Catawba River

Basinwide Water Quality Plan

September 2004

Division of Water Quality
Water Quality Section

North Carolina Department of Environment and Natural Resources

Catawba River Basinwide Water Quality Plan

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Prepared by:
Dave Toms
Dave.Toms@ncmail.net

NC Department of Environment & Natural Resources
Division of Water Quality – Planning
1617 Mail Service Center
Raleigh, NC 27699-1617

(919) 733-5083, ext. 577

This Document was approved by the NC Environmental Management Commission on September 9, 2004 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 Catawba River basin. This plan is the second five-year update to the Catawba River Basinwide Water Quality Plan approved by the NC Environmental Management Commission in February 1995.

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North Carolina's Basinwide Approach to Water Quality Management

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. The NC Division of Water Quality (DWQ) prepares basinwide water quality plans for each of the 17 major river basins every five-years. While these plans are prepared by the DWQ, implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholders in the state.

The goals of basinwide planning are to:

- Identify water quality problems and restore full use to Impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies.
- Assure equitable distribution of waste assimilative capacity.
- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

The first basinwide plan for the Catawba River basin was completed in 1995 and the second in 1999. This 2004 *Catawba River Basinwide Water Quality Plan* is the third five-year update. The format of this plan was revised in response to comments received during the first and second planning cycles. DWQ now places greater emphasis on more detailed information specific to the Catawba River basin's watersheds. A greater emphasis was placed on identifying causes and sources of pollution for individual streams in order to facilitate local restoration efforts.

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

Catawba River Basin Overview

The Catawba River basin, along with the Broad River basin, forms the headwaters of the Santee-Cooper River system. This river system begins on the eastern slopes of the Blue Ridge Mountains in NC, flows through the NC piedmont to the NC-SC border near Charlotte, and continues to flow through South Carolina to the Atlantic Ocean.

The basin contains the Linville River, one of only four state designated Natural and Scenic Rivers. The mainstem of the Catawba River is regulated by a series of seven hydropower reservoirs: Lake James, Lake Rhodhiss, Lake Hickory, Lookout Shoals Lake, Lake Norman, Mountain Island Lake and Lake Wylie. Lake Wylie crosses the border of NC and SC. There are 3,048 miles of named and classified freshwater streams and over 50,000 freshwater impoundment acres within the NC portion of the basin.

Surface Water Classifications and Use Support Assessments

Use support assessments based on surface water classifications form the foundation of this basinwide plan. Surface waters are classified according to their best-intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Use support methodology has changed significantly since the 1999 revision of the Catawba River Basinwide Water Quality Plan.

1. In the 1999 basinwide plan use support assessments, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. *The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance* issued by the EPA requested that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting, Impaired, Not Rated or No Data. These ratings refer to whether the classified uses of the water (such as water supply, aquatic life and primary/secondary recreation) are being met.

2. Use support methods have been developed to assess ecosystem health and human health risk through the development of use support ratings for five categories: aquatic life, fish consumption, recreation, shellfish harvesting and water supply. These categories are tied to the uses associated with the primary classifications applied to NC rivers, streams and lakes. A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*. Detailed information on use support methods is provided in Appendix III and summary tables in Section A, Chapter 3.

Notable Themes in the 2004 Catawba River Basinwide Water Quality Plan

The varied nature of the topics discussed below demonstrates the wide range of stressors leading to water quality degradation in the Catawba River basin. In most cases of documented water quality declines, a combination of many stressors has produced general habitat degradation (see Section A, Chapter 4, Part 4.13). Very rarely can water quality declines be attributed to a single pollutant. In some way, every person, industry, farm and municipality in the basin impacts water quality. Therefore, every resident of the basin must play a role in management strategies designed to protect and restore the streams, lakes and rivers in the basin.

Population Growth and Urbanization

Pressure from a rapidly expanding human population is the driving force behind water quality degradation in the Catawba River basin. The overall population of the basin, based on the percent of the counties that are partially or entirely in the basin, is 1,170,512. This makes the Catawba River basin the most populated river basin in the state. The basin population is expected to grow by more than 696,000 people by 2020. Population growth for the basin as a whole, from 1990 to 2000, is estimated at 18.5 percent, the fastest growing basinwide population in the state. The estimated population density is 356 persons/square mile, versus the average statewide population density of 163 persons/square mile, making this also the most densely populated basin in the state.

The expanding population is accompanied by an increase in urban and built-up land cover that increases the rate and intensity of polluted stormwater runoff. In the Catawba River basin, urban and built-up land increased by 52.0 percent from 1982 to 1997 according to the Natural Resources Inventory. Land cover is discussed in detail in Section A, Chapter 2, Part 2.5.

The impacts on rivers, lakes and streams as development surrounding metropolitan areas consumes neighboring forests and fields can be significant and permanent if stormwater runoff is not controlled. Greater numbers of homes, stores and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

The current effects of this growth on water quality can be seen in the map of Impaired streams in the Catawba River basin (Figure A-3). Sparsely developed watersheds and those contained in the national forests of the northwestern portion of the basin generally contain streams with high water quality, excellent aquatic species populations, and are supporting their designated uses. Water quality declines dramatically in streams in the central and southern watersheds, where urbanization is focused around urban centers and interstate corridors.

Population growth trends and the accompanying impacts to water quality are discussed in Section A, Chapters 2 and 4.

Reducing Stormwater Runoff Impacts
Stormwater runoff is a primary carrier of nonpoint source pollution in both urbanized and rural areas. The impact of stormwater runoff is particularly severe in developing areas where recently graded areas are highly susceptible to erosion, and urbanized areas where stormwater runoff is rapidly channeled through curb and gutter systems into nearby streams.

There are many different stormwater programs administered by DWQ. One or more of these programs affect many communities in the Catawba River basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Local governments that are or may be affected by these programs are presented in Table A-27.

The Importance of Local Involvement
As the Basinwide Planning Program completes its third cycle of plan development, there are many efforts being undertaken at the local level to improve water quality. The Division of Water Quality encourages local agencies and organizations to learn about these efforts and determine

how similar programs may be implemented in their own watersheds. Funding organizations are also encouraged to seek out these programs and support them whenever possible.

Local organizations and agencies are able to combine professional expertise and local knowledge not present at the state and federal level. This allows groups to holistically understand the challenges and opportunities of local water quality concerns. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests and encourages others to become involved and invested in these projects. Working in cooperation across jurisdictional boundaries and agency lines opens the door to additional funding opportunities and eases the difficulty of generating matching or leveraged funds. This will potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of local efforts is key to water quality improvements, and DWQ applauds the foresight and proactive response by locally based organizations and agencies to potential water quality problems. There are many excellent examples of local agencies and groups using these cooperative strategies throughout the state. Please refer to Section C, Chapter 1, Parts 1.4 and 1.5 for a discussion of local initiatives already underway in the Catawba River basin.

Chain Lakes Management Challenges

One of the most prominent hydrologic features of the Catawba River basin is the series of Duke Power hydropower impoundments along the river's mainstem, widely referred to as the Catawba River Chain Lakes (Figure A-4). This chain-like configuration presents a unique challenge to water quality management. The outflows from upstream reservoirs, as well as inputs from the surrounding watershed and direct discharges to the lakes themselves, influence the water quality in each impoundment. Therefore, water quality issues in a particular impoundment cannot be addressed without first considering the influence of watershed conditions, upstream water quality, and releases from upstream reservoirs. Downstream impacts must also be evaluated before any management decisions are implemented.

Impacts to water quality can also be magnified by the presence of a reservoir. Dams significantly slow the flow of water and create conditions not present in riverine systems. These conditions increase nutrient availability and give algae more time to grow. In theory, a reservoir may suffer the symptoms of excessive nutrient and sediment inputs, while a river receiving the same level of pollutants may not. In this case, the river may be moving pollutants quickly downstream, thus, preventing localized water quality problems. Similarly, two reservoirs receiving the same pollutant load may not exhibit the same symptoms. For example, one reservoir may have many small, isolated coves that allow algae to grow for extended periods of time, while another reservoir may simply act like a wide, slow-flowing portion of a river with a continuous exchange of water and minimal algal growth.

In some ways, the prosperity enjoyed by this area of North Carolina can be linked to the presence of these dams. In addition to power generation, the lakes are now popular recreational areas and provide drinking water to the local population. The lakes are also contributing to a recent economic expansion as new residents seek lakefront housing. For statistics on the lakes, see Table A-14.

Unfortunately, several of the Catawba Chain Lakes are suffering impacts from a number of stressors. Table 1 provides a brief summary of primary stressors affecting the impoundments. The cumulative effects of these stressors have resulted in nutrient enrichment impairment of Lake Rhodhiss and Lake Wylie. The stressors leading to these impairments are many and varied and the management strategies necessary to restore them must be equally broad in scope. Detailed discussion of these lakes can be found in Section A, Chapter 4, Part 4.7.

Table 1 Lake Stressor Summary

Assessment Parameter	Lake James	Lake Rhodhiss	Lake Hickory	Lookout Shoals	Lake Norman	Mountain Island	Lake Wylie
% Saturation DO	N	**Y**	**Y**	**Y**	N	N	**Y**
Algae	N	**Y**	**Y**	N	N	N	**Y**
Chlorophyll *a*	N	**Y***	N	N	N	N	**Y**
pH	N	**Y**	N	N	N	N	N
Sediment	N	**Y**	**Y**	N	N	**Y**	N
Taste & Odor	N	**Y**	**Y**	N	N	N	N
Macrophytes	**Y**	N	**Y**	**Y**	**Y**	**Y**	N

"**Y**" Indicates parameter is noted within the impoundment.
* Standard exceeded in less than 10% of readings.

Hydropower Relicensing

Part I of the Federal Power Act (FPA) requires that Duke Power's Catawba-Wateree Project has a license in order to operate. Relicensing is the process for obtaining a new license for a hydro project after the existing license expires. Duke Power's current license for the project was issued in 1958 and will expire in 2008.

The FPA provides the Federal Energy Regulatory Commission (FERC) exclusive authority to license all nonfederal hydro projects that are located on navigable waterways or federal lands. Licenses are normally issued for a period of 30-50 years and contain conditions that regulate project operations. To continue to operate project facilities after the expiration of an existing license, a licensee must obtain a new license for its project.

The conditions in the new license are expected to change the way these hydro stations and reservoirs are operated, primarily via rebalancing how the limited water supply is utilized. Changing how this finite resource is used will benefit some interests and negatively impact others. The final decision as to the terms and conditions of the new license is almost exclusively reserved to the FERC and certain government resource agencies, including DWQ through the 401 Certification process, with mandatory conditioning authority. However, there are many opportunities for other organizations, governmental entities and individual stakeholders to substantially influence these decisions. In the end, Duke Power hopes to obtain a new license to operate the project in a manner that comprehensively balances the use of the resource in the best overall public interest (Duke Energy Corporation, 2003).

Challenges Related to Achieving Water Quality Improvements

The long-range mission of basinwide planning is to provide a means of addressing the complex problem of planning for increased development and economic growth while maintaining, protecting and enhancing water quality and intended uses of the Catawba River basin's surface waters. Within this basinwide plan, DWQ presents management strategies and recommendations for those waters considered Impaired or that exhibit some notable water quality problems.

To achieve the goal of restoring Impaired waters throughout the basin, DWQ must work more closely with other state agencies and stakeholders to identify and control pollutants. The costs of restoration will be high, but several programs exist to provide funding for restoration efforts. These programs include the Clean Water Management Trust Fund, the NC Agricultural Cost Share Program, the Ecosystem Enhancement Program, and the federally funded Environmental Quality Incentives Program, among many others.

Due to increasing development, there are significant challenges that must be faced in balancing economic growth with the protection of water quality in the Catawba River basin. Point source impacts on surface waters can be measured and addressed through the basinwide planning and permitting processes. Nonpoint sources of pollution can be identified through the basinwide plan, but actions to address these impacts must be taken at the local level. Such actions should include: development and enforcement of local erosion control ordinances; requirement of stormwater best management practices for existing and new development; development and enforcement of buffer ordinances; and land use planning that reduces impacts on natural resources. This basinwide plan presents many water quality initiatives and accomplishments that are underway within the basin. These actions provide a foundation on which future initiatives can be built.

General Nonpoint Source Recommendations

Below is a list of potential management strategy components that should be applied in some combination to restore any impaired water and protect unimpaired waters in the basin. Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how the aquatic community will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management approach is implemented. There is no silver bullet restoration strategy that can be applied to all degraded waters. DWQ encourages adaptive management strategies that can be adjusted to fit the characteristics of a degraded waterbody and feasibility requirements for the individuals and organizations implementing it. The extremely high restoration cost estimates listed below serve notice to the importance of protecting unimpaired waterbodies so that restoration is not necessary.

Actions one through five are important to restoring and sustaining aquatic communities in a watershed, with the first three recommendations being the most important.

1. **Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development** (increased stormwater volumes and increased frequency and duration of erosive and scouring flows).

This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.

   a. Over the short-term, currently feasible retrofit projects should be identified and implemented.
   b. In the longer term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
   c. Priorities should include evaluating the retrofit potential of existing instream impoundments.
   d. Grant funds for these retrofit projects may be available from EPA initiatives, such as Section 319 funds or the North Carolina Clean Water Management Trust Fund.

2. **A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods.** As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:
   a. Implementation of available BMP opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
   b. Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and effectiveness of source reduction practices.
   c. Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
   d. Development and implementation of a broad set of source reduction activities focused on: reducing nonstorm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.
3. **Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat.** Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would probably be advantageous to implement retrofit BMPs before embarking on stream channel restoration, as restoration is probably best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt et al., 2002; and Weinkam et al., 2001). Grant funds for these retrofit projects may be available from federal sources, such as EPA's Section 319 funds or state sources including North Carolina Clean Water Management Trust Fund.
4. Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading and its impacts to some extent. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting BOD and nutrient removal at appropriate sites.
5. Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.
6. Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may be beneficial.

7. Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:
   a. redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters;
   b. protecting existing woody riparian areas on all streams;
   c. replanting native riparian vegetation on stream channels where such vegetation is absent; and reducing and properly managing pesticide and fertilizer use.

DWQ plans to further evaluate Impaired waters in the Catawba River basin in conjunction with other agencies that address nonpoint source pollution issues and develop management strategies for a portion of these Impaired waters for the next *Catawba River Basinwide Water Quality Plan* (2009).

Point Source Pollution
For streams degraded by point source pollution, this plan presents a management strategy to reduce the impacts from that pollutant source. As a standard permitting policy, DWQ does not allow new nutrient loads from point sources to Impaired waters until a TMDL is complete for that waterbody. In addition, applications for new or expanding nutrient discharges to all mainstem reservoirs in the Catawba River basin must be accompanied by an analysis of nutrient related impacts using a DWQ approved nutrient response model for the receiving reservoir.

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

Section 303(d) of the Clean Water Act requires states to identify waters not meeting the criteria determined by their designated uses. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. EPA issued guidance in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list within 8-13 years.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list when water quality designated uses are attained. In other cases, the new data will show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality designated uses are met. Currently, there are 77 waters listed on the *North Carolina's 2002 Integrated 305(b) and 303(d) Report* in the Catawba River basin. These waters were listed for a variety of stressors including: turbidity, fecal coliform and copper contamination, habitat degradation and unknown causes.

Assessment of Water Quality in the Catawba River Basin

Biological, chemical and physical monitoring data collected between September 1997 and August 2002 were used to assign use support ratings in this basin.

Aquatic Life
The aquatic life use support category is applied to all waters in North Carolina. Therefore, this category is applied to all 3,048.3 freshwater miles and 50,764.2 freshwater acres in the Catawba River basin. Approximately 24.5 percent of stream miles (746.0 miles) and 100.0 percent of freshwater acres (50,764.2 acres) were monitored. There were 174.2 (23.4%) Impaired stream miles and 5,868.1 (11.6%) Impaired freshwater acres.

Fish Consumption
Like the aquatic life use support category, the fish consumption category is also applied to all waters in the state. Fish consumption use support ratings are based on fish consumption advice or specific advisories issued by the NC Department of Health and Human Services (NCDHHS). If a limited fish consumption advice, advisory or a no consumption advisory is posted at the time of use support assessment, the water is rated Impaired.

The NCDHHS has developed regional fish consumption advice (all waters south and east of I-85) for certain fish species shown to have elevated levels of mercury in their tissue. Only a small portion of the Catawba River basin lies south of I-85 (lower Mecklenburg, Union and Gaston counties). Due to the presence of dams that impede fish travel throughout the Catawba River basin, only those waters draining to and entering the mainstem Catawba below I-85 and are not impeded by dams are considered Impaired/Evaluated. Thus, 704.0 miles and 4,395 acres are impaired in the Catawba River basin. All other waters are rated No Data. Because this impairment is based on regional advice rather than site specific data, these waters will not appear on the 303(d) per EPA guidance.

Recreation
Like the aquatic life use support category, the recreation category is also applied to all waters in the state. Approximately 7.7 percent of stream miles (235.1 miles) and 81.3 percent of freshwater acres (41,255.1 acres) were monitored by DWQ. There were 24.4 stream miles and no freshwater acres Impaired in the recreation use support category.

Water Supply
There are 997.7 stream miles and 47,081.9 currently classified for water supply in the Catawba River basin. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment consultants.

Impaired Waters
The Table 2 presents Impaired waters (in all categories) in the Catawba River basin that were monitored by DWQ within the last five years. The use support category for which a waterbody is Impaired is indicated in the table. Descriptions of Impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each waterbody are discussed in detail in the appropriate subbasin chapter. Maps showing current use support ratings for waters in the Catawba River basin are presented in each subbasin chapter in Section B.

