrial laboratories had achieved this certification in either aquatic toxicity analyses and/or aquatic population survey. The NC Biological Laboratory Certification Program, much like WET permitting in North Carolina, is looked at as a national leader in its field.

Pretreatment Program

The goal of pretreatment program is to protect municipal treatment plants or publicly-owned treatment works (POTWs) as well as the environment from the discharge of hazardous or toxic wastes into a public sewage system. The pretreatment program regulates non-domestic (e.g., industrial) users of POTWs that discharge toxic wastes under the Domestic Sewage Exclusion of the Resource Conservation and Recovery Act (RCRA). In essence, the program requires that businesses and other entities that use or produce toxic wastes pretreat their wastes prior to discharging their wastewater into the sewage collection system of POTW. State-approved pretreatment programs are typically administered by local governments that operate POTWs.

Local pretreatment program address four areas of concern: (1) interference with POTW operations, (2) pass-through of pollutants to a receiving stream, (3) municipal sludge contamination, and (4) exposure of workers to chemical hazards. Interference refers to any problem with plant operation, including physical obstruction and inhibition of biological activity. DWQ and the local government develop local pretreatment limits by determining the maximum amount of each pollutant the plant can accept at the influent (or headworks) and still protect the receiving water, the POTW itself, and the POTW's sludge disposal options.

Operator Certification and Training Program

Water pollution control systems must be operated by individuals certified by the North Carolina Water Pollution Control System Operators Certification Commission (WPCSOCC). The level of training and certification that the operator must have is based on the type and complexity of the wastewater treatment system. These systems include: wastewater treatment plants, wastewater collection systems and "non-discharge" ground absorption systems, such as alternative on-site disposal technologies and spray irrigation facilities. The Commission currently certifies operators in four grades of wastewater treatment, four grades of collection system operation, subsurface operation, spray irrigation operation, animal waste management and a variety of specialized conditional exams for specific technologies (e.g. oil/water separators).

The Technical Assistance and Certification Group of the North Carolina Division of Water Quality provides staff support for the Commission and assists in organizing training for operators in cooperation with the North Carolina University System, the North Carolina Community College System and through the professional associations for operators and pollution control professionals. Specialty courses and seminars for operators are also offered by the North Carolina combined Section Of The Water Environment Association/American Water Works Association (WEA/AWWA).

Training and certification of operators is essential to the proper operation and maintenance of pollution control systems. Without proper operation and maintenance, even the most effectively designed treatment system will not function efficiently. The goal of the WPCSOCC is to train

competent and conscientious professionals that will provide the best wastewater treatment and thus protect the environment and public health.

Nondischarge and Regional Wastewater Treatment Alternatives

DWQ requires NPDES permit applicants to consider alternatives for disposal of wastewater effluent other than discharge to a stream. For some, there may be no other economically feasible alternatives. However, for others, particularly smaller dischargers, there are a number of potentially cost-effective and environmentally sound alternatives. There are several types of non-discharging wastewater treatment systems including spray irrigation, rapid infiltration, trickling systems and underground injection. Researchers in North Carolina are evaluating artificial wetlands as wastewater treatment systems. Permit requirements for nondischarging systems are listed in Administrative Code Section 15 NCAC 2H .0200 - Waste Not Discharged to Surface Waters.

Another alternative to a surface water discharge is to tie into an existing wastewater treatment system. Where possible, DWQ is encouraging smaller dischargers to connect to large established municipal systems. Regionalization, as this is called, has several advantages. Large municipal facilities, unlike smaller package-type plants, have a larger and better-trained staff, thereby reducing the potential for plant malfunctions. When malfunctions do occur in a large plant, they can be caught and remedied more quickly than in a small plant. Larger facilities provide a higher level of treatment more economically and more consistently than can smaller plants. Larger plants are monitored daily. Additionally, centralizing the discharges reduces the number of streams receiving effluent. As DWQ evaluates future permit expansion requests from regional facilities, it will look favorably upon plants that accept flows from smaller discharges.

Nondischarge permits are required for alternative methods of wastewater treatment. Nondischarge permits are also issued for the land application of residual solids (sludge) from wastewater treatment processes.

NONPOINT SOURCE CONTROL PROGRAMS

Agricultural Nonpoint Source (NPS) Control Programs

Agricultural BMPs have been developed largely to control the five major agriculturally-related causes of pollution: nutrients, sediment, pesticides, oxygen-demanding substances and bacteria. BMPs vary from site to site and are dependent upon a particular pollutant but include practices such as grassed waterways and vegetated buffers, nondischarging animal waste lagoons, integrated crop and pest management and soil testing. BMPs may be administered through one or more of the agricultural programs described below. Common agricultural BMPs are listed in Appendix VI.

- **North Carolina Agriculture Cost Share Program**
  In 1984, the North Carolina General Assembly budgeted approximately $2 million to assist landowners in 16 counties within the "Nutrient Sensitive Water" (NSW) watersheds including the Upper Neuse River (Falls Lake) and the New River in Onslow County to implement BMPs for agricultural and silvicultural activities. These funds were increased in May 1987 to include 17 additional coastal counties by the passage of a General Statute formally creating the *Agriculture Cost Share Program for Nonpoint Source Pollution Control (NCACSP).* In 1989 the NCACSP became a statewide program. The NCACSP will pay a farmer 75 percent of the average cost of implementing approved BMPs and offer technical assistance to the landowners or users which would provide the greatest benefit for water quality protection. The primary purpose of this voluntary program is water quality protection.

The local Soil and Water Conservation District Boards under the administration of the North Carolina Soil and Water Conservation Commission (SWCC) are responsible for 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. The criteria for allocating funds to the District is "based on the identified level of agricultural related nonpoint source pollution problems and the respective District's BMP installation goals and available technical services as demonstrated in the Districts annual strategy plan" (NC Administrative Code, Title 15, Chapter 6, Section 6E). This local participation is crucial to the success of the program.

The DEHNR-Division of Soil and Water Conservation (DSWC) provides staff, administrative and technical support to the SWCC. The DSWC also coordinates the efforts of various associated Program committees and acts as the clearinghouse for District strategy plans, contracts, etc. A legislated Technical Review Committee meets quarterly "to review the progress of the Program" (G.S. 143-215.74B) and to make technical recommendations to the Commission.

Technical assistance for the implementation of approved BMPs is provided to the Districts through a 50:50 cost share provision for technical positions to be filled at the District level. The USDA-Natural Resources Conservation Service also provides technical assistance.

- **North Carolina Pesticide Law of 1971**

In 1971 the General Assembly created and authorized the North Carolina Pesticide Board to regulate the use, application, sale, disposal and registration of pesticides for the protection of the health, safety, and welfare of the people and for the promotion of a healthy and safe environment. Some of the responsibilities of the Pesticide Board and the North Carolina Department of Agriculture include registering all pesticides prior to distribution and sale in North Carolina, sampling pesticides to insure that all products are up to guaranteed analysis and unadulterated by any other pesticide, sampling pesticides at time of application to insure that the applicator is following label instructions, and certifying the competency of applicators and dealers of restricted use pesticides.

The Pesticide Section of the North Carolina Department of Agriculture conducts mandatory annual inspections of all aircraft used in pesticide application and conducts random inspections of ground application equipment and chemigation systems (application of pesticides through irrigation systems). These inspections are intended to encourage proper calibration and use of equipment in order to avoid excessive application rates and accidental spills from faulty systems. Stop use orders are issued for noncompliance with the regulations.

Inspections are also required for bulk storage tanks prior to filling. All commercial pesticide storage facilities are required to have an approved Pre-fire Plan. In addition, each large commercial storage facility is required to develop and maintain an Emergency Contingency Plan. This plan describes the actions facility personnel shall take to respond to fires, explosions, spills, or any other sudden or gradual release of pesticides or pesticide contaminated materials to air, soil, or surface waters. The Contingency Plan is designed to minimize hazards to human health and the environment.

Penalties are assessed to careless pesticide applicators. Enforcement of the law is based on where the pesticide is deposited rather than just where it is applied. For example, if a pesticide is found in a stream as a result of wind drift, the applicator is subject to legal action. The Raleigh Office staff of the NCDA Pesticide Section is comprised of 20 employees. There are 10 Inspectors who conduct field-level compliance monitoring and investigation services. The annual budget for pesticide control and analytical work is $1.4 million.

- **NCDA Pesticide Disposal Program**

In 1976, the North Carolina Pesticide Board adopted regulations governing the disposal of pesticides. These regulations make it illegal in North Carolina to dispose of hazardous waste (which includes certain pesticides) in sanitary landfills. While households and farms which generate less than 220 pounds of hazardous waste and less than 2 pounds of acutely hazardous waste are exempt from federal disposal requirements, the regulations prohibiting the disposal of these wastes in sanitary landfills still applies to them. The option to use commercial hazardous waste disposal companies is too expensive and most companies will not pickup small quantities. As a result of this dilemma, the NCDA created the Pesticide Disposal Program in 1980 through appropriations from the General Assembly.

The goal of the Program is to provide an available, affordable and environmentally acceptable mechanism in which any homeowner, farmer, or institution can dispose of unwanted or unusable pesticides. It is mandatory, however, that all pesticide products are labeled correctly before NCDA will pick them up. An EPA permitted hazardous waste treatment or disposal facility (TSD) requires proper identification before the products can be disposed.

The Food and Drug Division of the North Carolina Department of Agriculture administers the Pesticide Disposal Program. The same staff used for enforcing the North Carolina Pesticide Law of 1971 are used in the Disposal Program.

- **Animal Waste Management**

Regulations

On December 10, 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H .0217) to establish procedures for properly managing and reusing animal wastes from intensive livestock operations. The goal of the rule is for intensive animal operations to operate so that animal waste is not discharged to waters of the state. This means that if criteria are met and no waste is discharged to surface waters, then an individual permit from DWQ is not required. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve more than or equal to the following animal populations: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds with a liquid waste system. These operations are deemed permitted if a signed registration and an approved waste management plan certification are submitted to DWQ by the appropriate deadlines.

The deadline for submittal of registrations to DWQ for existing facilities was December 31, 1993. Animal waste management plans for existing facilities must be certified by a technical specialist designated by the Soil and Water Conservation Commission and submitted to DWQ by December 31, 1997. The standards and specifications of the USDA Natural Resources Conservation Service are the minimum criteria used for plan approval by the local Soil and Water Conservation Districts.

Operator Training and Certification

The North Carolina General Assembly ratified Senate Bill 974 (NCGS 143-215.74C - E) on July 29, 1995, which requires that the Department of Environment, Health and Natural Resources, in cooperation with the Cooperative Extension Service, develop and administer a training and certification program for operators of swine facilities with more than 250 swine that land apply animal waste. The Department assigned the task of developing and administering this program to the Technical Assistance and Certification Group of the Water Quality Section. The purpose of this program is to reduce nonpoint source pollution associated with the operation of animal waste management systems. Animal waste management systems are defined as a combination of structural and non-structural practices that collect, treat, store, or apply animal waste to the land. All animal operations with 250 or more swine (Sus scrofa)

are required to designate an Operator in Charge who has primary responsibility for the operation of the animal waste management system. There are approximately 4,000 animal operations in the state that are required to designate an Operator in Charge.

A steering committee was established that includes representatives from the animal agriculture industry, environmental groups, North Carolina Department of Agriculture, Natural Resources Conservation Service, Division of Soil and Water Conservation, North Carolina Cooperative Extension Service and the Division of Environmental Management. The primary purpose of this committee was to develop the instructional manual and exam questions for the training and certification program. The manual has been completed and is being used in the training sessions that are primarily being conducted by the Cooperative Extensive Service in each county. Also involved in the training will be personnel from the NC Department of Agriculture, Natural Resources Conservation Service and pork producers. The training sessions for the operators began in April 1996. The examinations will be administered by the Technical Assistance and Certification Group in eighteen locations throughout the state beginning in May, 1996.