Table 2 Monitored Impaired Waters within the Catawba River Basin (as of 2003)

Name	Assessment Unit	Class	Subbasin	Miles	Acres	Category
Youngs Fork (Corpening Creek)	11-32-1-4b	C	03-08-30	1.9		Aquatic Life
Youngs Fork (Corpening Creek)	11-32-1-4a	C	03-08-30	3.6		Aquatic Life
Jacktown Creek	11-32-1-4-1	C	03-08-30	2.4		Aquatic Life
North Fork Catawba River	11-24-(2.5)b	B- TR	03-08-30	3.5		Aquatic Life
Irish Creek	11-35-3-(2)b	WS-III	03-08-31	3.0		Aquatic Life
Hunting Creek	11-36-(0.7)	WS-IV	03-08-31	7.4		Aquatic Life
CATAWBA RIVER (Rhodhiss Lake below elevation 995)	11-(37)	WS-IV & B CA	03-08-31		1,848.5	Aquatic Life
Lower Creek	11-39-(0.5)a	C	03-08-31	8.8		Aquatic Life
Lower Creek	11-39-(0.5)b	C	03-08-31	5.1		Aquatic Life
Lower Creek	11-39-(6.5)	WS-IV	03-08-31	6.8		Aquatic Life
Spainhour Creek	11-39-3	C	03-08-31	4.7		Aquatic Life
McGalliard Creek	11-44-(3)	WS-IV CA	03-08-31	3.9		Aquatic Life
Horseford Creek	11-54-(0.5)	WS-IV	03-08-32	0.4		Aquatic Life
Lower Little River	11-69-(0.5)	C	03-08-32	14.0		Aquatic Life
McDowell Creek	11-115-(1.5)b	WS-IV	03-08-33	2.9		Aquatic Life
McDowell Creek	11-115-(1.5)a	WS-IV	03-08-33	4.4		Aquatic Life
Killian Creek	11-119-2-(0.5)b	C	03-08-33	3.2		Aquatic Life
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	WS-IV & B CA	03-08-34		601.1	Aquatic Life
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	WS-V & B	03-08-34		3,418.5	Aquatic Life
Long Creek	11-120-(2.5)	WS-IV	03-08-34	11.3		Aquatic Life & Recreation
Sugar Creek	11-137a	C	03-08-34	0.3		Aquatic Life
Irwin Creek	11-137-1	C	03-08-34	11.8		Aquatic Life
Little Sugar Creek	11-137-8a	C	03-08-34	5.5		Aquatic Life
McAlpine Creek (Waverly Lake)	11-137-9c	C	03-08-34	4.6		Aquatic Life
Clark Creek (Shooks Lake)	11-129-5-(0.3)b	C	03-08-35	14.3		Aquatic Life
Clark Creek (Shooks Lake)	11-129-5-(0.3)c(1)	C	03-08-35	2.4		Aquatic Life
Henry Fork	11-129-1-(12.5)a	C	03-08-35	10.3		Aquatic Life

Maiden Creek	11-129-5-7-2-(1)	WS-II	03-08-35	4.9		Aquatic Life
Maiden Creek (Including Maiden reservoir below elevation 842)	11-129-5-7-2-(2.5)	WS-II CA	03-08-35	2.1		Aquatic Life
Clark Creek	11-129-5-(9.5)	WS-IV	03-08-35	1.8		Aquatic Life
Indian Creek	11-129-8-(6.5)b	C	03-08-35	6.0		Aquatic Life
Catawba Creek	11-130c	C	03-08-37	4.9		Aquatic Life
Crowders Creek	11-135c	C	03-08-37	3.3		Aquatic Life & Recreation
Crowders Creek	11-135g	C	03-08-37	1.5		Aquatic Life & Recreation
Crowders Creek	11-135d	C	03-08-37	7.3		Aquatic Life & Recreation
Crowders Creek	11-135a	C	03-08-37	1.9		Recreation
Crowders Creek	11-135b	C	03-08-37	3.1		Recreation
Crowders Creek	11-135e	C	03-08-37	1.5		Recreation
Crowders Creek	11-135f	C	03-08-37	1.4		Recreation
Abernethy Creek	11-135-4b	C	03-08-37	1.8		Aquatic Life
Blackwood Creek	11-135-7	C	03-08-37	4.4		Recreation
Sixmile Creek	11-138-3	C	03-08-38	8.8		Aquatic Life

Section A

General Basinwide Information

Section A - Chapter 1
Introduction to Basinwide Water Quality Planning

1.1 What is Basinwide Water Quality Planning?

Basinwide water quality planning is a nonregulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the 17 major river basins in the state (Figure A-1 and Table A-1). Preparation of a basinwide water quality plan is a five-year process, which is broken down into three phases (Table A-2). While these plans are prepared by the DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholder groups in the state. The first cycle of plans was completed in 1998, but each plan is updated at five-year intervals.

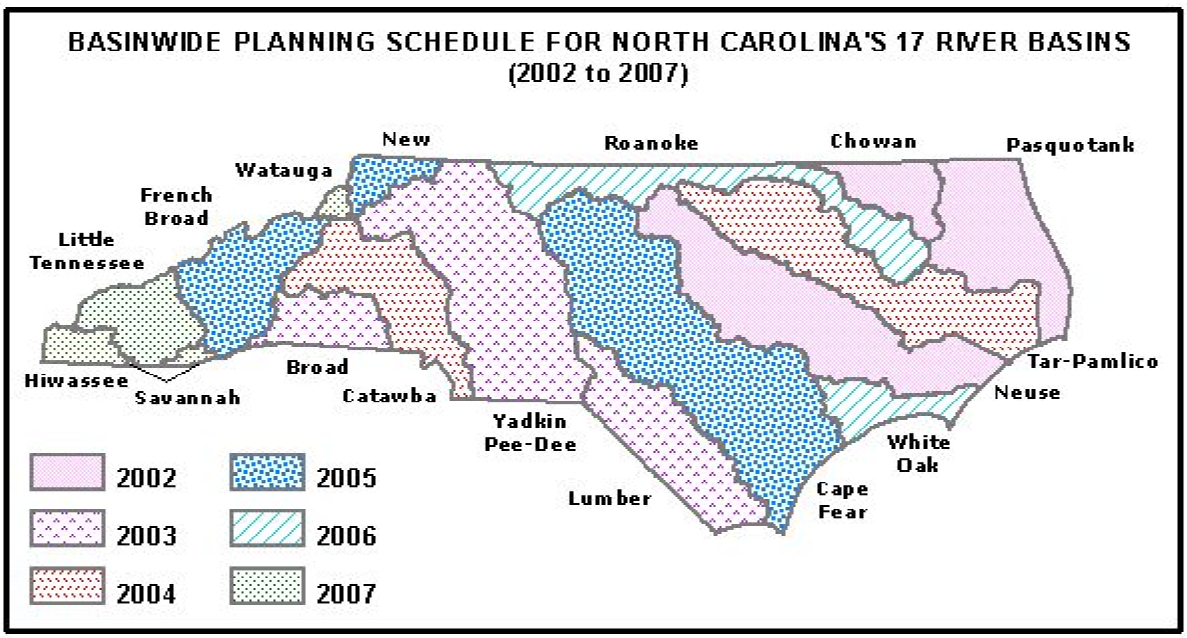


Figure A-1 Basinwide Planning Schedule (2002 to 2007)

1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide planning are to:
- Identify water quality problems and restore full use to Impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:
- Collaborate with other agencies to develop appropriate management strategies.
- Assure equitable distribution of waste assimilative capacity.
- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

Table A-1 Basinwide Planning Schedule (2000 to 2007)

Basin	DWQ Biological Data Collection	River Basin Public Workshops	Public Review and Draft Out For Review	Final Plan Receives EMC Approval	Begin NPDES Permit Issuance
Chowan	Summer 2000	3/2001	5/2002	7/2002	11/2002
Pasquotank	Summer 2000	3/2001	5/2002	7/2002	12/2002
Neuse	Summer 2000	6/2001	5/2002	7/2002	1/2003
Broad	Summer 2000	11/2001	11/2002	2/2003	7/2003
Yadkin-Pee Dee	Summer 2001	4/2002	1/2003	3/2003	9/2003
Lumber	Summer 2001	12/2002	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 2002	3/2003	12/2003	3/2004	9/2004
Catawba	**Summer 2002**	**10/2003**	**7/2004**	**9/2004**	**12/2004**
French Broad	Summer 2002	11/2003	2/2005	4/2005	9/2005
New	Summer 2003	4/2004	6/2005	9/2005	3/2006
Cape Fear	Summer 2003	5/2004	4/2005	8/2005	4/2006
Roanoke	Summer 2004	4/2005	4/2006	8/2006	1/2007
White Oak	Summer 2004	10/2005	9/2006	12/2006	6/2007
Savannah	Summer 2004	10/2005	11/2006	2/2007	8/2007
Watauga	Summer 2004	10/2005	12/2006	3/2007	9/2007
Hiwassee	Summer 2004	10/2005	11/2006	2/2007	8/2007
Little Tennessee	Summer 2004	3/2006	1/2007	4/2007	10/2007

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

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

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

1.3 Major Components of the Basinwide Plan

Each basinwide plan is subdivided into four major sections. The format provides general basinwide information, information by each major watershed, and descriptions of water quality protection initiatives.

Section A: Basinwide Information

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

Section B: Subbasin Information

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

Section C: Current and Future Initiatives

- Presents current and future water quality initiatives and success stories by federal, state and local agencies, and corporate, citizen and academic efforts.

Appendices

- Lists NPDES dischargers and individual stormwater permits.
- Describes water quality data collected by DWQ, use support methodology and 303(d) listing methodology.
- Provides workshop summaries, points of contact, and a glossary of terms and acronyms.

1.4 Benefits of Basinwide Water Quality Planning

Basinwide planning and management benefits water quality by:

- *Focusing resources* on one river basin at a time.
- *Using sound ecological planning and fostering comprehensive NPDES permitting* by working on a watershed scale.
- *Ensuring better consistency and equitability* by clearly defining the program's long-term goals and approaches regarding permits and water quality improvement strategies.
- *Fostering public participation* to increase involvement and awareness about water quality.
- *Integrating and coordinating programs and agencies* to improve implementation of point and nonpoint source pollution reduction strategies.

1.5 How to Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for citizens and other local stakeholders to participate in the planning process during:

- Local Workshops: (Prior to the preparation of draft basinwide plans.) DWQ staff present information about basinwide planning and the basin's water quality. Participants can ask questions, share concerns, and discuss potential solutions to water quality issues in the basin.
- Public Review: (After the draft plan is prepared.) DWQ staff discuss the draft plan and its major recommendations, seeking public comments and questions.
- Public Comment Period: (After the draft plan is prepared.) The comment period is at least 30 days in length. Draft plans are made available on-line or by request.

1.6 Other References

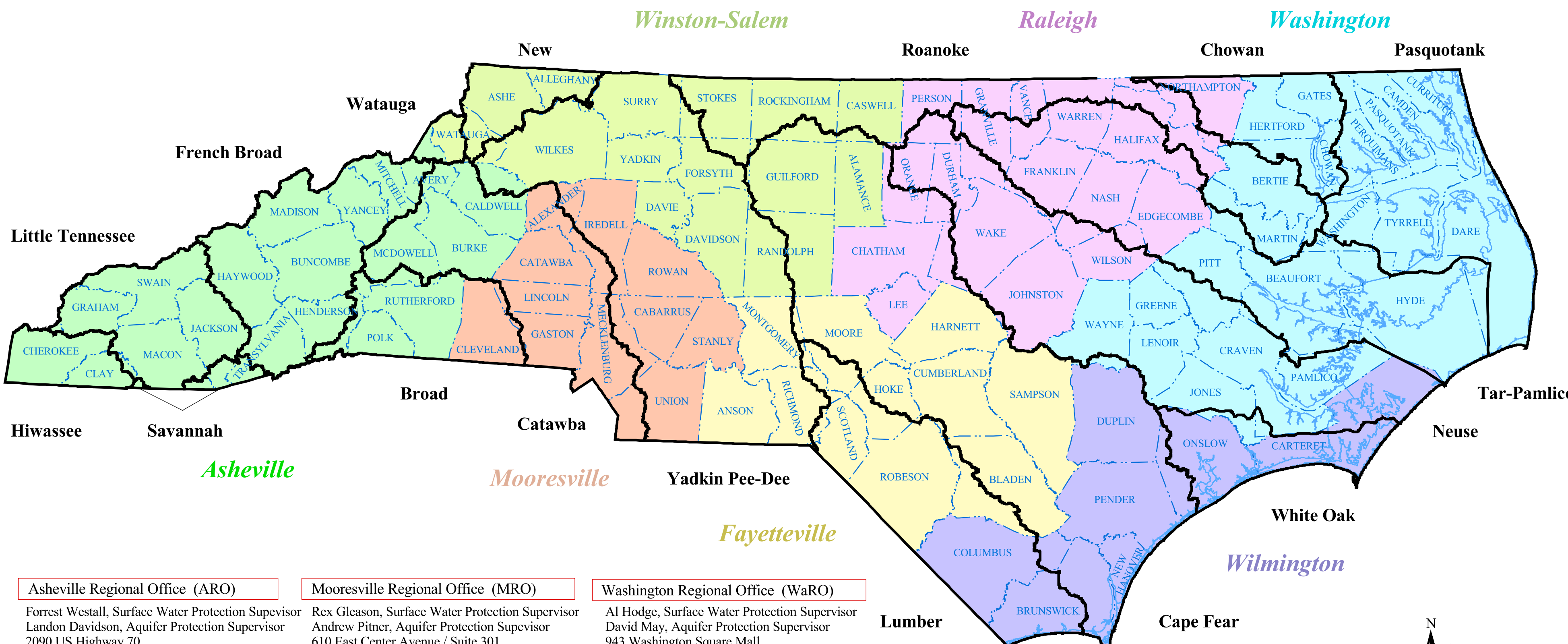
There are several reference documents and websites that provide additional information about basinwide planning and the basin's water quality:

- *A Citizen's Guide to Water Quality Management in North Carolina*. August 2000. This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. 156 pages.
- *Catawba River Basinwide Assessment Report*. June 2002. This technical report presents physical, chemical and biological data collected in the Catawba River basin. 146 pages.
- *Catawba River Basinwide Water Quality Management Plan*. February 1995. This first basinwide plan for the Catawba River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 181 pages.
- *Catawba River Basinwide Water Quality Management Plan*. December 1999. This second basinwide plan for the Catawba River basin presents water quality data, information and recommended management strategies for the second five-year cycle. 200 pages.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Catawba River Basin*. DWQ NC Wetlands Restoration Program.
- NC Division of Water Quality Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description*. Creager, C.S. and J.P. Baker. 1991. DWQ Water Quality Section. Raleigh, NC.

1.7 Division of Water Quality Functions and Locations

For more information on the above documents, DWQ activities or contacts, please visit http://h2o.enr.state.nc.us/basinwide/ or call (919) 733-5083 and ask for the basin planner responsible for your basin of interest. Feel free to contact the appropriate Regional Office for additional information (Figure A-2). For general questions about the Department of Environment and Natural Resources, contact the Customer Service Center at 1-877-623-6748.

Figure A-2 North Carolina Department of Environment and Natural Resources Division of Water Quality Regional Offices



Asheville Regional Office (ARO)

Forrest Westall, Surface Water Protection Supevisor
Landon Davidson, Aquifer Protection Supervisor
2090 US Highway 70
Swannanoa, NC 28778
COURIER 12-59-01
Phone: (828) 296-4500
Fax: (828) 299-7043

Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Yancey

Mooresville Regional Office (MRO)

Rex Gleason, Surface Water Protection Supervisor
Andrew Pitner, Aquifer Protection Supevisor
610 East Center Avenue / Suite 301
Mooresville, NC 28115
COURIER 09-08-06
Phone: (704) 663-1699
Fax: (704) 663-6040

Alexander, Cabarrus, Catawba, Cleveland, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Stanly, Union

Washington Regional Office (WaRO)

Al Hodge, Surface Water Protection Supervisor
David May, Aquifer Protection Supevisor
943 Washington Square Mall
Washington, NC 27889
COURIER 16-04-01
Phone: (252) 946-6481
Fax: (252) 946-9215

Beaufort, Bertie, Camden, Chowan, Craven, Currituck, Dare, Gates, Greene, Hertford, Hyde, Jones, Lenoir, Martin, Pamlico, Pasquotank, Perquimans, Pitt, Tyrrell, Washington, Wayne

Winston-Salem Regional Office (WSRO)

Steve Tedder, Surface Water Protection Supervisor
Sherri Knight, Aquifer Protection Supervisor
585 Waughtown Street
Winston-Salem, NC 27107
COURIER 13-15-01
Phone: (336) 771-4600
Fax: (336) 771-4630

Alamance, Alleghany, Ashe, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry, Watauga, Wilkes, Yadkin

Central Office

DENR
DIVISION OF WATER QUALITY
WATER QUALITY SECTION
1617 MAIL SERVICE CENTER
RALEIGH NC 27699-1617
COURIER 52-01-00
Phone: (919) 733-7015
Fax: (919) 733-2496

Fayetteville Regional Office (FRO)

Paul Rawls, Surface Water Protection Supervisor
Art Barnhardt, Aquifer Protection Supervisor
225 Green Street
Suite 714 / Systel Building
Fayetteville, NC 28301-5043
COURIER 14-56-25
Phone: (910) 486-1541
Fax: (910) 486-0707

Anson, Bladen, Cumberland, Harnett, Hoke, Montgomery, Moore, Richmond, Robeson, Sampson, Scotland

Raleigh Regional Office (RRO)

Ken Schuster, Surface Water Supervisor
Jay Zimmerman, Aquifer Protection Supervisor
3800 Barrett Drive
Raleigh, NC 27609
INTEROFFICE
Phone: (919) 571-4700
Fax: (919) 571-4718

Chatham, Durham, Edgecombe, Franklin, Granville, Halifax, Johnston, Lee, Nash, Northampton, Orange, Person, Vance, Wake, Warren, Wilson

Wilmington Regional Office (WiRO)

Rick Shiver, Surface Water Protection Supervisor
Charlie Stehman, Aquifer Protection Supervisor
127 Cardinal Drive Extension
Wilmington, NC 28405-2845
COURIER 04-16-33
Phone: (910) 395-3900
Fax: (910) 350-2004

Brunswick, Carteret, Columbus, Duplin, New Hanover, Onslow, Pender

NCDENR

NC Division of Water Quality
Basinwide Planning Program
October 6, 2004

Section A - Chapter 2
Catawba River Basin Overview

2.1 General Overview

The Catawba River basin, along with the Broad River basin, forms the headwaters of the Santee-Cooper River system, which flows through South Carolina to the Atlantic Ocean (Figure A-3). The Catawba River begins on the eastern slopes of the Blue Ridge Mountains in Avery, Burke, Caldwell and McDowell counties and flows southeast to the North Carolina-South Carolina border near Charlotte (Figure A-4).

Catawba River Basin Statistics

Total Area: 3,285 sq. miles
Freshwater Stream Miles: 3,048
Freshwater Lakes Acres: 50,764
No. of Counties: 11
No. of Municipalities: 61
No. of Subbasins: 9
Population (2000): 1,170,512 *
Pop. Density (2000): 356 persons/sq. mi.*

* Estimated based on % of county land area that is partially or entirely within the basin.

Many of these streams have Good to Excellent water quality and are classified as trout waters. The basin contains the Linville River, one of only four rivers in the state designated as a Natural and Scenic River. The Linville River flows through the Pisgah National Forest Wilderness area and into Lake James. In 2002, Wilson Creek gained designation as a National Wild and Scenic River.