Persons who wish to be certified as operators of animal waste management systems must attend a minimum of six hours of training and demonstrate competence in the operation of animal waste management systems by passing an examination. The training and certification requirements must be completed once every five years. Participants in the training program will receive instruction in the following areas: 1) proper operation of animal waste management system components such as lagoons and irrigation systems; 2) waste utilization plans and proper waste, soil and tissue sampling techniques; 3) proper application of waste including calculation of application rates and calibration of equipment; and 4) consequences of improper management and environmental stewardship.

Inspection and Enforcement
Prior to July, 1995, DWQ's limited compliance resources were mostly directed toward getting existing facilities registered, insuring that new and existing facilities had approved waste management plans and responding to citizen complaints.

Following major lagoon dike breaks in late June and July, 1995, DWQ and the Department's natural resources divisions made a major commitment to inspecting all animal operations. As of December 1, 1995, over 4,000 operations were inspected.

These inspections have found a very high percentage of these facilities with problems. DWQ is currently working with these problem facilities to get them into compliance. These efforts include technical assistance, Notices of Violations, notification of loss of deemed permitted status and other appropriate enforcement actions. Approximately 1,800 out of the 3,922 reports entered in the Division's database indicate a compliance problem. As of May 13, 1996, approximately 200 facilities were found to have a discharge during an inspection.

As of May 13, 1996, 40 civil penalty cases were assessed and 8 court injunctions have been filed. Eighty-five facilities have lost their deemed permitted status and are required to obtain a certified waste management plan prior to the December 31, 1997 deadline.

Animal Inspection Database
May 13, 1996

Inspections	Total	Swine	Cattle	Poultry
Reports Entered	3922	3,012	803	107
Inadequate Freeboard	579	449	87	43
Seepage observed from lagoon	118	85	26	7
Erosion observed	426	376	32	18
Inadequate acreage available for spray	112	96	3	13
Cover crop inadequate	225	206	4	15
Man made conveyance of wastes	154	99	52	3
Inadequate Records	1,078	868	162	48
Non-Man made conveyance of wastes	59	43	8	8

This is preliminary information based on only the inspection reports entered as of the date of the report. These numbers are not considered accurate until a quality assurance procedure is in place. These numbers will change daily based on the entry of new reports and quality assurance checks of the information in the data base.

Swine Farm Siting Act
The Swine Farm Siting Act, SB 1080, was adopted on July 11, 1995 to minimize adverse impacts on property adjoining concentrated animal operations. The Act specifies that a swine house or lagoon of a new farm sited on or after October 1, 1995 is required to be at least 1,500 feet from any occupied residence; at least 2,500 feet from any school, hospital, or church; and at least 100 feet from any property boundary. The Act restricts the application of lagoon effluent to land at least 50 feet from a residential property line and from any perennial stream or river, excluding irrigation ditches and canals. If written permission is given by the property owner and recorded with the Register of Deeds, a swine house or lagoon may locate closer to a residence, school, hospital, church, or property boundary.

- **NC Cooperative Extension Service and Agricultural Research Service**
Crop and animal production programs are administered under the research and education activities of the NC Agricultural Research Service (ARS) and the NC Cooperative Extension Service (CES). The research and education efforts are broad and include areas such as variety development, crop fertilizer requirements, soil testing, integrated pest management, animal housing, animal waste management, machinery development and irrigation. Guidelines for most agricultural enterprises have been developed and made available to farmers. A more intensified water quality emphasis is being incorporated in these areas and many other projects undertaken by ARS and CES. The local contact that county CES agents have with farmers and homeowners provides an excellent opportunity for dialogue and education in nonpoint source pollution control. This network of contacts can be used to inform people about BMPs and to provide some structure for a general NPS education program.

The NC Agricultural Research Service and the NC Cooperative Extension Service conduct broad research and education efforts that include areas such as variety development, crop fertilizer requirements, soil testing, integrated pest management, animal housing, animal waste management, machinery development, and irrigation. County Cooperative Extension agents work closely with farmers and homeowners, providing an excellent opportunity for dialogue and education in nonpoint source pollution control. In addition, CES has begun assisting DWQ in holding a series of public workshops in each river basin prior to DWQ's preparation of the draft basin plan.

- **Soil, Plant Tissue, and Animal Waste Testing Program**
These services provide farmers with information necessary to improve crop production efficiency, to manage the soil properly and to protect environmental quality. The Soil, Plant

Tissue and Animal Waste Testing Program is administered by the Agronomic Division of the North Carolina Department of Agriculture. Water and wastewater from lagoons is also tested for irrigation and fertilizer use.

- **Watershed Protection and Flood Prevention Program (PL 83-566)**
  The purpose of the Watershed Protection and Flood Prevention Program is to provide technical and financial assistance in planning, designing, and installing improvement projects for protection and development of small watersheds. The Program is administered by the USDA-Natural Resources Conservation Service in cooperation with the NC Division of Soil and Water Conservation, the State Soil and Water Conservation Commission, the U.S. Forest Service, Soil and Water Conservation Districts, and other project sponsors.

  The emphasis of the Program over the past three decades has been to provide flood control. However, legislation has shifted emphasis of PL-566 land treatment projects so that a project proposal must demonstrate off-site water quality benefits in order to have any chance of funding.

- **Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA)**
  There are several provisions authorized by the federal Food Security Act of 1985 (FSA) and re-authorized by the Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA) which offer excellent opportunities for the abatement of agricultural nonpoint source pollution. The FSA and FACTA make the goals of the USDA farm and conservation programs more consistent by encouraging the reduction of soil erosion and production of surplus commodities and the retention of wetlands. At the same time, the provisions can serve as tools to remove from production those areas which critically degrade water quality by contributing to sedimentation. Important water quality-related provisions are known as the Conservation Reserve, Conservation Compliance, Sodbuster, Swampbuster, and Conservation Easement, Wetland Reserve, and Water Quality Incentive Program. These provisions are administered by the USDA.

  Conservation Reserve Program
  The Conservation Reserve Program (CRP) is administered by the USDA Agricultural Stabilization and Conservation Service (ASCS) and the USDA Natural Resources Conservation Service (NRCS). Other cooperating agencies include the NC CES, NC Division of Forest Resources and local Soil and Water Conservation Districts. The CRP was established to encourage removing highly erodible land from crop production and to promote planting long-term permanent grasses and tree cover. The ASCS will share up to half of the cost of establishing this protective cover. The intention of the program is to protect the long term ability of the US to produce food and fiber by reducing soil erosion, improving water quality and improving habitat for fish and wildlife. Additional objectives are to curb the production of surplus commodities and to provide farmers with income supports through rental payments over a 10 year contract period for land entered under the CRP.

  Conservation Compliance
  The Conservation Compliance provision of the FSA and FACTA discourages the production of crops on highly erodible cropland where the land is not carefully protected from erosion. Highly erodible land is defined as land where the potential erosion (erodibility index) is equal to eight times or greater than the rate at which the soil can maintain continued productivity. This rate is determined by the Natural Resources Conservation Service.

  A farmer had until January 1, 1990 to develop and begin applying a conservation plan on highly erodible land. Plans were required to be operational by January 1, 1995. If a conservation plan is not developed and implemented, the farmer loses eligibility in price and

income supports, crop insurance, FHA loans, Commodity Credit Corporation storage payments, farm storage facility loans, Conservation Reserve Program annual payments, and other programs under which USDA makes commodity-related payments. In other words, Conservation Compliance is an economic disincentive, quasi-regulatory program.

Sodbuster

The Sodbuster provision of the FSA and FACTA is aimed at discouraging the conversion of highly erodible land for agricultural production. It applies to highly erodible land that was not planted in annually tilled crops during the period 1981-85. As with the other provisions of the FSA, the Natural Resources Conservation Service determines if a field is highly erodible. If a highly erodible field is planted in an agricultural commodity without an approved conservation system, the landowner (or farmer) becomes ineligible for certain USDA program benefits.

Swampbuster

The purpose of Swampbuster is to discourage the conversion of wetlands to cropland use. Wetlands are defined as areas that have a predominance of hydric soils that are inundated or saturated by surface water or groundwater at a frequency or duration sufficient to support a prevalence of hydrophytic (water loving) vegetation. It is the responsibility of the Natural Resources Conservation Service to determine if an area is a wetland. Like the other provisions of the FSA and FACTA, a farmer will lose eligibility for certain USDA program benefits on all the land which is farmed if a wetland area is converted to cropland.

Conservation Easement

The Conservation Easement provision encourages producers whose FHA loans are in or near default to place their wetland, highly erodible land, and fragile land in conservation, recreation, or wildlife uses for periods of at least 50 years. The producer benefits by having the FHA loan partially canceled. The environment benefits by reducing the level of soil disturbing activities and the threat of agricultural pollutants.

Wetland Reserve

FACTA established a voluntary program for farmers to grant the federal government a 30-year or perpetual easement to wetlands. Eligible land includes farmed or converted wetlands which could be restored to their highest wetland function and value. The goal is to enroll one million acres by the end of 1995.

Water Quality Incentive Program

FACTA established this cost sharing program to help farmers control pollution problems associated with agricultural activities. A producer could receive up to $3,500 in cost share assistance to implement approved BMPs. The goal is to enroll 10 million acres by 1995.

Nonpoint Source Programs for Urban and Developed Lands

- **Federal Urban Stormwater Discharge Program / NC NPDES Stormwater Program**

In 1987, Congress passed the Water Quality Act Amendments to the Clean Water Act requiring the U.S. Environmental Protection Agency (EPA) to develop regulations on permit application requirements for stormwater discharges associated with industrial activities as well as those associated with large and medium municipal separate storm sewer systems (population greater than 100,000). These regulations became effective in December 1990.

The goal of the stormwater discharge permitting regulations in North Carolina is to prevent stormwater runoff pollution by controlling the source(s) of pollutants. Defining the potential pollutant sources and establishing controls of the sources that will reduce and minimize pollutant availability will result in an improvement to the water quality of the receiving streams, consistent with the overall goal of the water quality program. Authority to administer these

regulations has been delegated to the North Carolina Division of Water Quality (DWQ). The NPDES stormwater regulations require that facilities with stormwater point source discharges associated with industrial activity and municipalities defined as either large or medium municipal separate storm sewer systems be permitted.
The municipal permitting requirements are designed to lead to the formation of site-specific stormwater management programs for a municipal area. Therefore, the permits issued to municipalities for their municipal separate storm sewer systems will be explicitly written for each individual municipality. Municipal permits of this type in North Carolina are currently required for Charlotte, Durham, Greensboro, Raleigh, Winston-Salem and Fayetteville/Cumberland County. The municipalities will develop and implement comprehensive stormwater quality management programs to reduce the discharge of pollutants in stormwater to the maximum extent practicable (MEP). MEP will be defined separately for each municipality required to be permitted. Industrial facilities discharging through a municipal separate storm sewer system are required to submit a permit application to the state and receive their own NPDES stormwater permit.

Industrial activities which require permitting are defined in eleven categories in the federal regulations ranging from sawmills and landfills to phosphate manufacturing plants and hazardous waste treatment, storage or disposal facilities. The regulations cover point source discharges that are related to manufacturing, processing, or material storage areas at an industrial facility. Stormwater discharges associated with industrial activities are required to be covered by permits which contain technology based controls based on Best Available Technology (BAT)/Best Conventional Pollutant Control Technology (BCT) considerations or water quality controls, if necessary. Through monitoring and regulating stormwater discharge quality, the goal of the NPDES stormwater program is to reduce the pollutant load in stormwater runoff.

The permitting requirements described here represent Phase I of the stormwater program. EPA and Congress are currently involved in studies to determine the scope of additional stormwater coverage under Phase II of the stormwater program. Further stormwater NPDES coverage could include additional industrial activities or additional municipal areas. If additional areas of coverage are added under the federal stormwater programs, DWQ will be responsible for the appropriate permitting of these areas within North Carolina.