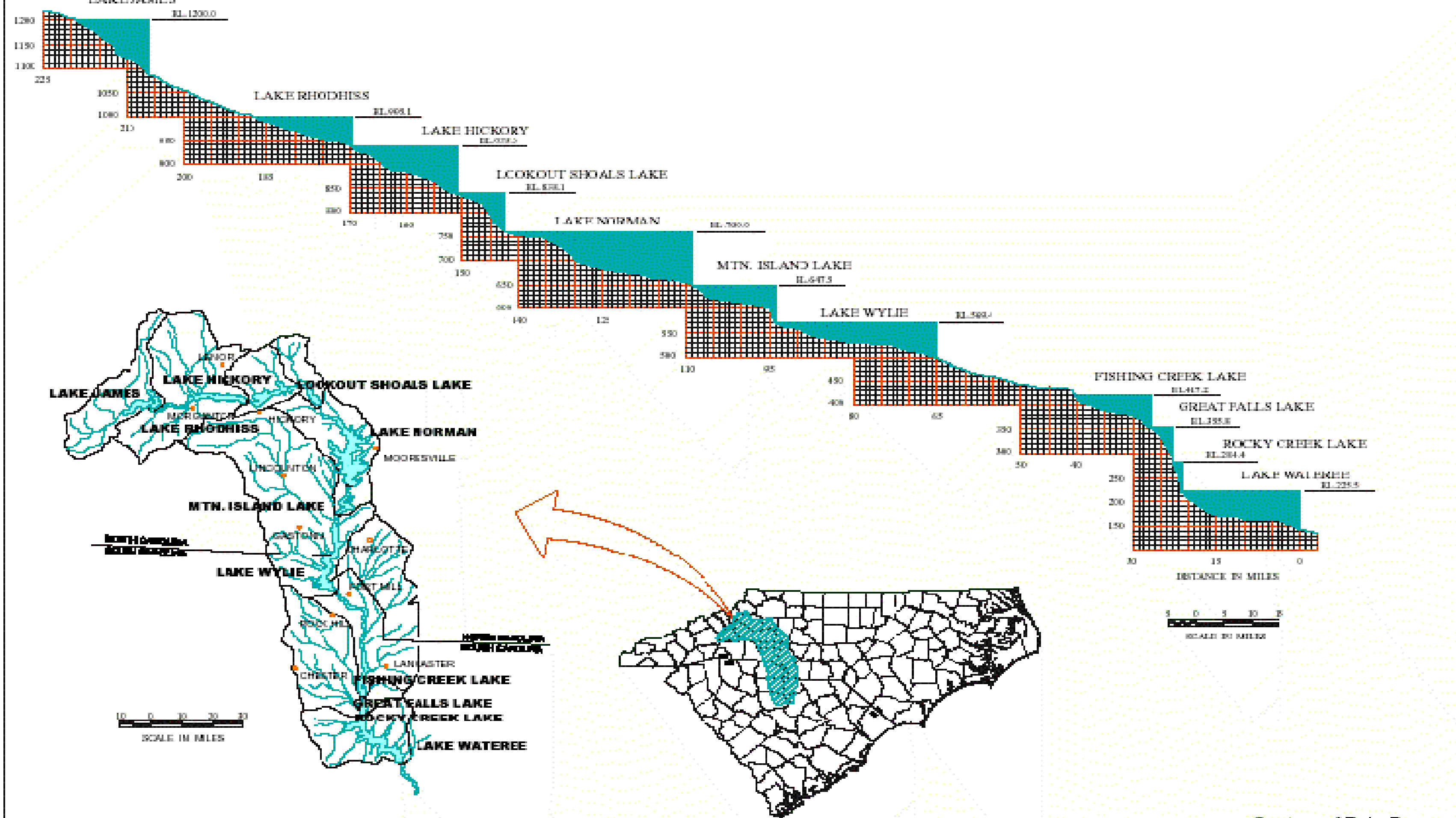
As the basin enters the piedmont from the mountains, land use shifts from forest to agricultural and urban uses. Nonpoint runoff from agricultural operations and urban areas has caused nutrient enrichment and habitat degradation in the streams, rivers and lakes of the area. Though urban areas are not numerous in the upper portions of the basin, the lower Catawba region contains many cities, including the growing Charlotte-Mecklenburg metropolitan area. In this region, urban growth has affected the water quality of the lakes, streams and rivers.

The mainstem of the Catawba River in North Carolina is regulated by a series of seven hydroelectric dams. The reservoirs formed by these dams are commonly referred to as the Catawba River Chain Lakes. All are owned by Duke Power and were created to generate electricity. The lakes begin with Lake James, located at the foot of the Blue Ridge Mountains, followed by Lake Rhodhiss, Lake Hickory, Lookout Shoals Lake, Lake Norman, Mountain Island Lake and Lake Wylie.

Population growth for the basin as a whole from 1990 to 2000 is estimated at 18.5 percent, and estimated population density is 356 persons/square mile. The statewide population density is 163 persons/square mile, demonstrating the population concentration within the Catawba River basin.

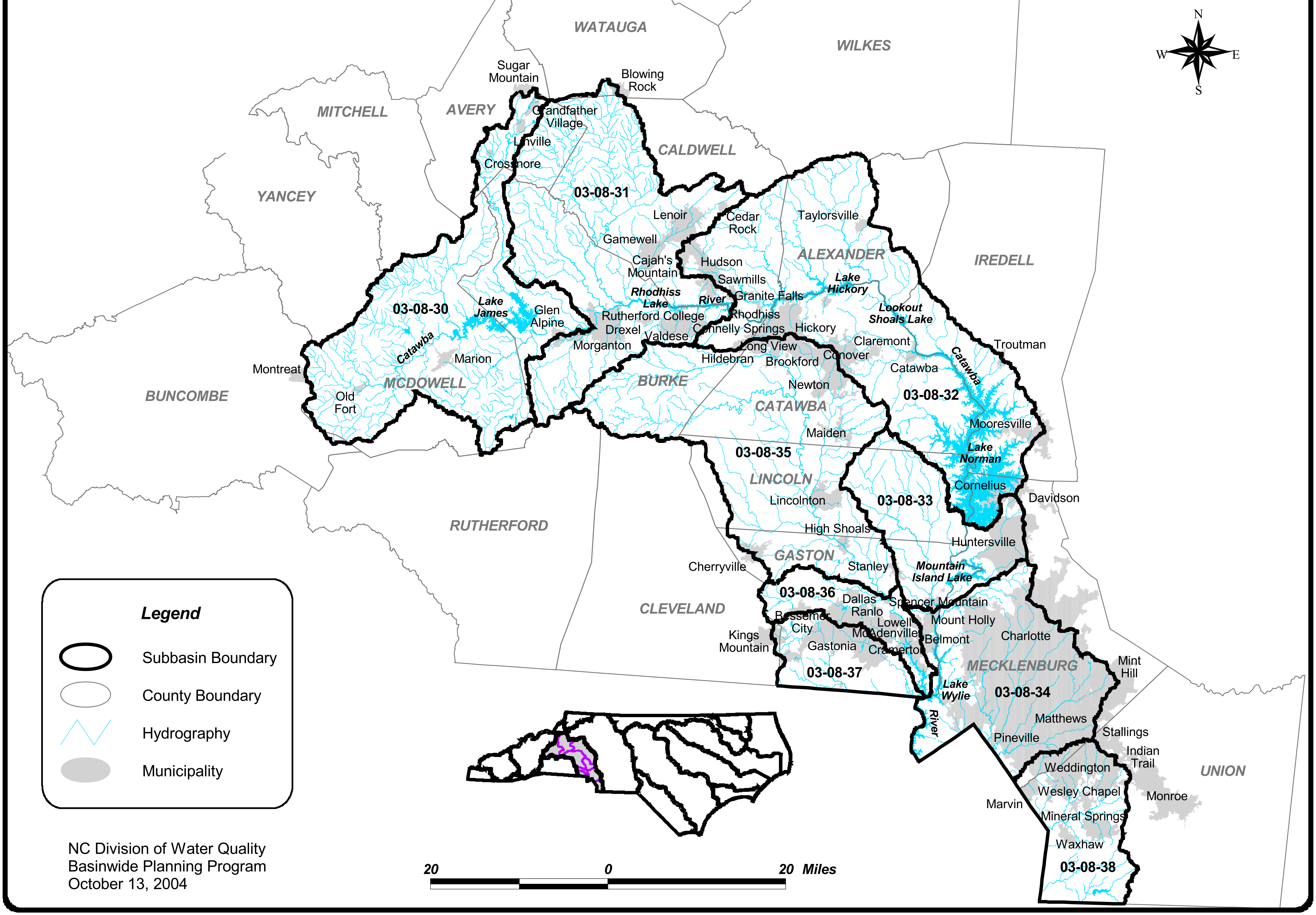
Over the 15-year period from 1982 to 1997, urban and built-up land cover increased by 183,000 acres or about 52 percent. Uncultivated cropland increased by 7,000 acres while pastureland decreased by 13,000 acres. Forest and cultivated cropland cover significantly decreased by 104,000 and 75,000 acres, respectively (USDA-NRCS, NRI, updated June 2001).

Figure A-3 General Map of Entire Catawba Basin



Courtesy of Duke Power

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



2.2 Surface Water Hydrology

2.2.1 Watershed Descriptions

DWQ has a two-tiered system in which the state is divided into 17 major river basins with each basin further subdivided into subbasins. The Catawba River basin is divided into nine subbasins (6-digit DWQ subbasins) (Figure A-4). Maps of each subbasin are included in Section B. DWQ and many other state agencies in North Carolina use this two-tiered system to identify watersheds for many different programs. Most federal government agencies, including the US Geological Survey (USGS) and the Natural Resources Conservation Service (NRCS), use a different system of defining watersheds.

Under the federal system, the Catawba River basin is made up of hydrologic areas referred to as hydrologic units (USGS 8-digit hydrologic units). The Catawba River basin is made up of three hydrologic units: the Upper Catawba, South Fork Catawba and Lower Catawba. Hydrologic units are further divided into smaller watershed units (14-digit hydrologic units) that are used for smaller scale planning like that done by the Ecosystem Enhancement Program (Section C, Chapter 1, Part 1.3.2). There are 94 14-digit hydrologic units in the Catawba River basin. Table A-3 compares the three systems.

Table A-3 Hydrologic Subdivisions in the Catawba River Basin

Major Waterbody Name	USGS 8-Digit Hydrologic Units	DWQ 6-Digit Subbasin Codes
Upper Catawba	03050101	03-08-30, 03-08-31, 03-08-32, 03-08-33, 03-08-34, 03-08-37
South Fork Catawba	03050102	03-08-35, 03-08-36
Lower Catawba	03050103	03-08-34, 03-08-38

2.2.2 Hydrologic Features

The Catawba River begins in mountainous western North Carolina near Grandfather Mountain and flows easterly and southerly through the piedmont into South Carolina, where it joins Big Wateree Creek to form the Wateree River. The hydrologic landscape is dominated by the presence of Duke Power's Catawba-Wateree Hydroelectric Project. The Catawba-Wateree Project is comprised of 13 hydropower plants and 11 reservoirs, including the James (Bridgewater), Rhodhiss, Hickory (Oxford), Lookout Shoals, Norman (Cowan's Ford), Mountain Island, Wylie, Fishing Creek, Great Falls, Rocky Creek, and Wateree reservoirs. Seven of these reservoirs, from Lake James to Lake Wylie, are at least partially located within the boundaries of North Carolina.

In addition to the mainstem lakes and river, the Catawba River basin includes the federally recognized Wild and Scenic Linville River and the South Fork Catawba River. The Linville River rushes through the high mountain wilderness areas of Burke County and into Lake James.

The South Fork Catawba River flows through the agricultural and industrial corridor along US Highway 321 and joins the mainstem Catawba River at Lake Wylie.

There are 3,048 stream miles and 50,764 freshwater acres (lakes) in the North Carolina portion of the Catawba River basin.

2.2.3 Minimum Streamflow

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. The Division of Water Resources, in conjunction with the Wildlife Resources Commission, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources issues the permits (Table A-4).

2.2.4 Water Withdrawals and Water Supply

Prior to 1999, North Carolina required water users to register their water withdrawals with the Division of Water Resources (DWR) only if the amount was 1,000,000 gallons or more of surface water or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 gallons per day.

There are 235 registered water withdrawals in the Catawba River basin. The US Geological Survey's (USGS) 1995 summary estimated total water use in the basin at 279 MGD. Eighty-six percent was withdrawn from surface water sources. Overall, public water systems supplied 152 MGD of surface water and 4 MGD of groundwater for both residential and nonresidential uses. The remaining residential water demand was met by 17 MGD of self-supplied groundwater. In addition, there was 87 MGD of self-supplied surface water withdrawn for nonresidential water uses not including electric power generation (NCDENR-DWR, January 2001). For more information on water withdrawals, visit the website at http://www.ncwater.org/ or call DWR at (919) 733-4064.

Table A-4 Minimum Streamflow Projects in the Catawba River Basin

Site	Waterbody	Drainage Area (sq. mi.)	Minimum Release (cfs)
Hydropower Dams			
Catawba-Wateree Project (FERC#2232)[a]	Catawaba River		
Lake James (Bridgewater Dam)	Catawaba River	380	25 (66[b])
Lake Rhodhiss	Catawaba River	1,088	40 (225[b])
Lake Hickory (Oxford Dam)	Catawaba River	1,310	40 (261)
Lookout Shoals Lake	Catawaba River	1,449	60 (278[b])
Lake Norman (Cowan's Ford Dam)	Catawaba River	1,770	80 (311[b])
Mountain Island Lake	Catawaba River	1,860	80 (314[b])
Long Shoals (FERC#7742)	South Fork Catawba River	470	92
High Shoals (FERC#4827)	South Fork Catawba River	510	None[c]
Hardins (FERC#6492)	South Fork Catawba River	512	43.5
Spencer Mountain (FERC#2607)	South Fork Catawba River	622	76
McAdenville (FERC#4186)	South Fork Catawba River	632	None[c]
Brushy Mountain (Millersville) (Non-Jurisdictional)	Lower Little River	80.7	2
Non-Hydropower Dams			
Lake Tahoma[d]	Buck Creek	23.1	None[e]
Henry River[f]	Henry Fork	81	24.5
Loch Dornie	Linville River	3.5	1.9
Land Harbor Lake	Linville River	19	6.6
West Fork Linville River	Linville Ridge	0.3	0.1
Anchor's Landing	Silver Creek	3.77	3.9
Ben Webber Lake	UT Long Creek	2.3	0.2
Miscellaneous Dams			
Blue Ridge Country Club	Laurel Branch	1.05	0.39
Duke Power Lincoln Combustion Turbine Station	Killian Creek	36	2.28

[a] The license issued for the Catawba-Wateree Project by the Federal Energy Regulatory Commission (FERC) will expire on 8/31/08. The flow requirements from each dam will be examined during the relicensing process.

[b] Minimum average daily flow that may be requested for a specified period of time by the state to maintain water quality standards. Flow requirements may be provided by power generation, spillage and/or leakage.

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

[d] The dam is a former hydropower facility (FERC#4021). The dam owners have surrendered the license to operate, and the dam will have a minimum flow requirement determined in accordance with the NC Dam Safety Law.

[e] Even though there is no minimum flow yet, the dam provides a run-of-river flow; i.e., instantaneous inflow equals instantaneous outflow.

[f] The site is a former, non-jurisdictional hydropower facility.

2.2.5 Interbasin Transfers

"Interbasin Transfer" is the term used to describe the withdrawal, diversion or pumping of surface water from one river basin and the use or discharge of all or any part of the water in a basin different from the basin of origin. Water users in North Carolina are required to register surface water interbasin transfers with the Division of Water Resources if the amount is 100,000 gallons per day or more. In addition, persons wishing to transfer 2 MGD or more, or increase an existing transfer by 25 percent or more, must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.22I). The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State. These boundaries differ from the 17 major river basins delineated by DWQ. The 8-digit hydrologic unit boundaries (Figure A-7) correspond to these basins within the Catawba River basin. Table A-5 summarizes IBTs involving the Catawba River basin.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

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

A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. For more information on water withdrawals, visit the website at http://www.ncwater.org or call DWR at (919) 733-4064.

Table A-5 Estimated Interbasin Transfers in the Catawba River Basin (1997)

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD) [1]
Charlotte-Mecklenburg	Charlotte-Mecklenburg	Catawba	Rocky	5.1
Charlotte-Mecklenburg	Union County	Catawba	Rocky	0.22
Burlington Industries	Burlington Industries	Catawba	Rocky	3.84
Gastonia	Gastonia	Catawba	South Fork Catawba	5.25
Gastonia	Cramerton	Catawba	South Fork Catawba	0.33
Gastonia	Lowell	Catawba	South Fork Catawba	0.45
Gastonia	McAdenville	Catawba	South Fork Catawba	0.42
Mooresville	Mooresville	Catawba	Rocky	2.6
Valdese	Burke County	Catawba	South Fork Catawba	0.08
Hickory	Hickory	Catawba	South Fork Catawba	5.1
Hickory	Newton	Catawba	South Fork Catawba	Emergency
Hickory	Conover	Catawba	South Fork Catawba	0.05
Hickory	Brookford	Catawba	South Fork Catawba	0.06
Belmont	Belmont	Catawba	South Fork Catawba	Unknown
Belmont	Cramerton	Catawba	South Fork Catawba	Emergency
Long View	Long View	Catawba	South Fork Catawba	1.3
Mount Holly	Stanley	Catawba	South Fork Catawba	Unknown
Lincoln County	Lincolnton	Catawba	South Fork Catawba	0.01
Lenoir	Caldwell County SE	Catawba	Yadkin	Unknown
Lenoir	Caldwell County N	Catawba	Yadkin	Unknown
Mooresville	Mooresville	Catawba	South Yadkin	0.28
Kings Mountain	Kings Mountain	Broad	Catawba	1.47
Blowing Rock	Blowing Rock	New	Catawba	Unknown
Anson County	Union County	Yadkin	Catawba	1.44
Alexander County	Taylorsville	South Yadkin	Catawba	0.41
Alexander County	Alexander County	South Yadkin	Catawba	Unknown
Alexander County	West Iredell	South Yadkin	Catawba	0.15
Statesville	Troutman	South Yadkin	Catawba	0.07
Monroe	Union County	Rocky	Catawba	Unknown
Newton	Newton	South Fork Catawba	Catawba	Unknown
Newton	Catawba	South Fork Catawba	Catawba	0.09
Dallas	Gastonia	South Fork Catawba	Catawba	Emergency
Bessemer City	Gastonia	South Fork Catawba	Catawba	Emergency
Bessemer City	Bessemer City	South Fork Catawba	Catawba	1.51
Ranlo	Gastonia	South Fork Catawba	Catawba	Emergency
Stanley	Stanley	South Fork Catawba	Catawba	Unknown
Lincolnton	Lincoln County	South Fork Catawba	Catawba	Unknown
Cherryville	Cherryville	South Fork Catawba	Broad	Unknown
Kings Mountain	Bessemer City	Broad	South Fork Catawba	Emergency

[1] All transfer amounts are based on average daily water use reported in 1997 Local Water Supply Plans, and the 1999 Water Withdrawal and Transfer Registration Database. "Unknown" refers to undocumented consumptive use. "Emergency" refers to connections that are designated as for emergency use.

2.3 Population and Growth Trends

In the following sections are three different ways of presenting population data for the Catawba River basin. The Office of State Budget and Management projects population growth by county using 2000 Census data as a starting point. This information is important in determining areas that expect significant population changes in the future. Data presented by municipality summarizes information on past growth of large urban areas in the basin. While the municipal data are not projected into the future, it is possible to locate areas where past growth may have impacted water quality. These two measures are based on political boundaries and not on watersheds areas. Population data were also presented by subbasin to gain insight into population densities within the basin. While the three different sets of information cannot be directly compared because the areas and time periods are different, general conclusions are apparent by looking at the information. Counties with the highest expected growth are associated with the largest municipal areas and the most densely populated subbasins in the Catawba River basin.

2.3.1 County Population and Growth Trends

Table A-6 shows the projected population for 2020 and the change in growth between 1990 and 2020 for counties that are wholly or partly contained within the basin. Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the Catawba River basin. This information is intended to present an estimate of expected population growth in counties that have some land area in the Catawba River basin.

Table A-6 Past and Projected Population (1990, 2000, 2020) and Population Change by County

County	Percent of County in Basin ♦	1990	2000	Projected % Growth 1990-2000	Projected Population 2020	Projected % Growth 2000-2020
Alexander	68	27,544	33,603	18.0	45,168	25.6
Avery	35	14,867	17,167	13.4	19,976	14.1
Burke	100	75,740	89,148	15.0	113,367	21.4
Caldwell	75	70,709	77,415	8.7	86,577	10.6
Catawba	100	118,412	141,685	16.4	186,058	23.8
Gaston	97	174,769	190,365	8.2	215,587	11.7
Iredell	22	93,205	122,660	24.0	182,758	32.9
Lincoln	93	50,319	63,780	21.1	90,778	29.7
McDowell	86	35,681	42,151	15.3	53,170	20.7
Mecklenburg	74	511,211	695,454	26.5	1,089,258	36.2
Union	25	84,210	123,677	31.9	210,738	41.3
Subtotals		1,256,667	1,597,105	21.3	2,293,435	30.4

♦ Source: North Carolina Center for Geographic Information and Analysis

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

Populations of counties wholly or partly contained within the basin increased by 340,438 people between 1990 and 2000. Figure A-5 presents projected population growth by county (2000-2020) for the Catawba River basin. Mecklenburg and Union counties are growing the fastest in the lower basin, with Iredell, Alexander and Catawba counties growing the fastest in the upper basin. The county populations are expected to grow by more than 696,000 by 2020. Along with the increased population there will be increased drinking water demands and wastewater discharges. There will also be loss of natural areas and increases in impervious surfaces associated with construction of new homes, businesses and transportation infrastructure. These side effects of population growth often have a negative impact on water quality if not carefully managed. A detailed discussion of these impacts can be found in Section A, Chapter 4, Parts 4.11-4.13.

For more information on past, current and projected population estimates, contact the Office of State Budget and Management at (919) 733-7061 or visit the North Carolina State Demographics website at http://demog.state.nc.us/.

2.3.2 Population, Growth Trends, and Population Density

Table A-7 presents population data from the Office of State Planning for municipalities with populations greater than 2,000 persons, located wholly or partly within the basin. The highest percentage of urban population growth has occurred in the lower basin around Cornelius, Huntersville and Indian Trail. Mooresville, Waxhaw and Wesley Chapel have also increased in population substantially over the last ten years.

Most population data are collected from within county or municipal boundaries. It is difficult to evaluate population and population density within watersheds using this information. Both county and municipal boundaries may extend beyond basin boundaries.

Information on population density at a watershed scale is useful in determining what streams are likely to have the most impacts as a result of population growth. This information is also useful in identifying stream segments that have good opportunities for preservation or restoration. This information is presented to estimate population and population density by each subbasin and for the entire basin. Assuming county populations are distributed evenly throughout each county, subbasins that are within counties with large urban areas may overestimate the actual population in that portion of the basin. The overall population of the Catawba River basin is 1,170,512, with approximately 356 persons/square mile for counties that are partially or entirely in the basin. Population density estimated by subbasin is presented in Figure A-6.

Figure A-5 Percent Projected County Population Growth (2000-2020) for Counties of the Catawba River Basin

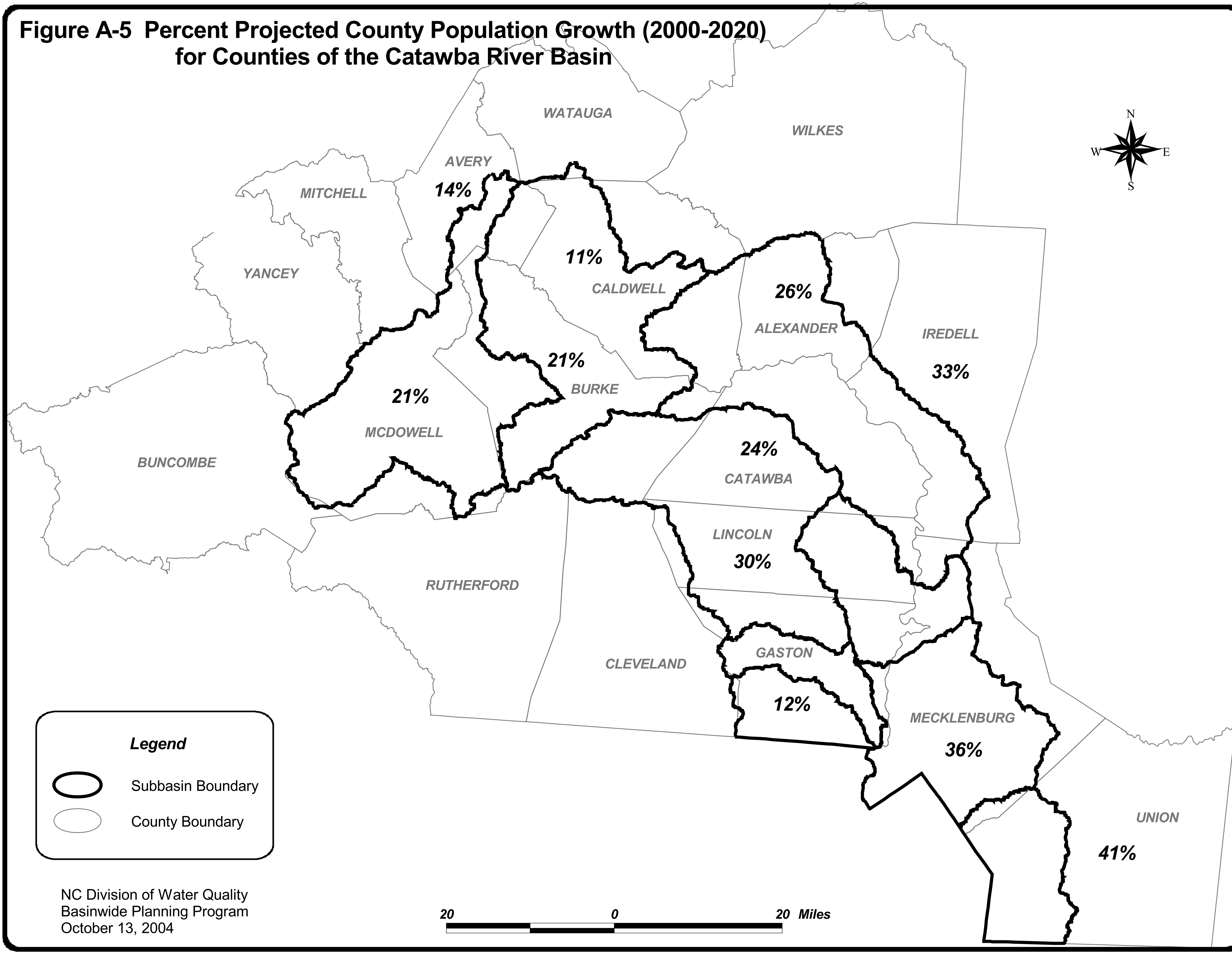


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Table A-7 Population (1980, 1990, 2000) and Population Change for Municipalities Greater Than 2,000 Located Wholly or Partly in the Catawba River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	Percent Change (1980-90)	Percent Change (1990-2000)
Belmont	Gaston	4,607	8,434	8,705	83.1	3.2
Bessemer City	Gaston	4,787	4,698	5,119	-1.9	9.0
Cajah Mountain	Caldwell	1,884	2,429	2,683	28.9	10.5
Charlotte •	Mecklenburg	315,474	395,934	540,828	25.5	36.6
Cherryville •	Gaston	4,844	4,756	5,361	-1.8	12.7
Conover	Catawba	4,245	5,465	6,604	28.7	20.8
Cornelius •	Mecklenburg	1,460	2,581	11,969	76.8	363.7
Cramerton	Gaston	1,869	2,371	2,976	26.9	25.5
Dallas	Gaston	3,340	3,012	3,402	-9.8	12.9
Davidson •	Iredell, Mecklenburg	3,241	4,046	7,139	24.8	76.4
Gamewell	Caldwell	2,910	3,357	3,644	15.4	8.5
Gastonia	Gaston	47,218	54,725	66,277	15.9	21.1
Granite Falls	Caldwell	2,580	3,253	4,612	26.1	41.8
Hickory	Burke, Caldwell, Catawba	20,757	28,474	37,222	37.2	30.7
Hudson	Caldwell	2,888	2,819	3,078	-2.4	9.2
Huntersville •	Mecklenburg	1,294	3,023	24,960	133.6	725.7
Indian Trail •	Union	811	1,942	11,905	139.5	513.0
Kings Mountain •	Cleveland, Gaston	9,080	8,763	9,693	-3.5	10.6
Lenoir	Caldwell	13,748	14,192	16,793	3.2	18.3
Lincolnton	Lincoln	4,879	6,955	9,965	42.5	43.3
Long View	Burke, Catawba	3,587	3,353	4,722	-6.5	40.8
Lowell	Gaston	2,917	2,710	2,662	-7.1	-1.8
Maiden	Catawba, Lincoln	2,574	2,470	3,282	-4.0	32.9
Marion	McDowell	3,684	4,765	4,943	29.3	3.7
Matthews •	Mecklenburg	1,648	13,651	22,127	728.3	62.1
Mint Hill •	Mecklenburg	7,915	11,615	14,922	46.7	28.5
Mooresville •	Iredell	8,575	9,317	18,823	8.7	102.0
Morganton	Burke	13,763	15,085	17,310	9.6	14.7
Mount Holly	Gaston	4,530	7,710	9,618	70.2	24.7
Newton	Catawba	7,624	9,077	12,560	19.1	38.4
Pineville	Mecklenburg	1,525	2,970	3,449	94.8	16.1
Ranlo	Gaston	1,774	1,650	2,198	-7.0	33.2
Sawmills	Caldwell	3,706	4,088	4,921	10.3	20.4
Stallings •	Union	1,826	2,152	3,189	17.9	48.2
Stanley	Gaston	2,341	2,897	3,053	23.8	5.4
Valdese	Burke	3,364	3,914	4,485	16.3	14.6
Waxhaw	Union	1,208	1,294	2,625	7.1	102.9
Weddington ♦	Union	848	3,803	6,696	348.5	76.1
Wesley Chapel	Union	-----	1,018	2,549	-----	150.4

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

♦ Note: Weddington is listed in Mecklenburg and Union counties in the 2001 NC League of Municipalities Directory. It is also listed in Mecklenburg and Union counties on the Office of State Planning website for the April 2001 municipality population data even though there are no population figures listed for Mecklenburg County. However, on the 2000 GIS data layer, Weddington is only listed in Union County.

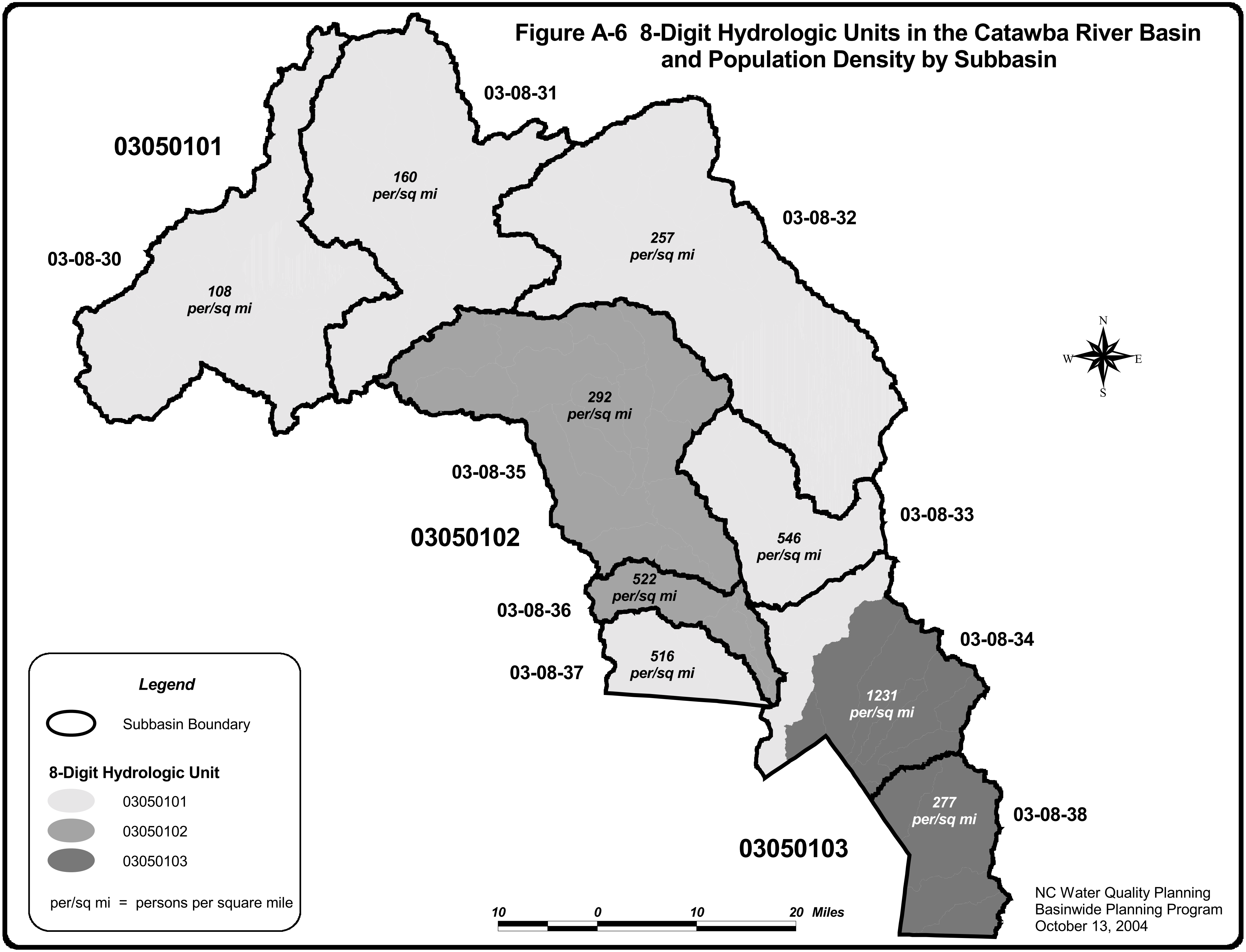
Figure A-6 8-Digit Hydrologic Units in the Catawba River Basin and Population Density by Subbasin
03050101
03-08-31
160 per/sq mi
03-08-30
108 per/sq mi
03-08-32
257 per/sq mi
292 per/sq mi
03-08-35
03050102
03-08-33
546 per/sq mi
522 per/sq mi
03-08-36
516 per/sq mi
03-08-37
03-08-34
1231 per/sq mi
277 per/sq mi
03-08-38
03050103
N
W
E
S
Legend
Subbasin Boundary
8-Digit Hydrologic Unit
03050101
03050102
03050103
per/sq mi = persons per square mile
10 0 10 20 Miles
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2.4 Local Governments and Planning Jurisdictions in the Basin

The Catawba River basin encompasses all or portions of 11 counties and 61 municipalities. Table A-8 provides a listing of these municipalities, along with the regional planning jurisdiction (Council of Governments). Fifteen municipalities are located in more than one major river basin.

Table A-8 Local Governments and Planning Units within the Catawba River Basin

County	Region	Municipalities
Alexander	E	Taylorsville ♦
Avery	D	Crossnore, Grandfather Village, Sugar Mountain ♦
Burke	E	Connelly Springs, Drexel, Glen Alpine, Hickory *, Hildebran, Long View *, Morganton, Rhodhiss *, Rutherford College, Valdese
Caldwell	E	Blowing Rock * ♦, Cajah Mountain, Cedar Rock, Gamewell, Granite Falls, Hickory *, Hudson, Lenoir, Rhodhiss *, Sawmills
Catawba	E	Brookford, Catawba, Claremont, Conover, Hickory *, Long View *, Maiden *, Newton
Cleveland	C	Kings Mountain * ♦
Gaston	F	Belmont, Bessemer City, Cherryville ♦, Cramerton, Dallas, Gastonia, High Shoals *, Kings Mountain * ♦, Lowell, McAdenville, Mount Holly, Ranlo, Spencer Mountain, Stanley
Iredell	F	Davidson * ♦, Mooresville ♦, Troutman ♦
Lincoln	F	High Shoals *, Lincolnton, Maiden *
McDowell	C	Marion, Old Fort
Mecklenburg	F	Charlotte ♦, Cornelius ♦, Davidson * ♦, Huntersville ♦, Matthews ♦, Mint Hill ♦, Pineville
Union	F	Indian Trail ♦, Marvin, Mineral Springs, Stallings ♦, Waxhaw, Weddington, Wesley Chapel
Watauga	D	Blowing Rock * ♦

* Located in more than one county.

♦ Located in more than one major river basin.

Note: Counties adjacent to and sharing a border with a river basin are not included as part of that basin if only a trace amount of the county (<2 percent) is located in that basin, unless a municipality is located in that county. (Note: Cleveland County is included only because of the municipality, Kings Mountain; and Watauga County is included only because of the municipality, Blowing Rock.)