- **Water Supply Watershed Protection Program**
Approximately 50 percent of North Carolina's population depends on surface water supplies for drinking, commercial, and industrial uses. Water supplies have become more important in recent years because of increased demand for water, concern over potential contamination by toxic substances, and protection of human health. As a result, the General Assembly passed the Water Supply Watershed Protection Act of 1989 (NCGS 143-214.5). This Act requires all local governments that have land-use jurisdiction within surface water supply watersheds, or a portion thereof, to be responsible for implementation and enforcement of nonpoint source management requirements related to urban development, according to minimum standards adopted by the state. NPS control strategies are included in the rules for urban, agricultural, silvicultural, and Department of Transportation activities. The Water Supply Watershed Protection Rules were adopted by the Environmental Management Commission on February 13, 1992 and became effective on August 3, 1992. These rules were recently revised (effective August 1, 1995) to give local governments more flexibility in the implementation of water supply protection programs.

The purpose of the Water Supply Watershed Protection Program is to encourage communities to work with the state to provide enhanced protection for their water supply from nonpoint pollution sources. There are five water supply classes that are defined according to existing land use and the amount and types of permitted wastewater discharges. (See Appendix I for a

summary of the management requirements for the five water supply classifications.) By classifying a watershed as a water supply watershed, local governments with land use jurisdiction within the watershed will take steps to control nonpoint sources of pollution and thereby reduce the potential of pollutants contaminating drinking water supplies. In turn, the state limits the point source discharges that can locate within the watershed which reduces the potential of contamination of the water supply.

This dual approach of state and local government action to preclude potential impacts from stormwater runoff and wastewater discharges is important since only a small fraction of the pollutants that enter water supplies from nonpoint sources have water quality standards. As more is learned about the types and effects of pollutants in our drinking waters, the state will be forced to adopt additional water quality standards. If these additional standards are imposed, one effect may be that water treatment facilities will be required to apply additional technology and possibly more expensive treatment facilities or operation to ensure safe drinking water. It is, therefore, very important for the state and local governments to consider alternative means of preventing nonpoint source pollution from entering drinking water supplies in the first place. The land-use requirements, including density controls, buffers along perennial streams and stormwater control requirements for high density developments are but a few ways to accomplish this.

The Water Supply Protection Program is administered by staff in the Operations Branch of the DWQ. These staff coordinate with the Division of Community Assistance (NCDCA) which helps local governments develop land-use ordinances, the Division of Environmental Health, which certifies that a proposed water supply is suitable for drinking water, and DWQ staff in NCDEHNR regional offices who are responsible for water quality sampling. Statewide, the compliance rate for submittals is 100%.

- **Coastal Stormwater Management**

In November 1986, the EMC adopted rules which required new development in a limited zone (575 feet) around Class SA (shellfish) waters to control stormwater either by limiting density or completely controlling a 4.5 inch, 24-hour storm with the use of a stormwater treatment system. The regulations applied to development activities which required either a CAMA major permit or a Sediment/Erosion Control Plan (generally development disturbing more than one acre). The design storm, low density limits, and aerial coverage were all quite controversial and the adopted rules represented a compromise by all parties. A sunset provision was added to the rules to force the staff and Commission to reconsider the rules after a year. These rules expired December 31, 1987, but new stormwater regulations were adopted having an effective date of January 1, 1988. These regulations are administered by the DWQ. Approximately five man-years are allocated to implementing this program. Planning Branch staff are responsible for providing guidance and interpretation to promote consistent implementation of the rules. DWQ regional staff review and approve plans and enforce the requirements of the regulations.

Perhaps the most important measure accomplished with the regulations has been the applicability of stormwater controls to development activities within the 20 CAMA coastal counties. Certainly the near-water impact of stormwater as addressed in the original rules is important, but the staff believed the cumulative impact of stormwater runoff throughout the coastal zone also needed to be addressed. Therefore, the expanded area of coverage helps provide better protection of both shellfish waters and coastal water quality in general.

Other major items specified in the rules address the sizing of stormwater treatment systems. For developments adjacent to SA waters, infiltration systems must be able to retain 1.5 inches of rainfall, whereas development in other areas must control one inch of rainfall. Wet detention ponds are not allowed for stormwater control near SA waters and must be sized for 85 percent TSS removal in other areas. In addition, porous pavement is considered an innovative

infiltration system (only five are allowed until they are proven to work) as evidence has not been provided regarding its effectiveness in coastal areas. A low density option of the new regulations applies a built-upon limit of 25 percent for SA areas and 30 percent for other coastal areas rather than a limit on effective impervious cover. Development exceeding these levels is required to have a engineered stormwater system as indicated.

In summary, the regulations which have an expanded aerial coverage increases the annual number of projects affected from approximately 50 (original rules) to 500. This increase is coincident with a reduction in design storm that is comparable to requirements in other states. In addition, the low density option, retained from the original regulations, is encouraged as operation and maintenance concerns associated with stormwater controls are not applicable.

- **Coastal Nonpoint Pollution Control Programs**
  As part of the Coastal Zone Act Reauthorization Amendments of 1990, Congress enacted a new section 6217 entitled "Protecting Coastal Waters". This provision requires states with coastal zone management programs (which includes North Carolina) that have received Federal approval under section 306 of the Coastal Zone Management Act (CZMA) to develop and implement Coastal Nonpoint Pollution Control Programs. The coastal nonpoint programs will provide additional control for sources of nonpoint pollution that impair coastal water quality. Sources subject to the 6217 Coastal NPS Program include: agriculture, forestry operations, urban and developing areas, marinas, hydromodification projects, and wetlands and riparian areas.

  Section 6217 requires coastal states to submit their coastal nonpoint control programs to the National Oceanic and Atmospheric Administration (NOAA) and the U.S. EPA for approval by July 1995. The programs are to be implemented by January, 1999. Failure to submit an approvable program by July 1995 will result in a state losing substantial portions of its Federal funding under section 306 of the CZMA and section 319 of the Clean Water Act. The coastal nonpoint program will be developed and administered jointly by the NC Division of Coastal Management and DWQ.

Summary of Changes Since 1989

- The N.C. DWQ has developed programs for the administration of NPDES stormwater permits for industries and municipalities.
- The N.C. DWQ has developed and issued eighteen general permits to cover a variety of facilities that discharge stormwater associated with industrial activity.
- Water Supply Protection Legislation was passed in N.C. which has resulted in the development and implementation of statewide water supply watershed protection requirements. This program is described in detail in the previous section.
- The stormwater management rules governing coastal areas, High Quality Waters and Outstanding Resource Waters have been modified. These rules were finalized and effective on September 1, 1995. These programs are described in more detail in the previous section.
- Educational Efforts: The N.C. DWQ has instituted a number of educational efforts related to stormwater management across the state. These efforts have included:

- Guidance Manuals:
1 *Stormwater Management Guidance Manual*
2 *Stormwater Management In North Carolina: A Guide For Local Officials*
- Fact Sheets on Stormwater Management
1 *Stormwater Problems and Impacts*
2 *Stormwater Control Principles and Practices*
3 *Stormwater Management Roles and Regulations*
4 *Local Stormwater Program Elements and Funding Alternatives*
- Statewide Stormwater Conference - (1994)

- Statewide Workshops on The Water Supply Protection Program (1994 & 95)
- Statewide Workshops on Stormwater Management (1995)

- **ORW and HQW Stream Classifications**
  Outstanding Resource Waters (ORW) and High Quality Waters (HQW) have management strategies that address handling of urban stormwater. Controls for urban stormwater, either through development density limitations or stormwater treatment systems, are required by DWQ. Other NPS management agencies are expected to place priority on protecting these waters as well. For example, the NC Department of Transportation and the NC Division of Land Resources require more stringent sediment control on construction sites in ORW and HQW areas.

- **CAMA Land Use Plans**
  The Coastal Area Management Act (CAMA), passed in 1974, requires the development of land use plans by each of the 20 coastal counties that fall within the coastal area. These plans must be consistent with state guidelines and address a wide range of issues, including resource protection and conservation, hazards mitigation, economic development and public participation. Land use plans must be updated every five years. 1995 revisions to the land use planning guidelines strengthened the connection between land use planning and surface water quality. Future land use plan updates must consider water quality use classifications, watershed planning and problems identified in basinwide plans. There are 91 jurisdictions that have prepared and adopted CAMA land use plans.

  A land use plan is a "blueprint" used by local leaders to help guide the decisions that affect their community. Through land use planning, local jurisdictions can influence how growth will affect surface water quality by adopting policies supported by local ordinances, promoting better sedimentation and erosion control standards, stream buffers and lower levels of impervious surface cover. Although land use plans are required only in the state's coastal area, these land use planning tools for the protection of water quality are available to any jurisdiction which chooses to implement them.

Construction - Sedimentation and Erosion Control Nonpoint Source Program

In 1973, the North Carolina General Assembly enacted the Sedimentation Pollution Control Act (SPCA). The Act authorized the establishment of a sediment control program to prevent accelerated erosion and off-site sedimentation caused by land-disturbing activities other than agriculture, forestry, and mining. The Land Quality Section of the Division of Land Resources is responsible for administration and enforcement of the requirements of the Act under the authority of the NC Sedimentation Control Commission.

The sediment control program requires, prior to construction, the submission and approval of erosion control plans on all projects disturbing one or more acres. On-site inspections are conducted to determine compliance with the plan and to evaluate the effectiveness of the BMPs which are used. The intent is to offer permanent downstream protection for stream banks and channels from damages caused by increased runoff velocities. If voluntary compliance with the approved plan is not achieved and violations occur, the Land Quality Section will pursue enforcement through civil penalties and injunctive relief. House Bill 448, passed in 1991, authorized the issuance of stop-work orders for violations of the SPCA. This additional enforcement mechanism will help improve the overall performance of the program.

Sedimentation control rules are more stringent for areas draining to waters supplementally classified as Trout or High Quality Waters.

Local programs are reviewed annually for compliance with the requirements of the Sedimentation Pollution Control Act. The Land Quality Section also conducts educational programs directed toward state and local government officials in order to strengthen the local programs. Persons engaged in land-disturbing activities and interested citizen groups are included in the educational effort.

The Sedimentation Control Commission has delegated to the Division of Highways of the North Carolina Department of Transportation (DOT) the authority to approve erosion and sedimentation control plans for land-disturbing activity conducted by that agency or by other persons under highway contracts with that agency. The DOT sedimentation control program has been reviewed by the Division of Land Resources under the authority of the Sedimentation Control Commission. DOT uses more stringent sedimentation controls in areas adjacent to High Quality Waters and Outstanding Resource Waters. The NC Department of Environment, Health, and Natural Resources (NCDEHNR) has established a position to evaluate environmental aspects of DOT highway projects and programs. DOT, in cooperation with DWQ, has developed and adopted formal BMPs for protection of surface waters. These BMPs and other efforts are significant improvements in developing a proactive system at DOT toward environmental issues.

On-Site Wastewater Disposal - Sanitary Sewage Systems Nonpoint Source Program

Septic tank soil absorption systems are the most widely used method of on-site domestic wastewater disposal in North Carolina. More than 52 percent of all housing units in the state are served by septic tank systems or other systems besides public or community sewage systems. A conventional septic system consists of a septic tank, a distribution box or equivalent branching lines, and a series of subsurface absorption lines consisting of tile or perforated pipes laid in a bed of gravel. All subsurface sanitary sewage systems are under the jurisdiction of the Commission for Health Services (CHS) of the Department of Environment, Health, and Natural Resources. The CHS establishes the rules for on-site sewage systems which are administered by the Division to Environmental Health. BMPs for onsite sewage systems are listed in Appendix VI.

According to GS 130A-335(e) and (f), the rules of the CHS and the rules of the local board of health shall address at least the following: sewage characteristics; design unit; design capacity; design volume; criteria for the design, installation, operation, maintenance, and performance of sanitary sewage collection, treatment, and disposal systems; soil morphology and drainage; topography and landscape position; depth to seasonally high water table, rock, and water impeding formations; proximity to water supply wells, shellfish waters, estuaries, marshes, wetlands, areas subject to frequent flooding, streams, lakes, swamps, and other bodies of surface or groundwaters; density of sanitary sewage collection, treatment, and disposal systems in a geographical area; requirements for issuance, suspension, and revocation of permits; and other factors which affect the effective operation in performance of sanitary sewage collection treatment and disposal systems.