Note: Gastonia has a minute portion located in the Broad River basin; however, it will only be included in the Catawba River basin at this time. Monroe has a minute portion located in the Catawba River basin; however, it will only be included in the Yadkin-Pee Dee River basin at this time.

Region	Name	Location
C	Isothermal Planning and Development Commission	Rutherfordton
D	Region D Council of Governments	Boone
E	Western Piedmont Council of Governments	Hickory
F	Centralina Council of Governments	Charlotte

2.5 Land Cover

Land cover can be an important way to evaluate the effects of land use changes on water quality. Unfortunately, the tools and database to do this on a watershed scale are not yet available. Parts 2.5.1 and 2.5.2 below describe two different ways of presenting land cover in the Catawba River basin. The CGIA land cover information is useful in providing a snapshot of land cover in the basin from 1993 to 1995. This information is also available in a GIS format so it can be manipulated to present amounts of the different land covers by subbasin or at the watershed scale. The National Resources Inventory (NRI 1982-1997) land cover information is presented only at a larger scale (8-digit hydrologic unit), but the collection methods allow for between-year comparisons. The two datasets cannot be compared to evaluate land cover data. This information is presented to provide a picture of the different land covers and some idea of change in land cover over time. In the future, it is hoped that land cover information like the GIS formatted dataset will be developed to make more meaningful assessments of the effects of land use changes on water quality. This dataset would also be useful in providing reliable and small-scale information on land cover changes that can be used in water quality monitoring, modeling and restoration efforts.

2.5.1 CGIA Land Cover

The North Carolina Corporate Geographic Database contains land cover information for the Catawba River basin based on satellite imagery from 1993-1995. The state's Center for Geographic Information and Analysis (CGIA) developed 24 categories of statewide land cover information. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-9. Figure A-7 provides an illustration of the relative amount of land area that falls into each major cover type for the Catawba River basin. Section B of this plan provides land cover data specific to each subbasin based on this information.

Table A-9 Description of Major CGIA Land Cover Categories

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

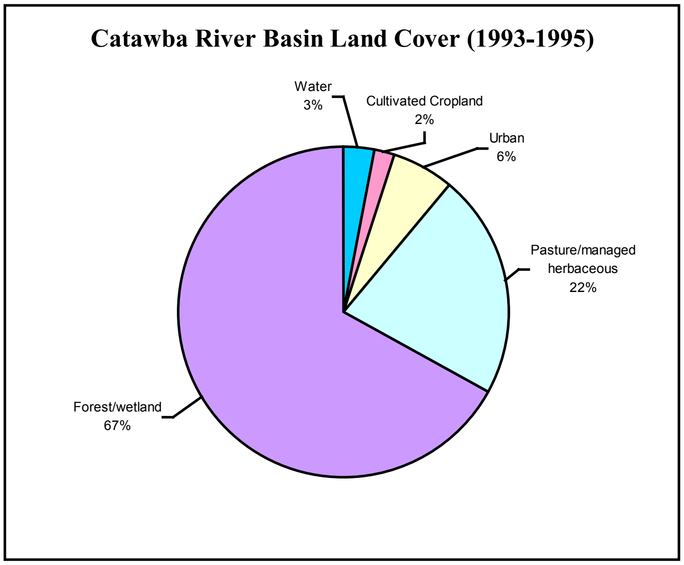

Figure A-7 Percentages within Major CGIA Land Cover Categories in the Catawba River Basin

2.5.2 NRI Land Cover Trends

Land cover information in this section is from the most current NRI, as developed by the Natural Resources Conservation Service (USDA-NRCS, NRI, updated June 2001). The NRI is a statistically based longitudinal survey that has been designed and implemented to assess conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. The NRI provides results that are nationally and temporally consistent for four points in time -- 1982, 1987, 1992 and 1997.

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

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

Table A-10 summarizes acreage and percentage of land cover from the 1997 NRI for the major watersheds within the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover. Definitions of the different land cover types are presented in

Table A-11. Figure A-6 also shows the relationship between the 8-digit hydrologic units and DWQ subbasin. These data can be used to evaluate changes in land cover over the large area represented by the 8-digit hydrologic units and should not be assumed to represent land cover changes at smaller scales in specific watersheds. In the Catawba River basin, the 8-digit hydrologic units extend into South Carolina, and thus, are partially contained in North Carolina.

Data from 1982 are also provided for a comparison of change over 15 years. During this period, urban and built-up land cover increased by 183,000 acres or about 52 percent. Uncultivated cropland increased by 7,000 acres while pastureland decreased by 13,000 acres. Forest and cultivated cropland cover significantly decreased by 104,000 and 75,000 acres, respectively. Most land cover change is occurring in the upper Catawba River basin hydrologic unit that includes the rapidly growing areas in Catawba and Iredell counties, and in the lower Catawba River basin hydrologic unit in Mecklenburg and Union counties. Figure A-8 presents changes in land cover between 1982 and 1997.

Table A-10 Land Cover in the Catawba River Basin by Major Watersheds – 1982 vs. 1997 (Source: USDA-NRCS, NRI, updated June 2001)

	MAJOR WATERSHED AREAS										
	Upper Catawba		South Fork Catawba		Lower Catawba		1997 TOTALS		1982 TOTALS		% change since 1982
LAND COVER	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	
Cult. Crop	53.5	3.7	39.9	10.2	20.8	8.0	114.2	5.4	188.8	8.9	-39.5
Uncult. Crop	49.4	3.4	12.9	3.3	3.2	1.2	65.5	3.1	58.2	2.8	12.5
Pasture	72.2	4.9	60.4	15.5	17.2	6.7	149.8	7.1	162.8	7.7	-8.0
Forest	674.1	46.2	170.1	43.5	81.2	31.4	925.4	43.9	1029.6	48.7	-10.1
Urban & Built-Up	316.4	21.7	89.7	22.9	128.8	49.8	534.9	25.4	352.0	16.7	52.0
Federal	190.5	13.1	0.0	0.0	0.0	0.0	190.5	9.0	188.7	8.9	1.0
Other	102.7	7.0	17.9	4.6	7.4	2.9	128.0	6.1	133.6	6.3	-4.2
Totals	1458.8	100.0	390.9	100.0	258.6	100.0	2108.3	100.0	2113.7	100.0	
% of Total Basin		69.2		18.5		12.3		100.0			
SUBBASINS	03-08-30 03-08-31 03-08-32 03-08-33 03-08-34 03-08-37		03-08-35 03-08-36		03-08-34 03-08-38						
8-Digit Hydraulic Units	03050101		03050102		03050103						

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

Table A-11 Description of Land Cover Types
(Source: USDA-NRCS, NRI, updated June 2001)

Type	Description
Cultivated Cropland	Harvestable crops including row crops, small-grain and hay crops, nursery and orchard crops, and other specialty crops.
Uncultivated Cropland	Summer fallow or other cropland not planted.
Pastureland	Includes land that has a vegetative cover of grasses, legumes and/or forbs, regardless of whether or not it is being grazed by livestock.
Forestland	At least 10 percent stocked (a canopy cover of leaves and branches of 25 percent or greater) by single-stemmed trees of any size which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover. The minimum area for classification of forestland is 1 acre, and the area must be at least 1,000 feet wide.
Urban and Built-up Areas	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	<u>*Rural Transportation*</u>: 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). <u>*Small Water Areas*</u>: Waterbodies less than 40 acres; streams less than 0.5 miles wide. <u>*Census Water*</u>: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than 0.5 miles in width. <u>*Minor Land*</u>: Lands that do not fall into one of the other categories.

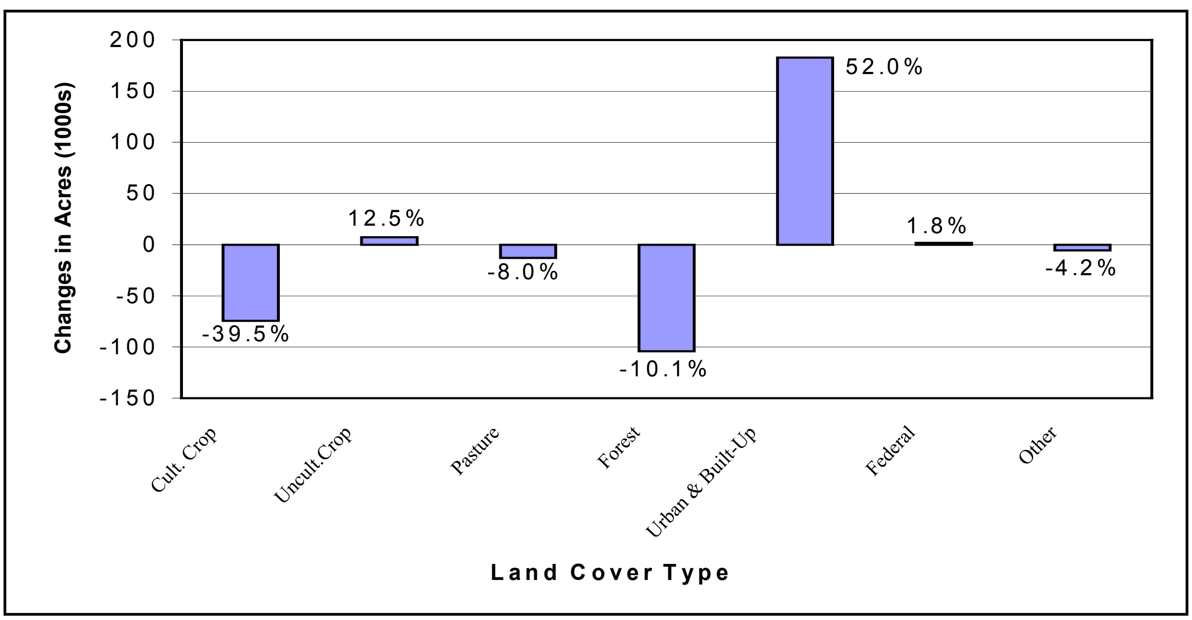

Figure A-8 Land Cover Changes from 1982 to 1997 for the Catawba River Basin
(Source: USDA-NRCS, NRI, updated June 2001)

2.6 NPDES Permits Summary

> *The primary pollutants associated with point source discharges are:*
>
> * oxygen-consuming wastes,
> * nutrients,
> * color, and
> * toxic substances including chlorine, ammonia and metals.

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities that serve populations greater than 100,000 and stormwater discharges associated with certain industrial activities. Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are issued under the NPDES program, which is delegated to DWQ by the Environmental Protection Agency.

2.6.1 Permitted Wastewater Discharges

> *Types of Wastewater Discharges*
>
> **Major Facilities**: wastewater treatment plants with flows ≥1 MGD (million gallons per day); and some industrial facilities (depending on flow and potential impacts to public health and water quality).
>
> **Minor Facilities**: Facilities not defined as Major.
>
> **100% Domestic Waste**: Facilities that only treat domestic-type waste (from toilets, sinks, washers).
>
> **Municipal Facilities**: Public facilities that serve a municipality. Can treat waste from homes and industries.
>
> **Nonmunicipal Facilities**: Non-public facilities that provide treatment for domestic, industrial or commercial wastewater. This category includes wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

Currently, there are 204 permitted wastewater discharges in the Catawba River basin. Table A-12 provides summary information (by type and subbasin) about the discharges. Various types of dischargers listed in the table are described in the inset box. A list of all facilities can be found in Appendix I. Facilities are mapped in each subbasin chapter in Section B. A location key to the facilities is provided at the beginning of Appendix I. Because the GIS data have not been updated as recently as the NPDES database, refer to Appendix I to determine the most current status of individual NPDES permit holders.

The majority of NPDES permitted wastewater flow into the waters of the Catawba River basin is from major municipal wastewater treatment plants. Nonmunicipal discharges also contribute substantial wastewater flow into the Catawba River basin. Facilities, large or small, where recent data show problems with a discharge are listed and discussed in each subbasin chapter in Section B.

Table A-12 Summary of NPDES Dischargers and Permitted Flows for the Catawba River Basin (as of 06/16/03)

	Catawba River Subbasin									
Facility Categories	**03-08-30**	**03-08-31**	**03-08-32**	**03-08-33**	**03-08-34**	**03-08-35**	**03-08-36**	**03-08-37**	**03-08-38**	**TOTAL**
Total Facilities	29	14	52	10	44	24	14	15	2	204
Total Permitted Flow (MGD)	8.62	24.69	14.51	10.99	119.67	27.33	24.08	7.26	2.51	239.66
Major Discharges	4	4	7	3	6	6	4	2	1	37
Total Permitted Flow (MGD)	7.4	24.58	10.53	10.0	117.9	26.5	21.4	6.62	2.5	227.43
Minor Discharges	25	10	45	7	38	18	10	13	1	167
Total Permitted Flow (MGD)	1.22	0.11	3.98	0.99	1.77	0.83	2.68	0.65	0.01	12.24
100% Domestic Waste	19	7	28	3	11	7	2	4	1	82
Total Permitted Flow (MGD)	0.87	0.10	0.79	0.05	0.73	0.16	0.09	0.07	0.01	2.87
Municipal Facilities	4	3	11	3	5	8	6	1	1	42
Total Permitted Flow (MGD)	4.52	24.58	12.65	10.75	104.03	26.03	21.38	6.0	2.5	212.44
Nonmunicipal Facilities	25	11	41	7	39	16	8	14	1	162
Total Permitted Flow (MGD)	4.10	0.11	1.85	0.24	15.64	1.29	2.70	1.26	0.01	27.20

2.6.2 Other NPDES Permits

Stormwater permits are granted in the form of general permits (which cover a wide variety of more common activities) or individual permits. Excluding construction stormwater general permits, there are 565 general stormwater permits and 38 individual stormwater permits (see Appendix I for a listing). Refer to Section A, Chapter 4, Part 4.12 for more information on stormwater programs and permits.

2.7 Animal Operations

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H.0217) establishing procedures for managing and reusing animal wastes from intensive livestock operations. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve animal populations of at least the following size: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. Figure A-9 displays general locations of animal operations in the Catawba River basin.

Key Animal Operation Legislation (1995-2003)

1995 Senate Bill 974 requires owners of swine facilities with 250 or more animals to hire a certified operator. Operators are required to attend a six-hour training course and pass an examination for certification. Senate Bill 1080 established buffer requirements for swine houses, lagoons and land application areas for farms sited after October 1, 1995.

1996 Senate Bill 1217 required all facilities (above threshold populations) to obtain coverage under a general permit, beginning in January 1997, for all new and expanding facilities. DWQ was directed to conduct annual inspections of all animal waste management facilities. Poultry facilities with 30,000+ birds and a liquid waste management system were required to hire a certified operator by January 1997, and facilities with dry litter animal waste management systems were required to develop an animal waste management plan by January 1998. The plan must address three specific items: 1) periodic testing of soils where waste is applied; 2) development of waste utilization plans; and 3) completion and maintenance of records on-site for three years. Additionally, anyone wishing to construct a new, or expand an existing, swine farm must notify all adjoining property owners.

1997 House Bill 515 placed a moratorium on new or existing swine farm operations and allows counties to adopt zoning ordinances for swine farms with a design capacity of 600,000 pounds (SSLW) or more. In addition, owners of potential new and expanding operations are required to notify the county (manager or chair of commission) and local health department, as well as adjoining landowners. NCDENR was required to develop and adopt economically feasible odor control standards by March 1, 1999.

1998 House Bill 1480 extended the moratorium on construction or expansion of swine farms. The bill also requires owners of swine operations to register with DWQ any contractual relationship with an integrator.

1999 House Bill 1160 extended (again) the moratorium on new construction or expansion of swine farms, required NCDENR to develop an inventory of inactive lagoons. The Bill requires owners/operators of an animal waste treatment system to notify the public in the event of a discharge to surface waters of the state of 1,000 gallons or more of untreated wastewater.

2000 Attorney General Easley reached a landmark agreement with Smithfield Foods, Inc. to phase out hog lagoons and implement new technologies that will substantially reduce pollutants from hog farms. The agreement commits Smithfield to phase out all anaerobic lagoon systems on 276 company-owned farms. Legislation will be required to phase out the remaining systems statewide within a 5-year period (State of Environment Report 2000).

2001 House Bill 1216 extended (again) the moratorium on new construction or expansion of swine farms.

Figure A-9 Animal Operations in the Catawba River Basin

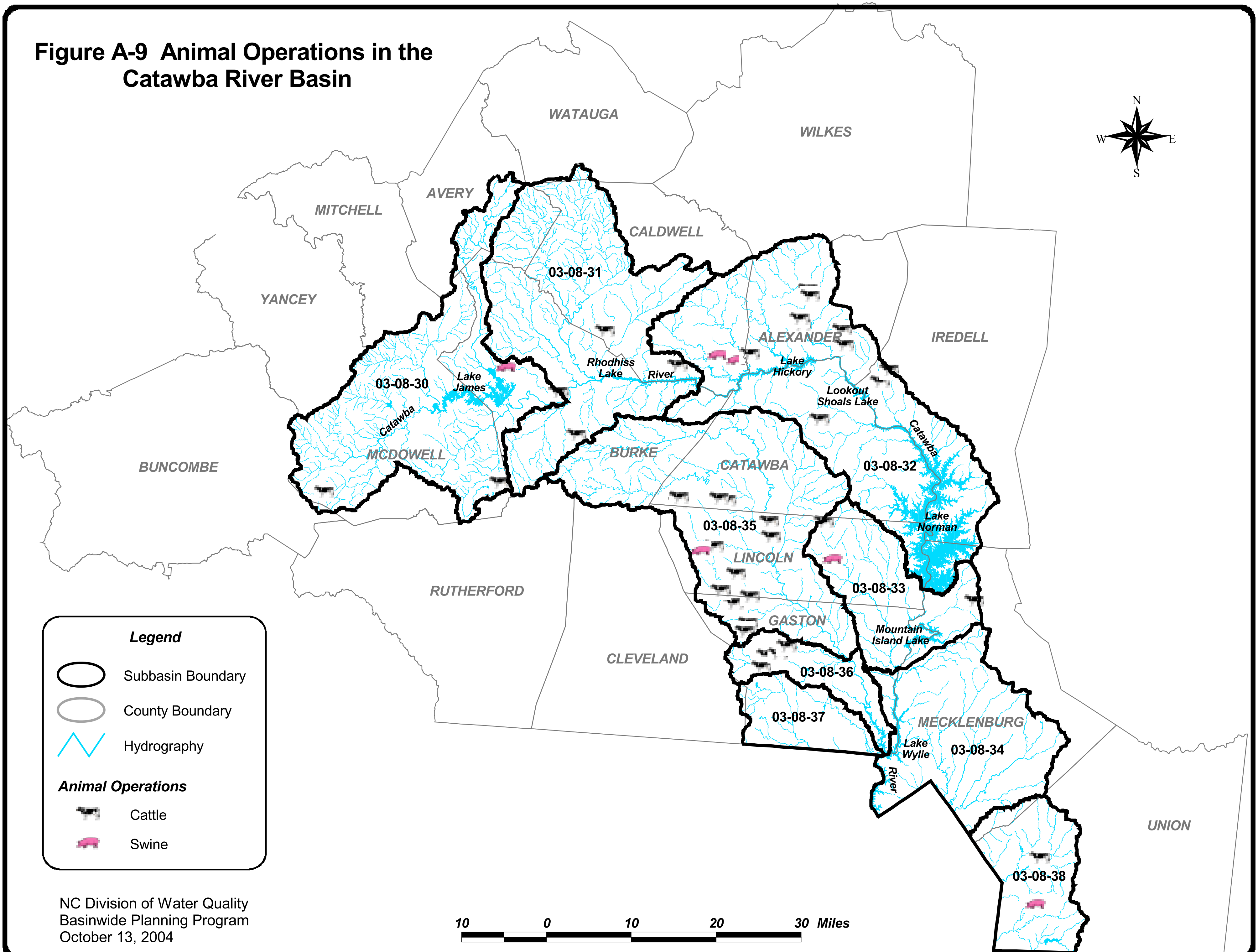

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Table A-13 summarizes, by subbasin, the number of registered livestock operations, total number of animals, number of facilities, and total steady state live weight as of July 2003. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin. There are no registered poultry operations in the Catawba River basin.

Table A-13 Registered Animal Operations in the Catawba River Basin (as of 07/03/03)

Subbasin	Cattle			Swine		
	No. of Facilities	**No. of Animals**	**Total Steady State Live Weight**	**No. of Facilities**	**No. of Animals**	**Total Steady State Live Weight**
03-08-30	2	360	504,000	0		
03-08-31	0			0		
03-08-32	8	3,288	4,603,200	1	2,600	368,420
03-08-33	1	175	245,000	0		
03-08-34	0			0		
03-08-35	8	3,121	4,369,400	0		
03-08-36	2	794	1,111,600	0		
03-08-37	0			0		
03-08-38	1	700	980,000	0		
Totals	22	8,438	11,813,200	1	2,600	368,420

* Steady State Live Weight (SSLW) is in pounds, after a conversion factor has been applied to the number of swine, cattle or poultry on a farm. Conversion factors come from the US Department of Agriculture, Natural Resource Conservation Service guidelines. Since the amount of waste produced varies by hog size, this is the best way to compare the sizes of the farms.

Between 1994 and 1998, there was a 20 percent increase in poultry capacity in the basin. There was a 22 percent decrease in dairy operations and a minimal increase in swine capacity. Information on animal capacity by subbasin (Table A-14) was provided by the USDA.

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

Subbasin	Total Swine Capacity		Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
03-08-30	292	391	-25	295	737	-60	550,507	431,907	27
03-08-31	3,921	3,477	13	743	747	-1	1,836,300	1,730,400	6
03-08-32	3,628	4,578	-21	4,203	5,485	-23	3,942,879	3,175,448	24
03-08-33	2,717	1,802	51	1,448	1,448	0	62,084	11,822	425
03-08-34	428	274	56	45	45	0	538	538	0
03-08-35	1,355	1,814	-25	4,896	6,757	-28	2,133,378	1,767,550	21
03-08-36	107	101	6	1,793	2,138	-16	100,352	352	28,409
03-08-37	236	236	0	223	223	0	276	250	10
03-08-38	1,838	1,280	44	192	237	-19	2,179,920	1,869,620	17
TOTALS	14,522	13,953	4	13,838	17,817	-22	10,806,234	8,987,887	20
% of State Total	<1%	<1%		14%	13%		5%	5%	

2.8 Natural Resources

2.8.1 Catawba River Chain Lakes

One of the most prominent hydrologic features of the Catawba River basin is the series of hydropower impoundments along the river's length that are widely referred to as the Catawba River Chain Lakes (Figure A-4). The discharge from the upstream reservoir, as well as inputs from the surrounding watershed and discharges to the lakes, influences the water quality of each impoundment. The most upstream impoundment, Lake James, has the best water quality of all of the lakes in the Catawba River chain.

The next three impoundments are Lake Rhodhiss, Lake Hickory and Lookout Shoals Lake. Enriched conditions found at these reservoirs are caused by nutrient loading from agricultural runoff, urban stormwater and municipal dischargers. Although nutrient concentrations in these reservoirs are sufficient to support substantial algal populations, short water retention times and limited light availability historically kept algae from reaching higher levels (NCDEHNR-DEM, 1992). During the last basin cycle, retention times increased due to drought, and the potential for intense algal growth was realized in Lake Rhodhiss and Lake Hickory. Refer to Section A, Chapter 4, Part 4.7 for more information on these lakes.

Lake Norman is located on the Catawba River below Lookout Shoals Lake and has historically exhibited good water quality. Water released from Lake Norman forms Mountain Island Lake, which is moderately productive. The final impoundment on the Catawba River in North Carolina is Lake Wylie. Lake Wylie is experiencing localized sedimentation and nutrient enrichment problems in the Crowders Creek and Catawba Creek arms of the lake.

All seven of the Catawba River Chain Lakes (Catawba-Wateree Project) are owned by Duke Power Company and were created to generate electricity. All of the chain lakes were completed between 1904 and 1928 with the exception of Lake Norman, which was completed in 1963. In addition to power generation, the lakes are popular recreational areas, and some are used for water supply purposes and for waterfront home development (Table A-15).

Part I of the Federal Power Act (FPA) requires Duke Power's Catawba-Wateree Project to have a license in order to operate. Relicensing is the process for obtaining a new license for a hydropower project after the existing license expires. Duke Power's current license for the project was issued in 1958 and will expire in 2008. Please refer to Section A, Chapter 4, Part 4.7.1 for a discussion on the relicensing process.

More detailed information on each of the lakes can be found in Section B.

Table A-15 Statistics on Major Lakes in the Catawba River Basin

Lake	Surface Area (Acres)	Mean Depth (Feet)	Shore Length (Miles)	Mean Retention Time (Days)	Trophic Level	Watershed Area (Sq. Mi.)	Major Uses *
Catawba River Chain Lakes (Upstream to downstream order)							
Lake James	6,510	46	145	208	Oligotrophic	380	Hydro, Rec
Rhodhiss Lake	3,515	20	90	21	Mesotrophic	1,090	Hydro, Rec
Lake Hickory	4,100	33	105	33	Oligotrophic	1,310	Hydro, Rec, WS
Lookout Shoals	1,270	30	39	7	Oligotrophic	1,449	Hydro, Rec
Lake Norman	32,510	33	520	239	Oligotrophic	1,790	Hydro, Rec, WS
Mt. Island Lake	3,234	16	61	12	Oligotrophic	1,859	Hydro, Rec, WS
Lake Wylie	12,450	23	327	39	Eutrophic	3,020	Hydro, Rec
Other Major Lakes (Not on Catawba River)							
Lake Tahoma	161				Oligotrophic		Rec (was Hydro)
Little River Dam	162				Eutrophic	25	Rec (was Hydro)
Maiden Lake	14				Eutrophic	20	WS
Bessemer City	15				Mesotrophic	0.4	WS
Newton City Lake	17				Oligotrophic		WS

* Hydro = Hydropower; Rec = Recreation; WS = Water Supply

The five other lakes in the Catawba River basin included in Table A-15 are not on the Catawba River. The Little River Dam, located on a tributary to Lake Hickory, is no longer used for hydropower purposes and has become a local fishing spot. Lake Tahoma, located on a tributary to the Catawba River upstream from Lake James, is now a recreational lake owned by Lake Tahoma, Incorporated. The last three lakes are small water supply reservoirs serving the municipalities of Maiden, Bessemer City and Newton.

2.8.2 Ecological Significance of the Catawba River Basin

Significant natural plant and animal communities in the basin are somewhat influenced by the geology of the area. The Catawba River basin supports several nationally significant aquatic habitat communities, notable for their rare mollusk, fish and insect populations (see Table A-16).

The most biologically important aquatic habitats in the basin are in Waxhaw Creek, Wilson Creek and Upper Creek. The Linville River, which also contains several rare species, is valued as a recreational river and has been designated a State Natural and Scenic River. Ecologically significant wetlands in the basin are mostly small, isolated bogs, such as the nationally significant Pineola Bog in Avery County and several bogs in McDowell County. These bogs are often home to a variety of rare plants and animals. Large, high quality floodplain wetland communities have not been identified in the basin.

Table A-16 Rare Aquatic and Wetland-Dwelling Species in the Catawba River Basin (as of August 2003)

Major Taxon	Scientific Name	Common Name	State Status	Federal Status
Crustacean	*Caecidotea carolinensis*	Bennett's Mill Cave water slater	SR	FSC
Crustacean	*Dactylocythere isabelae*	Catawba crayfish ostracod	SR	FSC
Fish	*Carpiodes velifer*	Highfin carpsucker	SC	
Fish	*Micropterus coosae*	Redeye bass	SR	
Fish	*Etheostoma collis pop 1*	Carolina darter - Central Piedmont population	SC	FSC
Fish	*Cyprinella zanema pop 1*	Santee chub - Piedmont population	SR	
Insect	*Ceraclea slossonae*	A caddisfly	SR	
Insect	*Bolotoperla rossi*	A stonefly	SR	
Insect	*Acerpenna macdunnoughi*	A mayfly	SR	
Insect	*Ephemerella berneri*	A mayfly	SR	
Insect	*Barbaetis benfieldi*	Benfield's bearded small minnow mayfly	SR	
Insect	*Homoeoneuria cahabensis*	Cahaba sand-filtering mayfly	SR	
Insect	*Heterocloeon petersi*	A mayfly	SR	
Insect	*Rhyacophila mainensis*	A caddisfly	SR	
Insect	*Matrioptila jeanae*	A caddisfly	SR	
Insect	*Triaenodes marginata*	A triaenode caddisfly	SR	
Insect	*Micrasema burksi*	A caddisfly	SR	
Insect	*Micrasema sprulesi*	A caddisfly	SR	
Insect	*Macdunnoa brunnea*	A mayfly	SR	
Insect	*Macromia margarita*	Mountain River cruiser	SR	FSC
Insect	*Palaeagapetus celsus*	A caddisfly	SR	
Insect	*Ophiogomphus howei*	Pygmy snaketail	SR	FSC
Insect	*Ophiogomphus edmundo*	Edmund's snaketail	SR	FSC
Mollusk	*Alasmidonta robusta*	Carolina elktoe	EX	
Mollusk	*Leptoxis dilatata*	Seep mudalia	T	
Mollusk	*Alasmidonta varicosa*	Brook floater	E	FSC
Mollusk	*Lasmigona decorata*	Carolina heelsplitter	E	E
Mollusk	*Villosa constricta*	Notched rainbow	SC	
Mollusk	*Villosa delumbis*	Eastern creekshell	SR	
Mollusk	*Villosa vaughaniana*	Carolina creekshell	E	FSC

Rare Wetland-Dwelling Animals in the Catawba River Basin				
Amphibian	*Hemidactylium scutatum*	Four-toed salamander	SC	
Bird	*Vireo gilvus*	Warbling vireo	SR	
Bird	*Haliaeetus leucocephalus*	Bald eagle	T	T (PD)
Insect	*Autochton cellus*	Golden banded-skipper	SR	
Mammal	*Sorex palustris punctulatus*	Southern water shrew	SC	FSC
Reptile	*Glyptemys muhlenbergii*	Bog turtle	T	T(S/A)

Rare Species Listing Criteria

E =	Endangered (those species in danger of becoming extinct)
T =	Threatened (considered likely to become endangered within the foreseeable future)
EX =	Extirpated
PD =	Proposed Delisted
SR =	Significantly Rare (rare in North Carolina, but not yet officially listed as threatened or endangered)
SC =	Special Concern (have limited numbers in North Carolina and vulnerable populations in need of monitoring)
FSC =	Federal Species of Concern (those under consideration for listing under the Federal Endangered Species Act)
T(S/A) =	Threatened due to Similarity of Appearance

2.8.3 Significant Natural Heritage Areas in the Catawba River Basin

Figure A-10 is a map of the Significant Natural Heritage Areas of the Catawba River basin. The North Carolina Natural Heritage Program (NHP) of the Division of Parks and Recreation compiles a list of Significant Natural Heritage Areas as required by the Nature Preserves Act. The list is based on the program's inventory of natural diversity in the state. Natural areas are evaluated on the basis of the occurrences of rare plant and animal species, rare or high quality natural communities, and geologic features. The global and statewide rarity of these elements and the quality of their occurrence at a site relative to other occurrences determine a site's significance. The sites included on this list are the best representatives of the natural diversity of the state, and therefore, have priority for protection. Inclusion on the list does not imply that any protection or public access exists.

Sites that directly contribute to the maintenance of water quality in the Catawba River basin are highlighted on the map and in the following text. More complete information on Significant Natural Heritage Areas may be obtained from the Natural Heritage Program.

1. **Waxhaw Creek Aquatic Habitat**. A section of Waxhaw Creek in Union County, from the vicinity of NC 200 downstream to the first tributary below SR 1117, is considered an important aquatic habitat for a rare species of freshwater mussel known as Carolina heelsplitter. Waxhaw Creek is one of only two streams in North Carolina and approximately five streams nationwide that have living populations of this federally endangered species.

2. **Wilson Creek Aquatic Habitat**. Wilson Creek is a large creek that flows southeast from the area of Grandfather Mountain to Johns River in northwestern Caldwell County. Wilson Creek is one of only two known sites that support a population of a rare dragonfly, Edmund's snaketail. Edmund's snaketail is a globally rare species, which was feared to be extinct until it was rediscovered a few years ago.

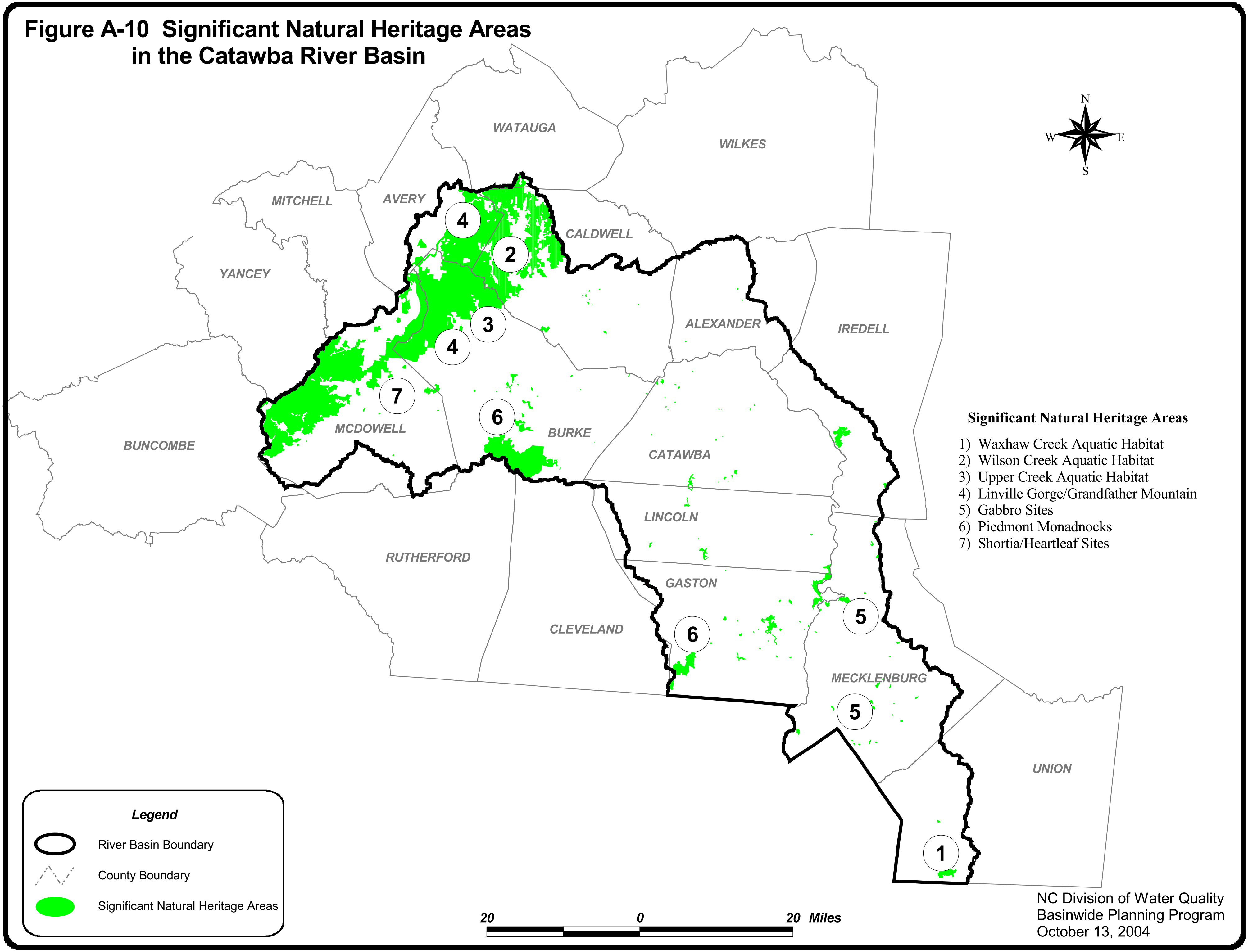


Figure A-10 Significant Natural Heritage Areas in the Catawba River Basin

3. **Upper Creek Aquatic Habitat**. Upper Creek is a fairly large stream that flows southward toward Catawba River in northern Burke County. The upper boundary of Upper Creek Aquatic Habitat is at Timbered Branch, and the downstream boundary is at Warrior Fork, just north of Morganton. Upper Creek is a nationally significant aquatic habitat recognized for being the best of only two known locations with a population of a rare dragonfly, Edmund's snaketail. Upper Creek also supports another rare dragonfly, the pygmy snaketail. Two rare freshwater mussel species, brook floater, a state threatened species; and eastern creekshell, a significantly rare species, are also found in Upper Creek.

4. **Linville Gorge/Grandfather Mountain**. Linville Gorge, a 10,000-acre high quality natural area significant for its 2,000-foot steep valley walls topped by quartzite cliffs, is one of the few primeval gorges in the Appalachians. It contains several rare plant species, as well as a few rare animal species and high quality examples of rare natural communities. Linville Gorge is within the Pisgah National Forest and has been established as a National Wilderness Area and a Registered Natural Heritage Area.

   Grandfather Mountain is the highest mountain (5,964 feet) in the Blue Ridge Ranges region of the Blue Ridge Mountains. Grandfather Mountain has an astonishing diversity of both endemic and disjunct species, with nearly 60 rare plant and animal species known. Nearly 1,000 acres of Grandfather Mountain in Watauga and Avery counties are permanently dedicated as a State Nature Preserve.