The rules also must provide construction requirements, standards for operation, and ownership requirements for each classification of sanitary systems of sewage collection, treatment, and disposal in order to prevent, as far as reasonably possible, any contamination of the land, groundwater, and surface waters. There exists a strict permitting procedure which regulates site selection, system design, and installation of on-site sewage systems. Privately owned subsurface sewage discharging systems are governed by NCDEHNR through local county health departments. Authorized local sanitariums serve as agents of NCDEHNR and assist in implementing the state sewage rules. Local boards of health may adopt by reference the state rules and append to those rules more stringent laws and local criteria which they desire. These amendments, however, must be approved by the state. Only nine counties in the state currently

operate under local rules. The 1983 amendments of the state public health laws eliminated the co-mingling of state rules with local rules except by state approval.

The Straight Pipe Elimination Amnesty Program was established in 1996 for the purpose of eliminating domestic sewage or wastewater discharges, from both straight pipes and overland flow of failing septic systems. The program contains three components: identification and elimination of domestic sewage discharges into streams currently or proposed to be used for public water supplies; an amnesty period to end on December 31, 1997 during which time violations of State rules and laws on domestic sewage and wastewater discharges identified as a result of this program will not result in legal consequences; and a public education effort on the program and the amnesty period.

Solid Waste Disposal NPS Programs

- **Federal Program**
  The major federal legislation in the area of solid waste management is the Resource Conservation and Recovery Act (RCRA) administered by the U.S. Environmental Protection Agency (EPA). RCRA deals almost entirely with hazardous waste management but it does require that states meet minimum standards for solid waste facilities. EPA does not have permitting authority over solid waste management facilities.

- **State Program**
  States are accorded a major role in solid waste management by RCRA. North Carolina now operates under revisions by the General Assembly to Chapter 130A of the General Statutes. The Division of Solid Waste Management (DSWM) in the Department of Environment Health and Natural Resources is authorized as the single state agency for the management of solid waste. DSWM is responsible for the development of the state's solid waste management plan, has permitting authority over all solid waste management facility siting and operation, inspects permitted facilities, provides technical assistance, investigates complaints, responds to emergencies, monitors ground water quality at facilities, promotes the state's recycling effort, and closes non-conforming sites.

  The Solid Waste Management Act of 1989 established the policies and goals of the state to recycle at least 25 percent of the total waste stream by January 1, 1993. This Act created a Solid Waste Management Trust Fund to promote waste reduction and fund research and demonstration projects to manage solid waste. In 1991, the Solid Waste Management Act of 1989 was amended to broaden the goal to reduce the solid waste stream by 40 percent through source reduction, reuse, recycling, and composting by June 30, 2001.

  The state adopted solid waste management rules, effective February 1, 1991, requiring liner, leachate collection, and final cover systems at all new landfills, lateral expansions of existing landfills, and at all active landfills by January 1, 1998. Septage rules and regulations also have been adopted and are administered through a permit program.

- **Local Program**
  Solid waste collection and disposal has long been a municipal function. The operation of solid waste collection and disposal facilities is among the enterprises which municipalities are expressly authorized by statute to operate (G.S. 160A-311 through 160A-321). Municipalities are also authorized to regulate the disposal of solid waste within their corporate limits. Such regulations may specify the location and type of receptacles to be used for collection (G.S. 160A-192).

  Outside municipal limits, counties are authorized to operate solid waste collection and disposal facilities either as a function of county government or through establishment of a special service

district (G.S. 153A-292 and 301). Since 1970, county governments have increasingly accepted responsibility for solid waste disposal activities and most disposal facilities in the state are now operated by counties or with county financial assistance.

Forestry NPS Programs

- **Forest Practice Guidelines Related to Water Quality**
  In 1989 the Sedimentation Pollution Control Act (SPCA) was amended to limit the forestry exemption to those operations that adhere to forest practice guidelines. The forestry amendment to the SPCA required the Division of Forest Resources to develop performance standards known as the Forest Practices Guidelines Related to Water Quality.

  Guidelines consist of nine performance standards for activities such as maintaining streamside management zones and applying fertilizer and pesticide applications. These Guidelines are used to determine if a forestry operation will fall under the jurisdiction of the Division of Land Resources which enforces the SPCA. The Guidelines were developed in October 1989 and were put into effect on January 1, 1990. A Memorandum of Agreement was also signed between the Division of Forest Resources and the Division of Land Resources to coordinate their respective activities in the sedimentation control program. DLR has also signed an MOA with DWQ.

  Site-disturbing forestry activities are being inspected by local DFR personnel as part of a training, mitigation, and monitoring program. Site inspections are conducted when a problem or potential problem is suspected to exist. Sites not brought into compliance within a reasonable time schedule are referred by DFR to DLR or DWQ for appropriate enforcement action. Commonly used forestry BMPs are listed in Appendix VI.

- **National Forest Management Act (NFMA)**
  The National Forest Management Act was passed in 1976 and applies to all lands owned or administered by the National Forest System. The Act stipulates that land management plans be prepared which consider economic and environmental aspects of forest resources. The Act further states that timber will be harvested from National Forest lands only where soil, slope, or other watershed conditions will not be irreversibly damaged; and where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of watercourses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat.

- **Forest Stewardship Program**
  The Division of Forest Resources initiated the Forest Stewardship Program in 1991 along with the cooperation and support of several other natural resource and conservation agencies. This program encourages landowners with ten or more acres of forestland to become involved and committed to the wise development, protection and use of all natural forest resources they own or control.

Mining NPS Program

In 1971 the North Carolina General Assembly passed the Mining Act to ensure that the usefulness, productivity, and scenic values of all land and waters involved in mining will receive the greatest practical degree of protection and restoration. The Mining Commission is the rule-making body for the Act and has designated authority to administer and enforce the rules and regulations of the Act to the Mining Program within the Land Quality Section of the NCDEHNR Division of Land Resources.

The Mining program has four major areas of responsibility. First, the Program requires submission and approval of a mining permit application prior to initiating land disturbing activity if the mining operation is one (1) or more acres in surface area. The mining permit application must have a reclamation plan for these operations. Second, the Program conducts on-site inspections to determine compliance with the approved application and whether or not the plan is effective in protecting land and water quality. Third, the program pursues enforcement action through civil penalties, injunctive relief, and/or bond forfeiture to gain compliance when voluntary compliance is not achieved. Finally, the Mining Program conducts educational efforts for mine operators.

Wetlands Regulatory NPS Programs

There are numerous reasons for preserving wetlands, but of special interest within the context of basinwide planning is their role in protecting water quality. Because of their intrinsic characteristics and location within the landscape, wetlands function to protect water quality in a number of ways. These functions include the retention and removal of pollutants, stabilization of shorelines, and storage of flood waters.

Numerous authors have studied the effectiveness of riparian wetland forests for nutrient retention and transformation (Jones et al. 1976; Yates and Sheridan 1983; Brinson et al. 1984; Lowrance et al. 1984; Peterjohn and Correll 1984; Jacobs and Gilliam 1985; Budd et al. 1987; and Groffman et al. 1991). The location of riparian wetlands allows them the opportunity to receive nutrients from the surrounding landscape as well as through overbank flooding. In addition to the storage of nutrients in wetland vegetation, the microbial and chemical processes within wetland soils may function to completely remove nutrients from the system.

Headwater riparian wetlands are extremely important and effective in terms of sediment and associated nutrient and toxicant retention and transformation. Since small streams comprise most of the total stream length within a watershed (Leopold 1974), these areas intercept the greatest proportion of eroded sediments and associated substances from uplands before these pollutant reach waters downstream. Novitzki (1978) found that approximately 80% of the sediments entering a stream were retained in headwater wetlands.

Wetlands adjacent to streams, rivers and lakes stabilize shorelines and help protect these bodies of water from erosive forces. This function is particularly important in urbanized watersheds where the prevalence of impervious surfaces contributes to greater peak storm flows. Wetland vegetation serves to dissipate erosive forces and anchors the shoreline in place preventing sediments and associated pollutants from entering waterways. Wetlands by their very nature of being "wet" are also vital for water storage. Those wetlands adjacent to surface waters, that have the opportunity to receive flood waters and surface runoff, are most important to water storage. Wetlands located in headwaters generally minimize peak flood waters in tributaries and main channels. Lakes and wetlands with restricted outlets hold back flood waters and attenuate flood peaks (Carter et al. 1978).

Several important state and federal wetland protection programs are described below. In addition to the following wetlands programs, provisions of the 1985 and 1990 Farm Bills, discussed in Section 5.3.1, should also help reduce wetlands impacts. Agriculture conversions should be reduced by the "swampbuster" provision of the 1985 Farm Bill, which encourages farmers not to convert wetlands for agriculture to prevent the loss of their USDA subsidies, loans, and price supports. Silviculture is exempted from the swampbuster provision and therefore, conversion of wetlands for intensive or managed forestry is not affected by this provision. A Wetland Reserve Program was established by the 1990 Farm Bill with the goal of allowing one million acres of prior-converted wetlands to revert back to wetlands by 1995.

- **Section 10 of the Rivers and Harbors Act of 1899**
  This act, administered by the US Army Corps of Engineers, provides the basis for regulating dredge and fill activities in navigable waters of the United States. Originally, this Act was administered to protect navigation and the navigation capacity of the nation's waters. In 1968, due to growing environmental concerns, the review of permit applications was changed to include factors other than navigation including fish and wildlife conservation, pollution, aesthetics, ecology, and general public interest. Activities which may be covered under the Act include dredging and filling, piers, dams, dikes, marinas, bulkheads, bank stabilization and others.

- **Section 404 of the Clean Water Act**
  The U.S. Army Corps of Engineers administers a national regulatory program under Section 404 of the Clean Water Act aimed at controlling the discharge of dredged or fill material into waters of the United States. Section 404 applies to the discharge of dredged or fill materials into waters of the United States including dredging. Waters of the United States refers to navigable waters, their tributaries, and adjacent wetlands. Activities covered under Section 404 include dams, dikes, marinas, bulkheads, utility and power transmission lines and bank stabilization. Although the 404 program does not fully protect wetlands, it is nonetheless the only existing federal tool for regulating wetland development statewide. State legislation has not been adopted to protect inland freshwater wetlands in North Carolina, as has been done for coastal wetlands, but the EMC in March of 1996 adopted rules which will formalize the wetlands protection measures associated with the 401 Water Quality Certification review process.

- **Section 401 Water Quality Certification (from CWA)**
  The Division of Water Quality is responsible for the issuance of 401 Water Quality Certifications. Section 401 of the federal Clean Water Act provides that no federal agency can issue any license or permit to conduct any activity that may result in a discharge to navigable waters unless the state in which the discharge may occur certifies that the discharge will not result in a violation of any state water quality or related standards. Thus, a 401 certification is required for, among other things, a discharge into surface waters or wetlands for projects that require a section 404 permit. A federal permit cannot be issued if a 401 certification is denied. Any conditions added to the 401 certification become conditions of the 404 permit. The 401 certification process is coordinated with the 404 and CAMA processes in the 20 counties of CAMA jurisdiction.

- **North Carolina Dredge and Fill Act (1969)**
  This act requires permits for "excavation or filling begun in any estuarine waters, tidelands, marshlands, or state-owned lake". This law is currently administered with North Carolina's Coastal Area Management Act (CAMA) (1974).

- **Wetlands Restoration Program/Funds**
  The Wetlands Restoration Program was established in 1996 as a nonregulatory program "...for the acquisition, maintenance, restoration, enhancement, and creation of wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, wildlife habitat, and recreational opportunities". The purposes of the program include: the restoration of wetlands function and values; to provide a consistent and simplified approach to mitigation requirements associated with permits or Corps of Engineers authorizations; to streamline the permitting process; to increase the ecological effectiveness of mitigation efforts; to achieve a net increase in wetlands acres, functions and values for each major river basin; to promote a comprehensive approach to environmental protection.

  Through the Wetlands Restoration Program, basinwide plans for wetlands and riparian area restoration will be developed. The goals of the plans are to protect and enhance "...water

quality, flood prevention, fisheries, wildlife habitat, and recreational opportunities..." These plans will be developed for each of the seventeen major river basins in the state beginning in July 1997. Compensatory mitigation (a required condition of section 404 permits issued by the U.S. Corps of Engineers) options will be addressed within the plans.

A Wetlands Restoration Fund has been established under the program. The Fund is a trust fund designed as a repository for monetary contributions and dedication of interest to real property under the compensatory mitigation options. These funds will primarily be used to restore, enhance, preserve or create wetlands and riparian areas in accordance with the basinwide plan.

Hydrologic Modification

Hydrologic modification is defined as channelization, dredging, dam construction, flow regulation and modification, bridge construction, removal of riparian vegetation, streambank modification/destabilization, and dam collapse. By its very nature hydrologic modification is closely tied to wetland issues. It is not surprising then that the U.S. Army Corps of Engineers (Corps) is the agency most involved in issuing permits for land-disturbing activities in wetlands. These permits are issued through Section 404 and the Rivers and Harbors Act discussed above.

In addition to wetland issues, dam construction and the lack of low flow releases into streams can severely impact downstream aquatic resources. Dam construction, repair, modification, and removal are regulated by the NC Division of Land Resources under the Dam Safety Law of 1967. A dam safety permit is required for any dam which is 15 feet or greater in height (from top of dam to lowest point on downstream toe) and the impoundment capacity is 10-acre-feet or greater at the top of the dam. Low-flow release requirements to maintain adequate instream flows are established in permits where appropriate. Instream flows are recommended by the NC Division of Water Resources.

There are several other programs which can affect hydrologic modification. The Forest Practice Guidelines Related to Water Quality requires streamside management zones to be maintained during logging operations. The Water Supply Watershed Protection Program also has requirements to maintain buffers for certain activities. The Conservation Reserve Program encourages the establishment of vegetative filter strips (66-99 feet wide) for farming operations. A significant number of local governments have established greenway programs within urban settings in order to maintain and protect riparian areas.

Water Supply Legislation in North Carolina

- **Water Supply Planning Law**
  The Water Supply Planning law (G.S. 143-355 (l) and (m)) was adopted in 1989 and amended in 1993. It requires all local governments that supply or plan to supply water to prepare a local water supply plan. In their plans, local governments are to include present and projected population, industrial development and water use within the service area, present and future water supplies, an estimate of technical assistance needs and other information that may be required by the Department. All local plans are to be approved and submitted to DWR by January 1, 1995. Information in those local plans is to be included in a State Water Supply Plan. The State Plan will also investigate the extent to which the various local plans are compatible.

- **Registration of Water Withdrawals and Transfers Law**
  The Registration of Water Withdrawals and Transfers law (G.S. 143-215.22H) requires any person who withdraws or transfers 1 MGD or more of surface water or groundwater to register the average daily and maximum daily withdrawal or transfer with the Environmental

Management Commission (EMC). The law also provides that if a local government has an approved local water supply plan on file with DWR, it does not have to register that withdrawal, thereby reducing duplication of effort by local governments that otherwise would be subject to both laws. In addition, the law includes a 5-year renewal requirement, which will ensure that the data is regularly updated.

- **Regulation of Surface Water Transfers Act**
  In 1993, the legislature adopted the Regulation of Surface Water Transfers Act (G.S. 143-215.22I et seq.). This law was designed to regulate large surface water transfers by requiring a certificate from the EMC and by repealing several other laws that had previously affected interbasin transfers. The law applies to anyone initiating a transfer of 2 MGD from one river basin to another and to anyone increasing an existing transfer by 25 percent or more if the total transfer is 2 MGD or more. Applicants for certificates must petition the EMC and include a description of the transfer facilities, the proposed water uses, water conservation measures to assure efficient use and any other information desired by the EMC. A certificate will be granted for the transfer if the Commission concludes that the overall benefits of the transfer outweigh its detriments. The Commission may grant the petition in whole or in part, or deny it, and it may require mitigation measures to minimize detrimental effects. The law also provides for a $10,000 civil penalty for violating various statutes.

- **Capacity Use Act**
  DWR administers the Capacity Use Act (G.S. 143-215.11 et seq.), which allows the EMC to establish a Capacity Use Area where it finds that the use of ground water, surface water or both requires coordination and limited regulation. If after an investigation and public hearings a Capacity Use Area is designated, the EMC may adopt regulations within the area, including issuance of permits for water users. In the near future, DWR plans to review the rules for implementation of the Capacity Use statute and develop a model of the aquifer system, in coordination with the Groundwater Section of DWQ, for Capacity Use Area 1, which was created to regulate surface water and ground water withdrawals in an area surrounding Texasgulf, Inc. in Aurora, N.C. A new ground water flow model will be used to simulate Capacity Use Area 1 as a basis for permitting withdrawals.

- **Dam Safety law**
  The Dam Safety law (G.S. 143-215.24) was amended in 1993, and rules are being developed for implementation of these amendments. Among the changes, the amendment defines "minimum stream flow" as a quantity and quality sufficient in the judgment of the Department of Environment, Health and Natural Resources (DEHNR) to meet and maintain stream classifications and water quality standards established by DEHNR and to maintain aquatic habitat in the affected stream length.

  The Dam Safety Law applies to dams that are 15 feet or more high or with impoundment capacity of 10 acre feet or more. The law requires that the EMC adopt rules specifying minimum stream flow in the length of the stream affected by a dam and sets specific parameters for minimum stream flow for dams operated by small power producers that divert water from 4,000 feet or less of a natural stream bed and return the water to the same stream.

<u>Section 319 Nonpoint Source Management and Other Programs</u>

- **Section 319**
  Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects that have been funded in the past include BMP demonstrations, watershed water quality improvement projects, data management, educational activities, modeling, stream restoration efforts, riparian buffer

establishment, and others. North Carolina DWQ established a Workgroup process in 1995 for prioritizing and selecting projects from the pool of cost-share proposals for inclusion in its annual application to EPA. DWQ staff first reviews proposals for minimum 319 eligibility criteria such as:

- support state Program milestones;
- address targeted, high priority watersheds;
- provide sufficient cost-share match (40% of project costs);
- propose adequate time periods;
- identify measurable outputs;
- use compatible GIS products with those of the state; and
- make commitment for educational activities and a final report.

Workgroup members separately review and rank each proposal which meets the minimum 319 eligibility criteria. The Workgroup consists of representatives from the state and federal agencies that deal with NPS issues, including agricultural, silvicultural, on-site wastewater, mining, solid waste and resource protection. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; degree of balance lent to the state Program in terms of project type; and competence/reliability of contracting agency. They then convene to discuss individual projects' merits, to pool all rankings and to arrive at final rankings for the projects. All proposals that rank above the funding target are included in the annual grant application to EPA, with DWQ reserving the right to make final changes to the list. Actual funding depends on approval from EPA and yearly Congressional appropriations.

- **Use Restoration Waters**

The North Carolina Division of Water Quality is currently developing the Use Restoration Waters (URW) program to restore surface waters to their designated uses. If adopted, this program will allow the state to work with local governments, businesses, and residents to develop management strategies appropriate for the area. In order to be effective, the URW program will include a mix of mandatory and voluntary programs. The voluntary and mandatory programs will be coordinated on a site-specific basis by DWQ and a group of stakeholders who have an interest in the impaired water body and associated watershed. In addition, the URW program will attempt to develop cooperative relationships among these agencies so that overlapping efforts can be consolidated and targeted to restore designated water body uses.

The URW Program will apply to polluted surface waters where the following conditions apply:

- ~~Biological, physical and/or chemical data indicate the specific sources of pollution.~~
- A use attainment study indicates that the sources of pollution are not transitory.
- It is possible to control the sources of pollution by implementing appropriate management strategies under the existing authority of the North Carolina Environmental Management Commission (EMC), other state commissions, and local agencies or voluntary actions implemented by citizens and other groups.

Based on current water quality data, there are approximately 4,300 miles of freshwater streams (or about 1.4 percent of total miles) and about 40,000 saltwater acres (or about 2 percent of total saltwater acres) that would be potential candidates for URW consideration.

The restoration strategies developed under the URW Program will be site-specific to the watershed of the nonsupporting or impaired water body. DWQ and the stakeholders will coordinate each URW strategy with other agencies' programs to create a holistic approach to address the array of pollution problems in the watershed.

- **The Nonpoint Source (NPS) Team Process**

Successfully managing NPS pollution requires not only a knowledge of science and technology, but also an understanding of the local resources and economy. Although there are some general management guidelines, there is no single technique for controlling NPS pollution. The most efficient and effective NPS solutions will be site-specific. Formulating NPS solutions often requires cooperation between different interested parties. Each group that contributes to the NPS problem must be part of the solution.

DWQ will coordinate the HiwasseeNPS Team to include a wide variety of stakeholders interested in the basin. This team will take the lead in identifying NPS problems and implementing solutions. The NPS Team process is discussed below and in Chapter 7.

1. Coordinate the NPS Team.
DWQ's goal in forming the Hiwassee NPS Team is to choose predominantly locally-based members that represent the federal, local, and state agencies, local governments, industries, and citizens' groups that have interests and responsibilities pertaining to NPS pollution. DWQ will consult local groups to determine which interests should be represented on the team.

Once the NPS Team is formed, DWQ and the team will work as partners to identify, prioritize, and address the NPS problems in the basin. DWQ will offer information from the state's water quality monitoring program and its staffs' knowledge of technical and financial resources. The NPS Team will describe current NPS initiatives, identify priority NPS-impaired waterbodies, and analyze NPS issues and needs. One of the most important missions of the DWQ-NPS Team partnership is to foster coordination and cooperation between the basin's diverse interest groups and agencies. The eventual goal of the NPS Team is to create and implement Action Plans that will address priority *NPS-impaired waterbodies* and *NPS issues* as part of the basinwide planning process. The implementation schedule will be determined as the plans are developed.

2. Take inventory of the initiatives and programs in place to address NPS pollution.
Each member of the NPS Team will describe the existing initiatives and programs of the agency or group he/she represents. A list of these initiatives is included in the basinwide plan to show readers some of the potential resources for addressing their NPS problems (see Chapter 5). This effort will provide an opportunity for mutual education, understanding and coordination with other stakeholders. An important responsibility of the NPS Teams will be to assess whether existing initiatives and programs in the basin are successfully improving water quality.

3. Choosing the priority NPS-impaired waterbodies and NPS issues.
Since the NPS Team will not be able to address all of the *NPS-impaired waterbodies* and *NPS issues* in the basin, it will have to follow a system for prioritization. The NPS Team will use the following process to target NPS-impaired waterbodies and select NPS issues.

Selecting the Priority NPS-impaired Waterbodies

Within the guidelines described below, the NPS Team will select at least one NPS-impaired waterbody for which an Action Plan will be developed. More than one waterbody may be selected if time and resources allow. The goal of the Action Plan will be to restore the designated use of the selected waterbody using a comprehensive, site-specific, and coordinated approach. The Actions Plans will be a prime candidate for funding under the federal Section 319(h) program.

The NPS Team will use both primary and secondary criteria to select the *priority NPS-impaired waterbodies*. The primary criteria are (in order of importance):

- Highly-valued resource waters, such as High Quality Waters and Water Supplies I-IV, that have a demonstrated pollution problem.
- Monitored waters that have an overall use support rating of non-supporting.
- Monitored waters that have a use support rating of partially supporting but have a high predicted loading for one or more pollutants.
- Highly valued resource waters, such as High Quality Waters and Water Supplies I-IV, that are in need of protection.
- Monitored waters that have an overall use support rating of partially supporting.

DWQ will provide a list of waterbodies that meet the primary criteria to the NPS Team.