5. **Gabbro sites**. Mecklenburg and Union counties contain areas of unique geology that support high quality wetland communities such as Upland Depression Swamp Forests. Several of the upland depressions have recently been protected, but most of the gabbro sites are highly threatened by development in the Charlotte area.

6. **Piedmont Monadnocks**. A cluster of monadnocks occurs on the southern edge of the Catawba River basin in Gaston, Catawba and Burke counties. Three of the most prominent monadnock clusters (remnant bodies of rock that are more resistant to erosion than the surrounding rocks) are Crowders and Kings Mountains, South Mountains and Bakers Mountain. In addition to their geologic significance, these monadnocks are significant natural areas for their biodiversity.

   The South Mountains are a rugged landscape of narrow ridges, ravine-like valleys and steep slopes. The South Mountains support communities typical of the Blue Ridge but are extremely rare in the Piedmont. Over 11,000 acres of South Mountains are protected as a state park, and the recent acquisition of the adjacent Rollins Tract by the NC Wildlife Resources Commission adds another 17,000 acres to the protected area. Crowders Mountain and Kings Pinnacle are protected as the 3,000-acre Crowders Mountain State Park. Approximately 300 acres of Bakers Mountain are owned by Catawba County and are under consideration for protection as a park.

7. **Shortia/Heartleaf sites**. Northern oconee bells and dwarf-flowered heartleaf are two very rare plants that live in areas of moist, sandy, acidic soils found on slopes of several streams in Catawba, Burke, and McDowell counties. These species have been extirpated over most of their former ranges by the damming of streams and rivers. Other populations have been

endangered through land development or excessive logging of the steep ravines in which the plants grow.

2.8.4 Forestry in the Catawba River Basin

In Caldwell County, the Division of Forest Resources (DFR) manages approximately 300 acres at the Tuttle Educational State Forest, which help protect the headwaters of Husband Creek and Celia Creek. The forest, established in 1978, is managed as an outdoor classroom for school groups and the general public, as well as for sustainable forestry. Visitation averages 35,000 per year, including nearly 6,000 school children that are provided classes that focus on water quality protection and soil conservation practices. More information is available on the North Carolina Division of Forest Resources' website at http://www.dfr.state.nc.us/.

The 1,700-acre Mountain Island Educational State Forest is currently being established on the western shores of Mountain Island Lake along the Lincoln/Gaston county line. This forest helps protect a significant portion of the watershed around Mountain Island Lake, which is used as the primary drinking water supply for the greater Charlotte/Mecklenburg region. This forest focuses on the benefits and importance of using proper Best Management Practices ("BMPs") and shows how active sustainable forest management is compatible with water quality protection. While the forest is not yet open to the public, a virtual tour is available on their website at http://www.dfr.state.nc.us/esf/miesf/miesf_home.htm.

There is an estimated 171,000 acres of the Pisgah National Forest within the Catawba River basin, which amounts to one-third of the entire holdings of the Pisgah National Forest. More information about the National Forests and the USDA-Forest Service can be found on the website at http://www.fs.fed.us/.

Forest Resources

Nearly 75 percent of forestland in the Catawba River basin is owned by nonindustrial private landowners. Less than 5 percent of the forestland is owned by forest products companies, with the remaining 20 percent under public ownership. Most of the forestland in public ownership consists of the Pisgah National Forest (USDA-Forest Service, *North Carolina's Forests*, 1990, *Southeastern Forest Experiment Station Resource Bulletin SE-142*).

From the most recent data available, 25 different businesses in the basin are considered "Primary Processors" of forestry-related raw material, which represents less than 10 percent of the total number of primary processors (285) located in North Carolina. Some examples of a primary processor include a sawmill, veneer mill, chip mill, paper mill or pallet mill. The state, with general appropriations combined with tax revenue from forest product Primary Processors, provides cost share assistance to private landowners for approved forestation practices through the "Forest Development Program". Other state and federal cost share programs also are available to promote forestation work and forestland management. More information on these cost share programs is available at local DFR county offices and the DFR website at http://www.dfr.state.nc.us/. At least 11,500 acres of land were reported as having been established or regenerated in trees across the Catawba River basin during September 1997 through August 2002.

During this same time period, DFR provided private forest landowners in the Catawba River basin 1,655 individual forest management plans, encompassing 71,480 acres. In addition, 28 tracts of private forestland are certified Stewardship Forests, totaling over 3,700 acres. DFR's Urban and Community Forestry Program recognizes four municipalities in the Catawba River basin, including Charlotte and Gastonia, as a "Tree City USA".

Forestry Regulation in North Carolina

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (G.S. Chapter 113A, Article 4 referred to as "SPCA"). However, forestry operations may be exempted from the permit requirements in the SPCA, if the operations meet compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A NCAC 1I .0101 - .0209, referred to as "FPGs") and General Statutes regarding stream obstruction (G.S. 77-13 and G.S. 77-14).

Additionally, the Environmental Management Commission enacted a temporary riparian buffer rule in 2001 (15A NCAC 2B .0243) that applies to the lakes and mainstem of the Catawba River. This riparian buffer rule goes into full effect in August 2004 and creates certain restrictions regarding timber removal and forestry activities in the buffer zone. Refer to Section A, Chapter 4, Part 4.11.3 for further discussion.

The North Carolina Division of Forest Resources (DFR) is delegated the authority to monitor and evaluate forestry operations for compliance with these aforementioned laws and/or rules. In addition, the DFR works to resolve identified FPG and basin buffer rule compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved by the DFR are referred to the Division of Land Resources for enforcement action; violations of Catawba River temporary buffer rules are referred to DWQ for enforcement. More information is available on the Water Quality Section of the DFR's website at http://www.dfr.state.nc.us/.

During the period September 1997 through August 2002, DFR conducted 1,186 FPG inspections of forestry-related activities in the Catawba River basin; 92 percent of the sites inspected were in compliance.

There are three Water Quality Foresters that cover the Catawba River basin. The DFR currently has a Water Quality Forester located in seven of the DFR's 13 Districts across the state. Service Foresters and county personnel along with their other forest management and fire control responsibilities handle water quality issues in the remaining districts. Water Quality Foresters conduct FPG inspections, develop pre-harvest plans, and provide training opportunities for landowners, loggers and the public regarding water quality issues related to forestry.

Forestry Best Management Practices

Implementing Forestry Best Management Practices ("BMPs") is encouraged by DFR in order to efficiently and effectively protect the water resources of North Carolina. The *Forestry Best Management Practices Manual* describes recommended techniques that may be used to comply with the state's forestry laws and help protect water quality. This document is available for viewing on the Water Quality Section of the DFR's website.

Among the BMPs promoted for timber harvesting is the use of bridge mats for establishing temporary stream crossings. Bridge mats are available for temporary use across the entire Catawba River basin. The DFR's Bridge Mat Loan and Education Program is an educational and protection project which promotes the benefits of using portable bridges for stream crossings, in lieu of using other techniques such as culverts or hard-surface crossings, both of which have a greater potential to result in sedimentation. All bridge mat purchases for the DFR's program are funded by grant awards from the USEPA's Nonpoint Source Pollution Management Program under Section 319(h) of the Clean Water Act {1987}. More information is available on the Water Quality Section of the DFR's website at http://www.dfr.state.nc.us/.

The NCDFR frequently hosts workshops and 'in-woods' field tours for loggers, landowners and other forestry professionals to provide refresher training on proper BMP implementation and the importance of protecting water quality during forestry activities.

Section A - Chapter 3
Summary of Water Quality Information for the Catawba River Basin

3.1 General Sources of Pollution

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

Point Sources

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

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

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

Nonpoint Sources

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

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

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

Cumulative Effects

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

3.2 Description of Surface Water Classifications and Standards

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

Statewide Classifications

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

Table A-17 Primary and Supplemental Surface Water Classifications

PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS*	
Class	**Best Uses**
C and SC	Aquatic life propagation/protection and secondary recreation.
B and SB	Primary recreation and Class C uses.
SA	Waters classified for commercial shellfish harvesting.
WS	*Water Supply watershed*. There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.
SUPPLEMENTAL CLASSIFICATIONS	
Class	**Best Uses**
Sw	*Swamp Waters*: Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
HQW	*High Quality Waters*: Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies.
ORW	*Outstanding Resource Waters*: Unique and special surface waters which are unimpacted by pollution and have some outstanding resource values.
NSW	*Nutrient Sensitive Waters*: Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.

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

Statewide Water Quality Standards

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

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

High Quality Waters (Class HQW)

There are 279 stream miles of HQW waters (Figure A-11) throughout the Catawba River basin. Special HQW protection management strategies 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.

Criteria for HQW Classification

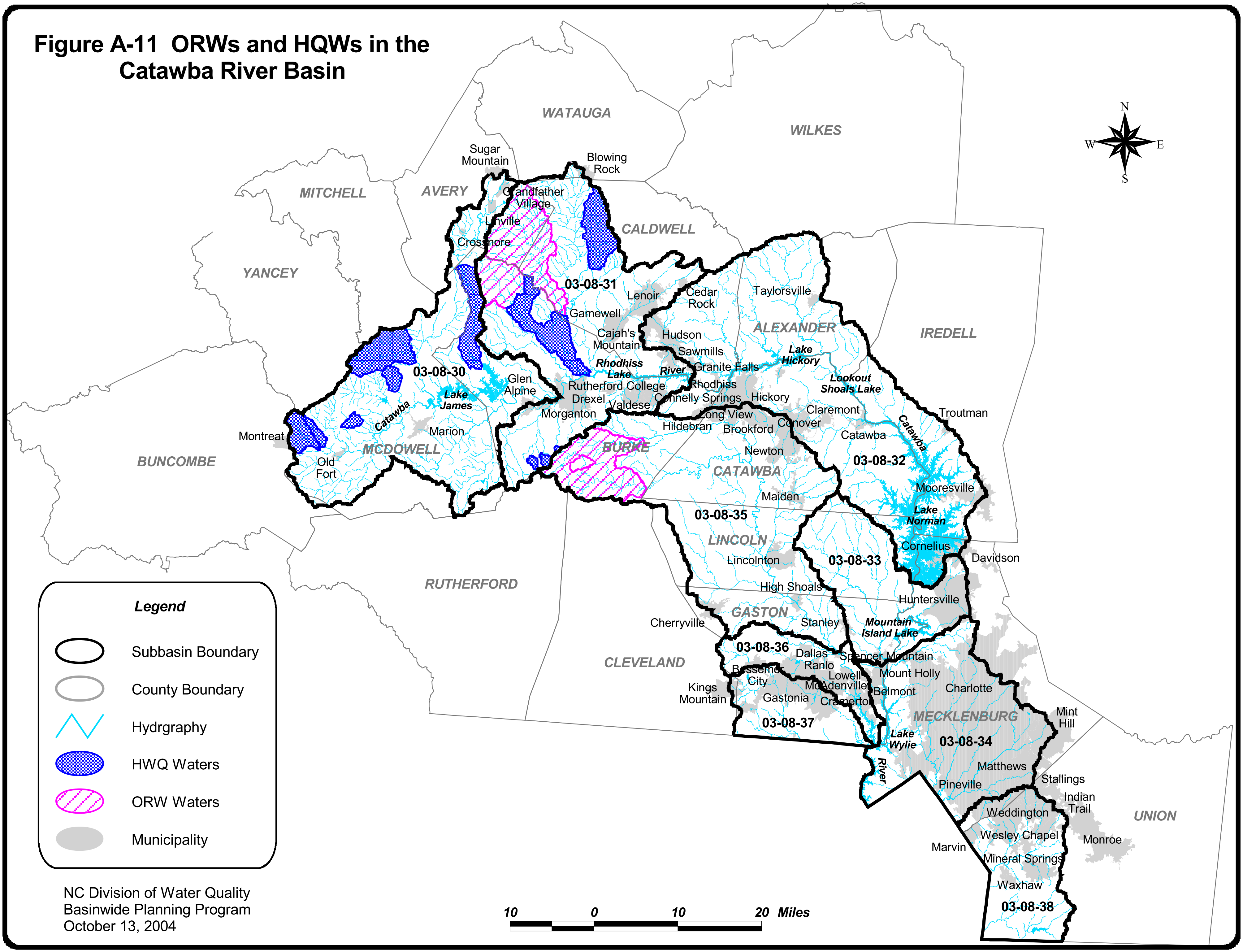
- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native or special native trout waters by the Wildlife Resources Commission.
- Waters designated as primary nursery areas or other functional nursery areas by the Division of Marine Fisheries.
- Waters classified by DWQ as WS-I, WS-II or SA.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan in accordance with rules established by the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program, and which drain to and are within one mile of HQWs, are required to control runoff from the development using either a low density or high density option. The low density option requires a 30-foot vegetated buffer between development activities and the stream; whereas, the high density option requires structural stormwater controls. In addition, the Division of Land Resources requires more stringent erosion controls for land-disturbing projects within one mile of and draining to HQWs.

Outstanding Resource Waters (Class ORW)

There are 257 stream miles of ORW waters (Figure A-11) in the Catawba River basin. These waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

Figure A-11 ORWs and HQWs in the Catawba River Basin



The ORW rule defines outstanding resource values as including one or more of the following:

- an outstanding fisheries resource;
- a high level of water-based recreation;
- a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
- within a state or national park or forest; or
- a 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 a 30-foot vegetated buffer or stormwater controls for new developments 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.

<u>Primary Recreation (Class B and SB)</u>

There are 229 stream miles and 45,687 freshwater acres classified for primary recreation in the Catawba River basin.

<u>Trout Waters (Class Tr)</u>

There are 568 stream miles and 166 freshwater acres with supplemental trout waters (Tr) classification. Different water quality standards for some parameters, such as dissolved oxygen, temperature and turbidity, have been developed to protect freshwaters for natural trout propagation and survival of stocked trout. These water quality standards result in more restrictive limits for wastewater discharges to trout waters. There are no watershed development restrictions associated with the Tr classification. However, the NC Division of Land Resources does require a 25-foot vegetated buffer between Tr waters and graded construction sites.

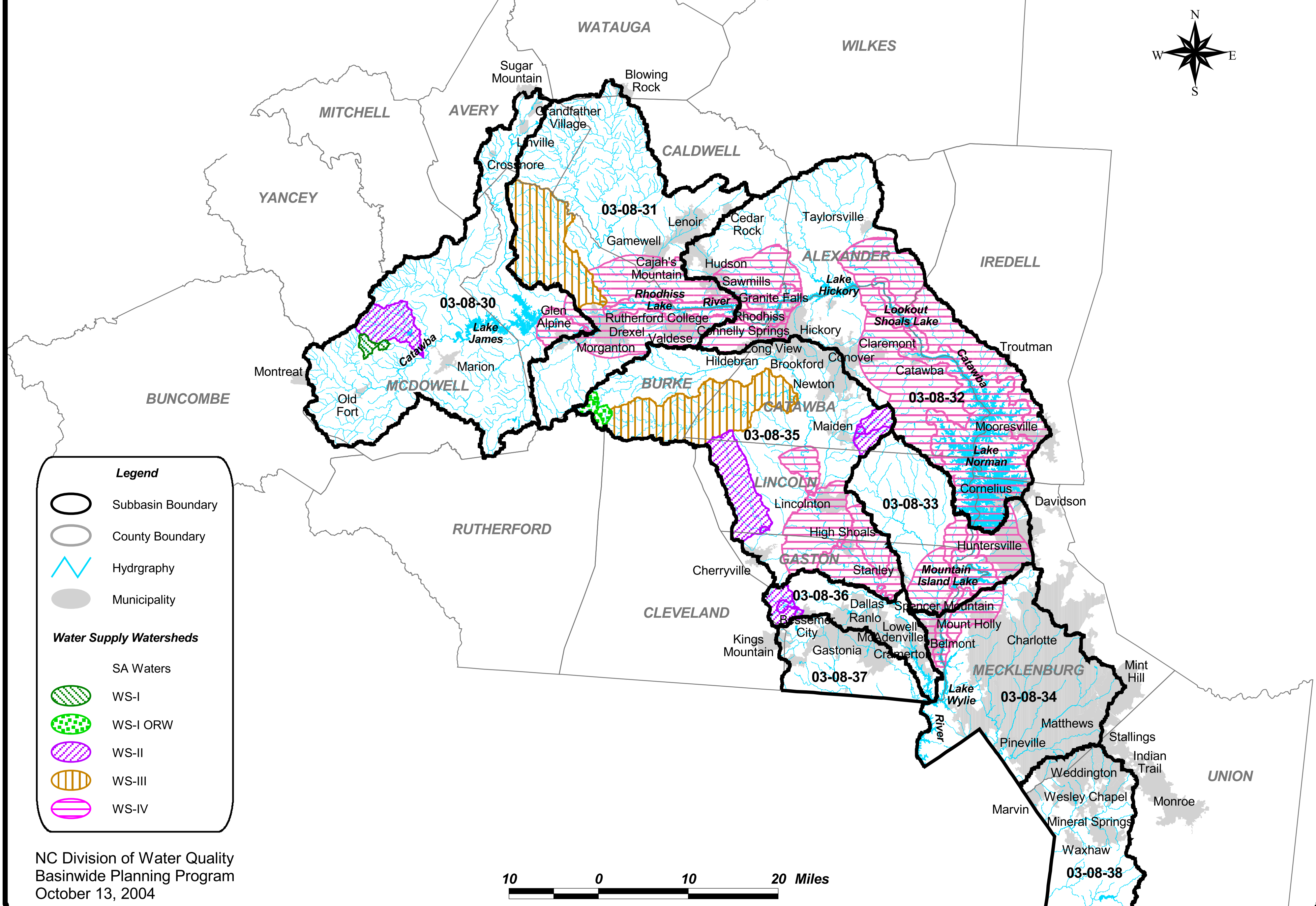
The NC Wildlife Resources Commission also administers a state fishery management classification, Designated Public Mountain Trout Waters. It provides for public access to streams for fishing and regulates fishing activities (seasons, size limits, creel limits, and bait and lure restrictions). Although many of these waters are also classified Tr by DWQ, this is not the same classification.

<u>Water Supply Watersheds (Class WS)</u>

There are 998 stream miles and 47,082 freshwater acres classified as water supply watersheds in the Catawba River basin (Figure A-12). The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution.