The secondary criteria for selecting the priority *NPS-impaired waterbodies* are:

- Waters that pose a potential threat to human health,
- Waters that are important for ecological reasons not reflected in their classification and use support ratings (such as endangered species, unique habitats, or significant biological resources),
- Waters that are highly eroded or have other evidence of serious erosion problems that are not reflected in the use support ratings,
- Waters that have experienced a recent, rapid decline in water quality, and
- Waters that have identifiable pollution sources and a high likelihood of successful restoration.

An NPS-impaired waterbody that meets the primary criteria as well as one or more of the secondary criteria listed above is a good candidate for prioritization by the NPS Team. However, the NPS Team may select a priority NPS-impaired waterbody that does not meet the primary criteria but meets *several* of the secondary criteria. This allows the team to select waters that DWQ did not monitor or waters for which the use support rating failed to describe the extent of the NPS problem.

Selecting the Priority NPS Issues

In order to address problems in the remaining NPS-impaired or threatened waterbodies (ones not prioritized for specific Action Plans), the follwing criteria will be used to target NPS issues throughout the basin:

- Issues that apply throughout a significant portion of the basin or address one or more impaired waters that were not selected as a *priority NPS-impaired waterbody,*
- Issues that have a clearly defined "problem" and "solution," and
- Issues that are within the team's ability to address through educational efforts, improved coordination between stakeholders, focused new initiatives, or involvement of additional stakeholders.

4. Determine what is needed to address the priority NPS-impaired waterbody and the NPS issues the team selects.

The NPS Team will decide which actions are likely to restore the priority NPS-impaired waterbodies and address the NPS issues. Some of the possible needs include:

- Public education. When water quality problems result from citizens' lack of knowledge about how their local actions affect water quality or from land use decisions, public education is a key component of the solution.

- Implementation of best management practices (BMPs). BMPs are structural or nonstructural management practices used to reduce nonpoint source inputs to receiving waterbodies in order to achieve water quality protection goals. Often higher levels of pollutant removal can be achieved by using a combination of different BMPs.
  - Structural BMPs generally work by capturing, retaining, and treating runoff before it leaves an area. Some examples of structural BMPs include constructed wetlands and wet detention ponds in urban settings and controlled drainage on agricultural lands. Structural BMPs require regular maintenance.
  - There are a variety of nonstructural BMPs. One nonstructural BMP is source reduction, which reduces the amount of pollutants that are introduced into the environment. Some types of source reduction are nutrient management plans for crop production and hazardous waste collection sites in urban areas. Another nonstructural BMP is maintaining natural drainageways to allow the vegetation and soil to cleanse runoff before it enters a waterbody.
- Ecosystem restoration and management. If a stream's ecosystem is badly damaged, removing pollutants alone will not always restore the water's uses. In cases like these, it will be necessary to restore the ecosystem through measures such as riparian revegetation and streambank stabilization.
- Local water quality planning. Development sites can be planned in order to reduce their risk of harming water quality. Some planning techniques include steering development towards less environmentally sensitive areas, using natural drainage systems rather than curb and gutter, and planning for development densities that allow for open space, greenways, and wildlife corridors.

5. Develop comprehensive Action Plans consisting of management strategies to address the priority NPS-impaired waterbody and the NPS issues.

The NPS Team members will work together to develop "Action Plans." These Action Plans will consist of a list of Action Items that form a coordinated, comprehensive effort to address each priority NPS-impaired waterbody and NPS issue. Each Action Item will include lead contacts, goals, and a schedule for completion and may utilize one or more of the following vehicles for implementation:

- Efforts by NPS Team members: The NPS Team members can make commitments to target their agency's/group's existing resources to address the priority NPS-impaired waterbody or NPS issues. Team members can also agree to share their expertise on a volunteer basis.
- Section 319: Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects that have been funded in the past include BMP demonstrations, watershed water quality improvement projects, data management, educational activities, modeling, stream restoration efforts, riparian buffer establishment, and others. Refer to Section 5.7 for a complete program description.
- Agriculture Cost Share Program: Provides a number of cost-share practices designed to solve soil, water, and related environmental problems in agricultural areas including forested buffer strips.
- Wetlands Restoration Program. A bill recently ratified by the NC General Assembly establishes a statewide Wetland Restoration Program that will provide a leadership role in targeting and consolidating all wetland and riparian area restoration initiatives in NC.
- Proposed Use Restoration Waters (URW) Program. DWQ is currently developing the URW program to restore surface waterbodies to their designated uses. If adopted, this program would allow the state to work with local governments, businesses, and residents to develop

focused management strategies appropriate for the area. Those affected by the URW program will be requested to meet well-defined milestones and goals for water quality improvement. If these milestones are not met on a voluntary basis within an established schedule, mandatory controls may be considered by the Environmental Management Commission.

- Federal Initiatives: There are a number of federal programs and resources that may be available to address the Priority NPS-impaired waterbody and NPS issues. These include US Fish and Wildlife Service funds, the USDA-NRCS Wetland Reserve Program, and the Environmental Quality Initiative Program (EQIP) provisions of the Farm Bill.
- Other Programs: There are numerous other programs sponsored by private and state agencies that could be initiated to address the NPS Team's priority waterbodies and issues. Some of these programs include corporate funding for educational programs, the Small Watershed Program, and US Fish and Wildlife Grants. A complete list of funding sources for NPS pollution is listed in Appendix VIII.

6. Implement Action Plans.

Implementation is the most important part of the state's NPS program since it is the only way to restore the priority NPS-impaired waterbody and address NPS issues. Most, if not all, members of the NPS Team will be involved with the implementation of one or more of the Action Items. During the implementation phase, the NPS Team will continue to meet on a regular basis. The purpose of these meetings will be for the team to update each other on their progress toward completing the Action Items and provide a forum for continuing the coordination between team members. When some of the team members experience setbacks in implementing an Action Item, the rest of the team can advise and/or provide additional help so that the item can be completed successfully.

7. Monitor to evaluate the effectiveness of management strategies.

The NPS Team will identify where additional water quality monitoring sites may be needed to document the effectiveness of its Action Plans. DWQ and the NPS Team will cooperate to assure that pre- and post-monitoring is in place before a new program, initiative or BMP is implemented. In order to supplement DWQ's monitoring programs, the team may seek the involvement of citizens' groups. Any agencies that receive 319 grants will be required to conduct pre- and post-evaluations as a part of their project.

8. Consider additional management strategies if the voluntary approaches do not result in an improvement in water quality.

If the NPS Team's management strategies do not show progress in improving water quality according to the designated schedule, DWQ and the team will work together to identify the reason for the lack of progress. Some of the potential courses of action are:

- Reevaluate the source of impairment.
- Increase and/or redirect voluntary measures.
- Consider additional measures.

APPENDIX VII

USDA Forest Service Transportation System
Management Guidelines

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES		GENERAL DIRECTION		STANDARDS
Transportation System Management	1.	Manage roads. trails and other travelways consistent with Management Area direction. Designate roads as open to motorized public use by: -Signing for specific uses; or -Surfacing with stone, shale, pavement or other hard surface material and not closing by gate, natural barricade, sign, or other visible closure method or device.		
	2.	Manage closed forest development roads for a wide range of non-motorized uses. Minimize conflicting uses (example bicycle use vs. linear wildlife opening). Resolve conflicts using an ID team approach and coordinate with other federal, state, and county agencies and user groups.		
	3.	Identify temporary roads currently used as linear strip openings. Determine whether to incorporate them into the Forest Development Road system and continue to use them as wildlife opening if water quality standards can be met, or convert to permanent wildlife openings, or restore to forest conditions. Coordinate the decision about long term uses with the North Carolina Wildlife Resources Commission.	a.	Assure drainage structures will accommodate mowing with motorized equipment without resource damage when areas are converted to permanent wildlife openings.
	4.	Allow non-motorized bicycle and horse travel on Forest development roads unless signed as closed to that use.		
	5.	Limit opportunities outside of established ORV areas for primitive roads suitable for travel only be off-road		

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES		GENERAL DIRECTION	STANDARDS
Transportation System Management		vehicles. Inventory forest roads currently used by such vehicles. Determine whether to incorporate these roads into the Forest Development Road System (traffic service level D) as designated four-wheel drive ways open for public use or permanently close and restore to forest conditions. Include designated roads in calculations of open road densities specified for different management areas. Identify where existing road conditions do not meet water quality standards and develop strategies to bring them into compliance, except where physical conditions preclude complete correction and the road can not be legally closed. Schedule implementation consistent with funding availability. Newly constructed roads designed as four-wheel drive ways will comply with water quality standards. Four-wheel drive ways are exempted from the Highway Standards Act.	
Road Planning Construction and Maintenance	1.	Insure road stability and protection of the environment, except; existing four-wheel drive ways may not be in full compliance with water quality standards. Develop strategies to bring these roads into compliance unless physical conditions preclude complete correction and the road can not be legally closed. Schedule implementation consistent with funding.	a. During transportation planning and road location, incorporate historic, geologic, physiographic, and soils information to locate potential problem areas and to select road locations least likely to cause damage to National Forest Resources. b. Design broad-based dips and ditch outlets so that runoff water will infiltrate soils and erosion will be deposited before reaching stream channels. c. Design and construct access road and skid trail crossings of intermittent streams so as to: not obstruct or impede stream flow; provide crossings with effective structures or ground

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES		GENERAL DIRECTION		STANDARDS
				cover to protect the banks and channel from accelerated erosion. Provide crossings with sufficient water control devices to collect and divert surface flow from the access road or skid trail into undisturbed areas or other control structures to restrain accelerated erosion and prevent visible sediment from entering intermittent streams; and provide crossings with ground cover or other means sufficient to prevent visible sediment from entering intermittent streams within 10 working days of initial disturbance and maintain such cover or structures until the site is permanently stabilized. (NC PPGRWQ Regulations)
Road Planning Construction and Maintenance (continued)	2.	Use Traffic Service Level C or higher construction standards where roads are open to public travel with conventional vehicles or where specialized needs exceed Traffic Service Level D capabilities (Traffic Service Levels are described in Appendix G). In all cases, road grades will not exceed that which, through proper design and maintenance, can not prevent erosion and damage to resources adjacent to the roadbed.	a.	Use the following standards for Traffic Service Level C roads: Design speed: 5-25 mph Width: 12-14 ft. with turnouts. Surface: Gravel as needed to support traffic. Max. sustained grade: 10% Lanes: 1 Min. curve radius: 50 feet Drainage: Outslope or ditch. Max. pitch: 12% for 200 feet.
	3.	Use Traffic Service Level D construction standards where this standard will accommodate the intended use. Except for existing designated four-wheel drive ways, road grades will not exceed that which, through proper design and maintenance, can not prevent erosion and		

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES	GENERAL DIRECTION	STANDARDS
Road Planning Construction and Maintenance (continued)	damage to resources adjacent to the roadbed. Develop strategies to correct resource damage adjacent to the roadbed on designated four-wheel driveways. Schedule implementation consistent with funding availability.	a. Use the following standards for Traffic Service Level D roads: Design speed: 5-10 mph Width: 12-14 feet Surface: Native or gravel as needed to support traffic. Max. sustained grade: 12% Lanes: 1 Min. curve radius: 50 feet Drainage: Outslope or ditch. Max. pitch: 14% for 200 feet.
		b. Use the following standards for Traffic Service Level D, four-wheel drive ways: Design speed: 2-10 mph Width: 6-10 feet Surface: Native rough, irregular, large rocks or boulders, mud, sand, loose materials, obstacles such as logs, some winching may be required. Max. sustained grade: 20-30% for 200-300 feet. Max pitch: 20-40% up to 100 feet Lanes: 1 Template: Existing
	4. Construct temporary roads only for non-recurrent use. Do not plan or permit purchasers to construct temporary roads in lieu of building specified roads needed for future recurrent management of the area.	a. Use the following standards for temporary roads: Width: 12-14 feet Surface: Native or spot surfacing. Max. sustained grade: 12% Lanes: 1 Drainage: Outslope or ditch.

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES	GENERAL DIRECTION	STANDARDS
Road Planning Construction and Maintenance (continued)		Max. pitch 15% for 200 feet. Revegatation of Roadbed: Establish vegetative cover in first seeding season after road closure.
		b. For temporary stream crossings, minimize soil movement through the use of temporary bridges or fords.
	5. Approve temporary road and skid road locations prior to construction.	

APPENDIX VIII

Potential Sources of Funding for Projects to Address Point Sources

Appendix VIII
Potential Sources of Funding for Projects to Address Point Sources

Funding Program	Application	Contact
U.S. Rural Utilities Service: Water and Wastewater Loan and Grant Program	For rural areas and towns up to 10,000 in population who wish to construct, enlarge, extend, or otherwise improve water or waste disposal facilities providing essential service primarily to rural residents and businesses. Applicants must provide evidence that they cannot finance desired facilities at reasonable rates and terms.	Jeff Duval Jefferson, NC (910) 246-2885
Rural Business and Cooperative Service: Rural Business Enterprise Grants	For rural areas and towns up to 50,000 in population to facilitate and support the development of small and emerging private business enterprises. This includes the construction and development of water and sewer facilities. Grants must either create or save jobs.	One of the RECD Rural Development Managers listed under "Rural Utilities Service" serving the area where the project is located.
Appalachian Regional Commission: Supplements to Other Federal Grants in Aid	For public bodies and nonprofit groups located in wester North Carolina to assist in the improvement of water and sewer facilities which will facilitate the creation or retention of industrial and commercial jobs.	Sara Stuckey NC Department of Administration 116 West Jones Street Raleigh, NC 27603-8003 (919) 733-7232
U.S. Economic Development Administration: Public Works and Development Facilities Grant Program	For any public or nonprofit agency to assist communities with funding public works and development facilities that contribute to the creation or retention of primarily private sector jobs and alleviation of unemployment and underemployment.	Dale L. Jones Economic Development Representative P.O. Box 2522 Raleigh, NC 27601 (919) 856-4570
NC Division of Water Quality: Construction Grants and Loans Program	Provides grants and loans to local government agencies for the construction, upgrade, and expansion of wastewater collection and treatment systems.	Bobby Blowe Construction Grants/Loans Section Division of Water Quality P.O. Box 29579 Raleigh, NC 27626-0579 (919) 733-6900
NC Division of Community Assistance: Small Cities Community Development Block Grant	For municipalities and counties (except for 22 entitlement cities and Wake and Cumberland Counties, which receive money directly from U.S. Dept. of Housing and Urban Development) to develop viable communities by providing decent suitable living environments and to expand economic opportunities mainly for persons of low to moderate income. Funds may be used for public water/wastewater activities.	Liz Wolfe or Phyllis Denmark Division of Community Assistance P.O. Box 12600 Raleigh, NC 27605-2600 (919) 733-2850

Appendix VIII
Potential Sources of Funding for Projects to Address Point Sources, continued

Funding Program	Application	Contact
NC Commerce Finance Center: Industrial Development Fund	For counties and their local units of government (with the same exceptions as above) which access the fund on behalf of new or existing manufacturing firms to provide a financing incentive for jobs creation in the state's most economically distressed counties. Funds may be used for a wide variety of repair, renovation, and modification type projects including sewer infrastructure.	Charles Johnson Industrial Finance Specialist 301 N. Wilmington St. P.O. Box 29571 Raleigh, NC 27626-0571 (919) 715-6558
Rural Economic Development Center, Inc.: Supplemental and Capacity Grants Program	*Supplemental Grants* - Provide funds to match federal and other grants that support necessary economic development projects in economically distressed areas. *Capacity Grants* - Enable local governments to acquire short-term capacity for the planning and writing of federal grants that address immediate economic needs.	Johnnie Southerland Senior Associate Wastewater Grants Rural Economic Development Ctr. 1200 St. Mary's Street Raleigh, NC 27605 (919) 715-2725

APPENDIX IX

Potential Sources Of Funding For Projects To Address Nonpoint Sources

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
NC Agriculture Cost Share Program for NPS Pollution Control (NCACSP)	**Agriculture:** Provides up to 75% cost-share, as well as technical assistance, for practices that protect water quality in agricultural areas.	Donna Moffit NC Division of Soil and Water Conservation (919) 715-6107
Environmental Quality Incentives Program (EQIP)	**Agriculture:** Establishes conservation priority areas -- agricultural lands with significant water, soil, and related natural resource problems. Provides 5 to 10 year contracts to pay up to 75% of the cost of conservation practices such as manure management systems, IPM, and erosion control. USDA also provides technical assistance.	Tim Jones USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-2867
Conservation Reserve Program (CRP)	**Agriculture:** Payments to farmers who voluntarily take highly erodible land out of production for at least ten years. Annual rental payments along with 50% cost-share for establishment of permanent cover (grass, trees).	Tim Jones USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-2867
Emergency Conservation Program	**Agriculture:** Provides technical assistance and direct cost-share payments for agricultural producers who, without federal assistance, cannot rehabilitate their private farm land after a natural disaster. Payments are limited to 64% of the first $62,400, 40% of the second $62,400, and 20% of the cost above $125,000.	Tim Jones USDA - Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-2867
Farm Debt Cancellation-Conservation Easement Program	**Agriculture:** Farm Service Agency credit borrowers who have loans secured by real estate and have qualifying land may be given debt cancellation on outstanding loan balances in exchange for conservation easements. The cancellation may not exceed 33% of the principal for current borrowers, or the fair market value of the easement for delinquent borrowers.	Mickey Cochran USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-3057

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
Interest Assistance Program	**Agriculture:** Provides guaranteed loans to, among other things, enhance and protect land and water resources -- including pollution abatement and control. Eligible recipients include farm owners/operators who are unable to obtain financing at reasonable rates or rates that allow them to maintain a positive cash flow.	Mickey Cochran USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-3057
Wetland Reserve Program (WRP)	**Agriculture:** Allows farmers to sell permanent wetland easements to USDA. Also cost-share to restore altered wetlands to natural condition. Eligible land includes prior converted cropland, farmed wetlands, riparian areas along streams or water courses that link protected wetlands.	USDA - Natural Resources Conservation Service Contact your local conservationist.
Small Watershed Program, PL-566	**Agriculture:** Technical and financial assistance for projects protecting and developing small watersheds. Historic emphasis on flood control, program now requires off-site water quality benefits.	Carroll Pierce NC Division of Soil and Water Conservation (919) 715-6110
GTE Foundation	**Education:** Supports projects improving math and science for underrepresented groups.	GTE Foundation GTE Corporate Communications One Stamford Forum Stamford, CT 06904 (203) 965-3620
Toyota TAPESTRY Grants	**Education:** Supports innovative science education by teachers in environmental education and physical science.	Eric Crossley National Science Teachers Assoc. Toyota Tapestry 1840 Wilson Blvd. Arlington, VA 22201-3000 (703) 312-9258
Toshiba America Foundation	**Education:** Supports secondary school science and math education.	John Sumansky Toshiba America Foundation 1251 Avenue of the Americas Suite 4100 New York, NY 10020 (212) 596-0600
Digital Equipment Corporation	**Education:** Supports science and math education through school-based and community-linked organizations.	Programs Manager Corporate Contributions Programs Digital Equipment Corp. 110 Powder Mill Rd. MSO 1/L14 Maynard, MA 01754-1418 (508) 493-6550

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
National Environmental Education and Training Foundation (NEETF)	**Education:** Provides funds for environmental education projects that foster informed decision-making, target adults and adolescents in informal educational settings, and address environmental issues affecting health. Require at least a 50% cash match provided by a non-federal source other than the award recipient.	NEETF 915 Fifteenth St. NW Suite 200 Washington, D.C. 20005 (202) 628-8200
National Research Initiative Competitive Grants Program	**Research:** Supports research on key problems of national and regional importance in biological, environmental, physical, and social science relevant to agriculture, food, and the environment, including assessment and protection of water resources. Scientists at public and private agencies and universities are eligible.	USDA - CSREES National Research Initiative Competitive Grants Program Room 323, Aerospace Center AG Box 2241 Washington, DC 20250-22441 (202) 401-5022 (Request for proposals published annually in the *Federal Register*.)
Environmental Contaminants - Identification and Assessment	**Research:** Provides short and medium duration studies/investigations of contaminant exposure and effect to individuals and organizations with a need for such information. Applicants must provide matching funds or in-kind services	Tom Ausperger US Fish and Wildlife Service P.O. Box 33726 Raleigh, NC 27636-3627 (919) 856-4520
Environmental Contaminants - Prevention	**Research:** Provides technical and engineering support to prevent contaminant problems. No direct financial assistance is provided.	Tom Ausperger US Fish and Wildlife Service P.O. Box 33726 Raleigh, NC 27636-3627 (919) 856-4520
Environmental Geochemistry and Biogeochemistry Research Program	**Research:** Supports interdisciplinary research on how chemical and biological processes in nature alter water quality. A minimum 1% cost-share is required. Eligible recipients are scientists, engineers, and educators at universities and other not-for-profit institutions.	National Science Foundation Division of Earth Sciences Director, Environmental Chemistry and Geochemistry Program 4201 Wilson Blvd. Arlington, VA 22230 (703) 306-1554
Hydrologic Science Research Program	**Research:** Supports research in hydrologic science on the quality of waters in streams and aquifers. A minimum 1% cost-share is required. Eligible recipients are scientists, engineers, and educators at universities and other not-for-profit institutions.	National Science Foundation Division of Earth Sciences Director, Hydrologic Sciences Program 4201 Wilson Blvd. Arlington, VA 22230 (703) 306-1549

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
Water and Watersheds Research Program	**Research:** A joint NSF/EPA special awards program to support interdiciplinary teams joining the physical, biological, and socioeconomic sciences and engineering in research on water quality issues. A minimum 1% cost-share is required. Eligible recipients are scientists, engineers, and educators at universities and other not-for-profit institutions.	National Science Foundation Directorate for Biological Sciences Executive Officer 4201 Wilson Blvd. Arlington, VA 22230 (703) 306-1400
Flood Plain Management Services	**Water Quality Planning:** Provides invormation and data on floods and actions to reduce flood damage to local governments.	U.S. Army Corps of Engineers, Planning Division Directorate of Civil Works, Chief Flood Plain Management Services 20 Massachusetts Ave., NW Washington, D.C. 20314-1000 (202) 761-0169
Resource Conservation and Development Program	**Water Quality Planning:** Provides funds and technical assistance to local governments and nonprofits to plan, develop, and implement programs for resource conservation and community sustainability.	Stan Steury RC&D Executive Director Blue Ridge RC&D Council, Inc. P.O. Box 2 Boone, NC 28607 (704) 265-4005
River Basin Surveys and Investigations	**Water Quality Planning:** Provides planning assistance to local agencies to develop coordinated water and relanted land resource programs, with priority given to solving upstream flooding of rural communityies, improving water quality from agricultural nonpoint sources, abd wetland preservation, etc.	USDA, Natural Resources Conservation Service Director, Watersheds and Wetlands Division P.O. Box 2890 Washington, D.C. 20013 (202) 720-3534
Soil and Water Conservation Program	**Water Quality Planning:** Provides technical assistance to local governments for resource planning and management to improve water quality and reduce pollution.	USDA, Natural Resources Conservation Service Contact your local conservationist
Watershed Protection and Flood Preventions (Small Watershed Program)	**Water Quality Planning:** Provides monitoring, loans, cost-share, and technical assitance for the installation of land treatment measures. Provides up to 100% of the cost of structural flood prevention measures. Eligible agencies include local government, nonprofits, and SWCDs.	USDA, Natural Resources Conservation Service Contact your local conservationist.

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
Rivers, Trails, and Conservation Assistance Program	**Water Quality Planning:** Provides technical assistance for assessing resources, identifying land protection strategies, and developing organizations to address environmental concerns.	Mary Rountree Great Smokey Mountains Nat. Park 107 Park Headquarters Gatlinburg, TN 37738-4102 (423) 436-1246
Section 205(j) Water Quality Planning Grants	**Water Quality Planning:** Provides funds for planning activities such as developing plans for meeting and maintaining local water quality standards, implementing such plans, and determining the nature, extent, and causes of water quality problems.	Alan Clark Division of Water Quality Planning Branch P.O. 29535 Raleigh, NC 27607 (919) 733-5083 ext. 570
NC Division of Water Resources Stream Repair Funding	**Stream Restoration:** Provides cost-share funds and technical assistance in stream restoration projects to local governments.	Jeff Bruton Division of Water Resources P.O. Box 27687 Raleigh, NC 27611-7687 (919) 733-4064
Forestry Stewardship Incentive Program	**Forestry:** Up to 50% cost-share (max $7,500/person-yr) to enhance management of nonindustrial private forest lands to increase timber supply and improve fish and wildlife habitat and recreation.	Larry Such NC Division of Forest Resources P.O. Box 29581 Raleigh, NC 27626 (919) 733-2162 ext. 241
Forestry Incentives Program	**Forestry:** Up to 50% funding for tree planting and stand improvement to increase supplies from nonindustrial private forest lands.	Larry Such NC Division of Forest Resources P.O. Box 29581 Raleigh, NC 27626 (919) 733-2162 ext. 241
Rural Abandoned Mine Program	**Reclamation:** Direct payments of up to 100% in cost-share funds for conservation practices determined to be needed for reclamation, conservation, and development of up to 320 acres per owner of rural abandoned coal mine land or lands and waters affected by coal mining.	USDA, Natural Resources Conservation Service Contact your local conservationist.
Environmental Contaminants -- Natural Resource Damage Assessment	**Reclamation:** Provides funding for the assessment of damage to water quality and Trust resources from oil spills and/or other hazardous substance releases for individuals or organizations interested in the restoration of fish and wildlife, including aquatic habitat and water quality.	Tom Ausperger US Fish and Wildlife Service P.O. Box 33726 Raleigh, NC 27636-3627 (919) 856-4520

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
NC Conservation Tax Credit Program	**Land Conservation:** Allows credit against individual and corporate income taxes when real property is donated for conservation purposes. Interests in property that promote fish, wildlife, etc. conservation purposes may be donated to a qualified recipient for a substantial tax credit (currently 25% of the value of the gift up to $25,000).	Bill Flournoy NC DEHNR (919) 715-4191

APPENDICE X

Section 303(d) of the Clean Water Act

APPENDIX X

List of 303(d) Waters in the Hiwassee River Basin

What is the 303(d) list?

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses. Waters may be excluded from the list if existing control strategies for point and nonpoint source pollution will achieve the standards or uses. Waterbodies which are listed must be prioritized, and a management strategy or total maximum daily load (TMDL) must subsequently be developed for all listed waters.

303(d) List Development

The 305(b) report was used as a basis for developing the 303(d) list. Section 305(b) of the CWA requires states to report biennially to the U.S. Environmental Protection Agency (EPA) on the quality of waters in their state. In general, the report describes the quality of the state's surface waters, groundwaters, and wetlands, and existing programs to protect water quality. Information on use support, likely causes (e.g., sediment, nutrients, etc.) and sources (point sources, agriculture, etc.) of impairment are also presented in the report.

Many types of information were used to make use support assessments and to determine causes and sources of use support impairment. Chemical, physical, and biological data were the primary sources of information used to make use support assessments. North Carolina has an extensive ambient and biological monitoring network throughout the state. Benthic macroinvertebrate data which indicate taxa richness of pollution intolerant groups are an important data source. North Carolina also collects fish tissue and fish community structure data and phytoplankton bloom data that are used in the assessments. In addition, fish consumption advisories, information from other agencies, workshops, and reports, predictive modeling results, toxicity data, and self monitoring data is considered when making final use support determinations. Data from all readily available sources are used when the Division's standard operating procedures are followed when collecting and analyzing data. In the Hiwassee River Basin, the Tennessee Valley Authority (TVA) has collected data. Their data collection and analysis methods differ from DWQ's, and therefore their data were not used to determine final use support. However, the results of their sampling are summarized in Section 4.2.8. DWQ will use their data to help determine future sampling sites. For example, if TVA data show impairment, DWQ will try to monitor that waterbody to see if our data also indicate impairment. DWQ will also work with TVA to choose reference sites that both agencies believe have high quality. These sites will then be sampled to determine if similar results are obtained from each agency. Overlap sampling may also occur at other sites throughout the basin.

The list also includes probable problem parameters. Where the list has no problem parameter listed, the use support rating was based on biological data, and available chemical data showed no impairment. It should be noted that where a problem parameter has been identified, the water quality standard for that parameter was exceeded. This parameter is a potential cause of the impairment, but there may be other unidentified causes contributing to the impairment as well.

Only those waterbodies whose use support rating were not supporting (NS) or partially supporting (PS) in the 305(b) report were considered as candidates for the 303(d) list. Of those waterbodies that showed impairment (PS or NS rating) only those waterbodies that had a use support rating based on monitoring data collected in the last five years were

included on the 303(d) list. Since many changes can occur within a watershed in a five year period, conclusive information about a waterbody's use support cannot be made with older data. However, North Carolina will be collecting information on as many of these evaluated waterbodies as staffing and time permit for subsequent updates of the basin plan and 303(d) list. As more conclusive information on streams rated using older data or best professional judgment is obtained, evaluated waterbodies will be added to the list if the data indicate impairment. Finally, those waterbodies which were rated as NS or PS were then examined to determine if there were management strategies in place. If so, the streams were eliminated from the list. Management strategies that were considered included the following:

1. Miscellaneous nonpoint programs - Any waterbodies where DWQ was aware of nonpoint management studies (e.g. 319 or similar program) were eliminated if nonpoint sources were the only problem.

2. Point sources - All waters where point sources were the only problem were eliminated if the facility was under SOC, under schedule for removal, recently upgraded, or some other strategy was in place.

No waterbodies were dropped from the Hiwassee River Basin 303(d) list because management strategies were already in place.

Changes in the Hiwassee River Basin's 303(d) list from earlier lists are based on updated chemical and biological monitoring results. Both Brasstown Creek and Valley River were added to the list based on biological data collected in 1994 that resulted in fair ratings. The streams that were listed on the previous 303(d) list for the Hiwassee River Basin but omitted from this list were included on the old list due to information collected at a workshop in Asheville in the 1980s. No new monitoring data were collected on these waterbodies. If future data indicate impairment, the streams will be added to the list.

This listing process resulted in two waterbodies on the Hiwassee River Basin 303(d) list, and they are shown on Table A - X.1. Any stream included on the list must be prioritized for management strategy or total maximum daily load (TMDL) development. In part, the prioritization must be based on the degree of impairment and the uses of the waterbodies. Both waterbodies are rated as partially supporting; thus they have fairly equivalent degrees of impairment. One water was rated as a water supply, and could therefore impact human health as well as aquatic life, while the other waterbody is classified for aquatic life protection and as a habitat for trout. The waterbody that is in a water supply water was therefore rated as medium while the remaining waterbody was rated as low. No waterbodies were given a high priority due to a lack of conclusive information on the causes and sources of impairment and to other higher priority waters in need of management in other areas of the state where more definitive information on the causes and sources is known.

In addition, monitored streams that are fully supporting their uses but may be threatened were also examined, but none of these waters were added to the list at this time.

Additional Guidance on Using the 303(d) List

The column headings in the 303(d) list refer to the following:

Class - The information in this column indicates the classification assigned to the particular waterbody. Stream classifications are based on the existing and anticipated best usage of the stream as determined through studies and information obtained at public hearings. The

stream classifications are described in 15A NCAC 2B .0300, and a copy of the pertinent pages of these regulations is attached in Appendix II. (Note: The abbreviation Tr refers to trout water).

Wtrbdy - This is the North Carolina subbasin in which the waterbody is located. The NRCS 14 digit hydrologic units nest within the DWQ subbasins.

Problem Parameter - These are the causes of impairment as identified in the 305(b) report. No streams had an identified problem parameter in the Hiwassee River Basin as the ratings were based on benthic data, and available chemical data showed no impairment.

Rating - This column lists the overall use support rating. These values may be NS (not supporting), PS (partially supporting), and ST (supporting but threatened). The 305(b) report describes these use support ratings further.

Major (P,NP) - This column indicates whether point (P) or nonpoint (NP) sources are the major sources of impairment.

Subcategory - This column breaks the point and nonpoint sources down further. A summary of the subcategory codes is provided in the attachment at the end of this appendix.

Priority - This column indicates the priority the waterbody is given for TMDL development.

Table A - X.1 303(d) LIST FOR THE HIWASSEE RIVER BASIN

Name of Stream	Description	Class	Wtrbdy	Problem Parameters	Overall Rating	Basis	Major Sources (P,NP)	Subcategory	Priority
Brasstown Creek	From North Carolina-Georgia State	WS-IV	40501		PS	M			Medium
Valley River	From off US 19, nr Rhodo, to ab landfill	C Tr	40502		PS	M			Low

APPENDICE XI

Hiwassee River Basin Workshop Comments

Hiwassee River Basinwide Planning Workshop

November 8, 1995, 6:30 to 9:00 pm

Tri-County Community College, Murphy, NC

Sponsored by the North Carolina Cooperative Extension Service, North Carolina Division of Environmental Management, and North Carolina League of Municipalities

The North Carolina Division of Environmental Management will present water quality information being used to develop the Hiwassee River Basinwide Water Quality Management Plan. It will specify how point and nonpoint sources of water pollution will be addressed over the next 5 years in the Hiwassee River Basin, which includes most of Cherokee and Clay Counties. Workshop participants will have the opportunity to ask questions and provide feedback to improve the final Hiwassee River Basinwide Management Plan.

Workshop Objectives:

1. Describe local implications of the Hiwassee River Basinwide Management Plan; and
2. Increase public awareness and involvement in developing and implementing the Basinwide Management Plan.

Who Should Participate:

Elected officials, town and county managers, planners, public service agency staff, landowners, farmers, business people, developers, community leaders, and private citizens in the Hiwassee River Basin.

Contact For More Information:

Allen Caldwell, Cooperative Extension Director, Cherokee County (704-837-2210) and Clay County (704-389-6301)
Greg Jennings, NC State University, 919-515-6795
Alan Clark, NC Division of Environmental Management, 919-733-5083
Paula Thomas, NC League of Municipalities, 919-715-4000

THERE IS NO REGISTRATION FEE.

Hiwassee River Basin Public Workshop

Murphy, NC
November 8, 1995

Participants (approximatley 40) were asked to: 1) identify the priority issues for the Hiwassee River basin, and 2) recommend management actions that should be taken to resolve the priority issues. Ideas expressed by workshop attendees included:

- We have enough regulation already
- Government misrepresentation
- What is the roll of FEMA in water quality management?
- Where to draw the line between State protected waters and private property?
- Wetland definition and property rights
- Tourism vs. local water users
- Who decides which species are endangered and where are they?
- Can the State do more to clean up sewage treatment water?
- Rules are not enforced equally
- Beaver control
- Cherokee County landfill
- How are setbacks around water supplies and streams chosen?
- Future water resources
- Why can't we sample all streams?
- NPDES program concerns: toxics, individual permits
- Contradictions: trying to protect water vs. herbicide sprayed for vegetative control
- Airports are sited too close to rivers and lakes
- Control pollution from factories and not individuals
- Include Georgia in the process
- Utilize a voluntary approach
- Let counties control their own affairs
- Let courts resolve disputes
- Coordinate all government agencies - set example for private sector
- Proactive vs. Reactive management
- Delivery of the message; marketing of the basinwide approach; effective communication

In addition to the workshop comments, the Hiawassee Watershed Coaltion submitted the following comments expressing their perception of the priority issues for the basin:

<u>NPS Issues</u>
Development, improper access road/water control
Logging, forest harvest
Agricultural
Streambank erosion
Quarry (Crooked Creek)

<u>Wastewater</u>
Faulty spetic
Municipal sewer inadequacies

<u>Subbasin Priority</u>
Brasstown Creek
Nottely River
Tusquittee Creek (floodplain development)