There are five water supply classifications (WS-I to WS-V) that are defined according to the land use characteristics of the watershed. The WS-I classification carries the greatest protection for water supplies. No development is allowed in these watersheds. Generally, WS-I lands are publicly owned. WS-V watersheds have the least amount of protection and do not require development restrictions. These are either former water supply sources or sources used by

Figure A-12 Water Supply Watersheds in the Catawba River Basin



NC Division of Water Quality
Basinwide Planning Program
October 13, 2004

industry. WS-I and WS-II classifications are also HQW by definition because requirements for these levels of water supply protection are at least as stringent as those for HQWs. Those watersheds classified as WS-II through WS-IV require local governments having jurisdiction within the watersheds to adopt and implement land use ordinances for development that are at least as stringent as the state's minimum requirements. A 30-foot vegetated setback is required on perennial streams in these watersheds.

Pending and Recent Reclassifications in the Catawba River Basin

He Creek (4.8 mi.), Henry Fork (4.26 mi.) and Jerry Branch (1.75 mi.) in Burke County are in the process of being reclassified from WS-I ORW to WS-V ORW. This new classification will reflect the removal of a Morganton water intake from these headwater streams.

3.3 DWQ Water Quality Monitoring Programs in the Catawba River Basin

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

DWQ monitoring programs for the Catawba River Basin include:

- Benthic Macroinvertebrates (Section A, Chapter 3, Part 3.3.1)
- Fish Assessments (Section A, Chapter 3, Part 3.3.2)
- Aquatic Toxicity Monitoring (Section A, Chapter 3, Part 3.3.3)
- Lake Assessment (Section A, Chapter 3, Part 3.3.4)
- Ambient Monitoring System (Section A, Chapter 3, Part 3.3.5)

3.3.1 Benthic Macroinvertebrate Monitoring

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

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

Overview of Benthic Macroinvertebrate Data

Appendix II lists all the benthic macroinvertebrate collections in the Catawba River basin between 1983 and 2002, giving site location, collection date, taxa richness, biotic index values and bioclassifications. There were 174 benthic samples collected during this assessment period. Table A-18 lists the most recent bioclassifications (by subbasin) for all benthic sites in the Catawba River basin. Streams listed as "Good" or "Excellent" are generally found in the undeveloped mountainous regions of the basin. A designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than four meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. Refer to Section A, Chapter 3, Part 3.5 for more information.

Streams in the Catawba Basin showing water quality improvements include:

- Swannanoa Creek (Subbasin 03-08-30) - soybean oil spill recovery
- Mackey Creek (Subbasin 03-08-30) – discharger removal
- Unnamed Tributary to Abernethy Creek (Subbasin 03-08-37) – discharger upgrade

Streams showing a decline in water quality include:

- North Fork Catawba River (Subbasin 03-08-30) – possible discharger impacts
- Warrior Fork and Johns River (Subbasin 03-08-31) – possible impact from nursery plant area
- Headwaters of Lower Creek (Subbasin 03-08-31) – unknown
- McGalliard Creek (Subbasin 03-08-31) – urban impacts
- Middle and Lower Little Rivers (Subbasin 03-08-32) – low flow
- McDowell Creek (Subbasin 03-08-33) – urban impacts
- Dutchmans Creek (Subbasin 03-08-33) – unknown
- Killian Creek (Subbasin 03-08-33) – possible discharger effect
- Indian Creek (Subbasin 03-08-35) – unknown

Table A-18 Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent rating for each site) in the Catawba River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Impaired	Not Rated	Total
03-08-30	8	31	6	2	1	2	0	50
03-08-31	16	9	7	10	1	3	9	55
03-08-32	0	2	8	4	0	0	0	14
03-08-33	4	1	1	3	0	0	0	9
03-08-34	0	0	3	7	8	0	1	19
03-08-35	9	12	10	9	2	0	5	47
03-08-36	0	9	6	2	0	0	2	19
03-08-37	0	0	6	7	6	1	3	23
03-08-38	0	0	3	0	0	0	0	3
Total (#)	**37**	**64**	**50**	**44**	**18**	**6**	**20**	**239**
Total (%)	**15**	**27**	**21**	**18**	**8**	**3**	**8**	**100**

3.3.2 Fish Assessments

Scores are assigned to fish community samples using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Appendix II contains more information regarding the NCIBI. Since the late 1990s, application of the NCIBI has been restricted to wadeable streams that can be sampled by a crew of 2-4 persons using backpack electrofishers and DWQ Standard Operating Procedures (NCDENR-DWQ, 2001 (http://www.esb.enr.state.nc.us/BAU.html)).

Overview of Fish Community Data

Appendix II lists all of the fish community collections in the Catawba River basin between 1990 and 2002, giving site location, collection date and NCIBI rating. Fish community samples have been collected at 55 sites during this assessment period. Table A-19 lists the most recent ratings since 1990, by subbasin, for all fish community sites.

Table A-19 Summary of NCIBI Categories for All Freshwater Fish Community Sites (using the most recent rating for each site) in the Catawba River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Total
03-08-30	4	4	2	1	1	12
03-08-31	5	0	1	3	0	9
03-08-32	1	2	1	1	0	5
03-08-33	0	1	1	0	1	3
03-08-34	0	0	1	0	1	2
03-08-35	1	3	1	1	0	6
03-08-36	0	0	1	0	0	1
03-08-37	0	0	0	2	0	2
03-08-38	0	0	1	1	0	2
Total (#)	**11**	**10**	**9**	**9**	**3**	**42**
Total (%)	**26**	**24**	**21.5**	**21.5**	**7**	**100**

Catawba River Basin Fish Kills

DWQ has systematically tracked reported fish kill events across the state since 1996. From 1996 to 2002, DWQ field investigators reported 14 fish kill events in the Catawba River basin. Kill activity extent and fish mortality remained light, never exceeding 50,000. Causes listed on kill reports included chemical spills, toxic discharges and bacterial infections. The extent to which fish kills are related to land use activities is not known. DWQ attributes 34 percent of the 2002 Catawba River fish kills to unknown causes, of which land use cannot be excluded. Further investigation into the relationship between land use within a watershed and fish kills in an associated waterbody is necessary for watershed managers to make informed decisions. For more information on fish kills in North Carolina, refer to the website at http://www.esb.enr.state.nc.us/Fishkill/fishkillmain.htm.

3.3.3 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity (WET) by their NPDES permit or by administrative letter. DWQ's Aquatic Toxicology Unit (ATU) may also test other facilities. Per Section 106 of the Clean Water Act, the ATU is required to test at least 10 percent of the major discharging facilities over the course of the federal fiscal year (FFY). However, it is ATU's target to test 20 percent of the major dischargers in the FFY. This means that each major facility would get evaluated over the course of their five-year permit. There are no requirements or targets for minor dischargers.

In addition, the ATU maintains a compliance summary for all facilities required to perform tests and provides monthly updates of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

Ninety-five NPDES permits in the Catawba River basin currently require WET testing. Seventy-three permits have a WET limit; the other 22 permits specify monitoring but with no limit. The number of facilities required to monitor WET has increased steadily since 1987, the first year that WET limits were written into permits in North Carolina. The compliance rate has risen as well. Since 1996, the compliance rate has stabilized at approximately 85-90 percent. Figure A-13 summaries WET monitoring compliance in the Catawba River basin from 1987 to 2001. Facilities with toxicity problems during the most recent two-year review period are discussed in Section B subbasin chapters.

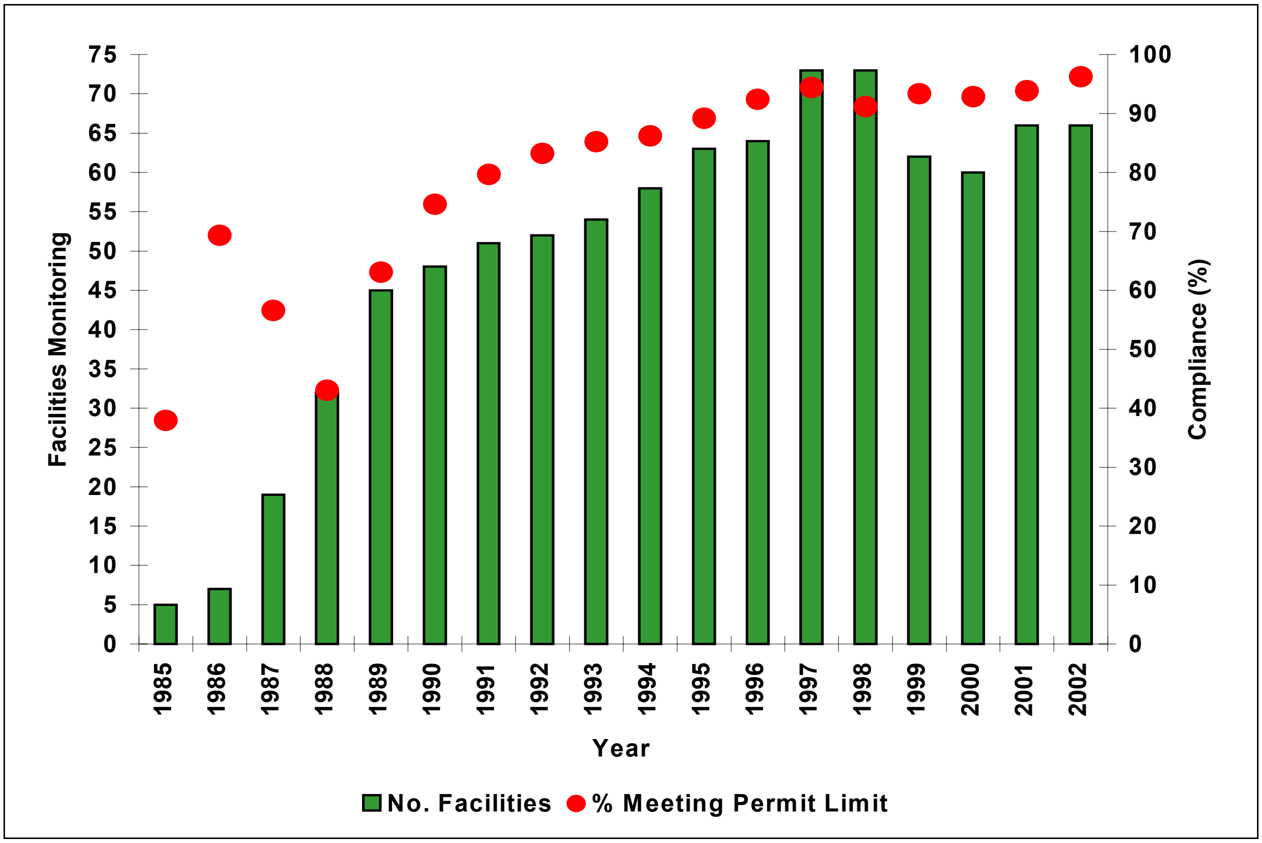


Figure A-13 Summary of Compliance with Aquatic Toxicity Tests in the Catawba River Basin

3.3.4 Lakes Assessment Program

Ten lakes in the Catawba River basin were sampled as part of the Lakes Assessment Program in the summer of 2001. These lakes are discussed in the appropriate subbasin chapter in Section B and in Section A, Chapter 4, Part 4.7: Lake Tahoma and Lake James (03-08-30); Lake Rhodhiss (03-08-31); Lake Hickory, Lookout Shoals Lake and Lake Norman (03-08-32); Mountain Island Lake (03-08-33); Lake Wylie (03-08-34); Newton City Lake (03-08-35); and Bessemer City Lake (03-08-36).

3.3.5 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collections of physical and chemical water quality data. North Carolina has 378 water chemistry monitoring stations statewide, including 34 stations in the Catawba River basin. Between 23 and 32 parameters are collected monthly at each station. The locations of these stations are listed in Table A-20 and shown on individual subbasin maps in Section B. Refer to *2003 Catawba River Basinwide Assessment Report* at the website http://www.esb.enr.state.nc.us/bar.html for more detailed analysis of ambient water quality monitoring data.

Table A-20 Locations of Ambient Monitoring Stations in the Catawba River Basin by Subbasin

Subbasin/ Map Code[1]	Station Number	Waterbody/ Location	County	Class
03-08-30				
A-1	C0145000	Catawba R at SR 1234 near Greenlee	McDowell	C
A-2	C0250000	Catawba R at SR 1221 near Pleasant Gardens	McDowell	C
A-3	C0550000	N Fork Catawba R at SR 1552 near Hankins	McDowell	C
A-4	C1000000	Linville R at NC 126 near Nebo	Burke	B HQW
A-5	C1210000	Catawba R at SR 1147 near Glen Alpine Marion	Burke	WS-IV
03-08-31				
A-6	C1370000	Wilson Cr at US 221 near Gragg	Avery	B Tr ORW
A-7	C1750000	Lower Cr at SR 1501 near Morganton Marion	Burke	WS-IV
A-8 *	C2030000	Lake Rhodhiss at SR 1001 near Baton Marion	Burke	WS-IV & B CA
03-08-32				
A-9	C2600000	Lake Hickory at NC 127 near Hickory	Catawba	WS-V & B
A-10	C2818000	Lower Little R at SR 1313 near All Healing Springs	Alexander	C
A-11	C3420000	Lake Norman at SR 1004 near Mooresville	Iredell	WS-IV & B CA
03-08-33				
A-12	C3699000	Mountain Island Lake Above Gar Cr near Croft	Gaston	WS-IV & B CA
A-13	C3860000	Dutchmans Cr at SR 1918 at Mountain Island	Gaston	WS-IV
A-14	C3900000	Catawba R at NC 27 near Thrift	Mecklenburg	WS-IV CA
03-08-34				
A-15	C4040000	Long Cr at SR 2042 near Paw Creek	Gaston	WS-IV
A-16	C4220000	Catawba R at power line crossing at South Belmont	Mecklenburg	WS-IV & B CA
A-33	C7500000	Lake Wylie at NC 49 near Oak Grove	Mecklenburg	WS-V & B
A-17	C8896500	Irwin Cr at Irwin Cr WWTP near Charlotte	Mecklenburg	C
A-18	C9050000	Sugar Cr at NC 51 at Pineville	Mecklenburg	C
A-19	C9210000	Little Sugar Cr at NC 51 at Pineville	Mecklenburg	C
A-20	C9370000	McAlpine Cr at SR 3356 Sardis Rd near Charlotte	Mecklenburg	C
A-21	C9680000	McAlpine Cr at SC SR 2964 near Camp Cox SC	Lancaster (SC)	FW
A-22	C9790000	Sugar Cr at SC 160 near Fort Mill SC	Mecklenburg	FW
03-08-35				
A-23	C4300000	Henry Fork R at SR 1124 near Henry River	Catawba	C
A-24	C4360000	Henry Fork R at SR 1143 near Brookford	Catawba	C
A-25	C4370000	Jacob Fork at SR 1924 at Ramsey	Burke	WS-III ORW
A-26	C4380000	S Fork Catawba R at NC 10 near Startown	Catawba	WS-IV
A-27	C4800000	Clark Cr at SR 1008 Grove St at Lincolnton	Lincoln	WS-IV
A-28	C5170000	Indian Cr at SR 1252 near Laboratory	Lincoln	WS-IV
03-08-36				
A-29	C5900000	Long Cr at SR 1456 near Bessemer City	Gaston	C
A-30	C6500000	S Fork Catawba R at NC 7 at McAdenville	Gaston	WS-V
A-31	C7000000	S Fork Catawba R at SR 2524 near South Belmont	Gaston	WS-V & B
03-08-37				
A-32	C7400000	Catawba Cr at SR 2302 at SC State Line	Gaston	C
A-34	C8660000	Crowders Cr at SC 564 near Bowling Green, SC	York (SC)	FW
03-08-38				
A-35	C9819500	Twelvemile Cr at NC 16 near Waxhaw	Union	C

* Removed May 2000

3.3.6 Notable Patterns in Ambient Data

The following patterns, as outlined in the *2003 Catawba River Basinwide Assessment Report*, support the conclusion that rapid urbanization and development are one of the greatest threats to water quality in the Catawba River basin. Each parameter discussed below is at its greatest average concentration in watersheds characterized by heavy urban development, such as those encompassing the Greater Charlotte Metropolitan Area and the urbanized corridors along Interstates 77, 85 and 40. In order to prevent the same decreases in water quality in watersheds facing similar impacts from growth, management strategies must be developed that effectively reduce impacts from point sources, nonpoint source runoff and habitat degradation.

Conductivity

Conductivity can be used to evaluate variations in dissolved mineral concentrations (ions) among sites with varying degree of impact resulting from point source discharges. Generally, impacted sites show elevated and widely ranging values for conductivity. Many stations (for example in subbasins 03-08-34, 03-08-35, and 03-08-36) showed widely varying values which were the result of point source dischargers located upstream of the sample site. Notable were the effluent and urban-dominated streams of Mecklenburg County. Please refer to Section B, Chapters 4 - 6 for further discussion.

Metals

Twenty stations had more than 10 percent of the copper concentrations greater than the action level (7.0 µg/l). Station C7000000, on the South Fork Catawba River, exhibited the most chronic copper concentrations, exceeding the action level on 81 percent of the measurements. Additionally, the great majority of stations exceeding the copper action level are located in the most heavily urbanized subbasins. In cases where an individual discharger has a documented toxic impact on a stream, those concerns are addressed through their NPDES permit. In many cases, however, metal contaminants are found in urban stormwater runoff. Proper use of stormwater BMP can reduce this impact. Please refer to Section A, Chapter 4, Part 4.11 for further discussion on this issue.

Fecal Coliform Bacteria

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a danger to people or animals. However, where fecal coliform are present; disease-causing bacteria may also be present, and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health. For further discussion on fecal coliform bacteria, human health impacts and management issues, refer to Section A, Chapter 4, Part 4.14.

Ambient monitoring revealed continuing bacteria concerns at many sites in the Catawba River basin. Although none of these sites were in waters classified for primary recreation, they indicate areas in the basin where pollution originating from urbanized and developing areas is a major concern. Table A-21 lists sites in each subbasin that show elevated fecal coliform bacteria concentrations. The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period nor to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period.

Table A-21 Summary of Ambient Sites with Elevated Fecal Coliform Bacteria Concentrations in the Catawba River Basin, September 1997 – August 2002[1]

Subbasin/ Station	Waterbody/ Location	N	% > 400	Geometric Mean
03-08-31				
C1750000	Lower Cr at SR 1501 near Morganton Marion	54	38.9	252.7
03-08-32				
C2818000	Lower Little R at SR 1313 near All Healing Springs	59	42.4	199.6
03-08-34				
C4040000	Long Cr at SR 2042 near Paw Creek	59	39	324.2
C8896500	Irwin Cr at Irwin Cr WWTP near Charlotte	59	49.2	592.0
C9050000	Sugar Cr at NC 51 at Pineville	58	36.2	308.6
C9210000	Little Sugar Cr at NC 51 at Pineville	58	29.3	233.5
C9370000	McAlpine Cr at SR 3356 Sardis Rd near Charlotte	59	40.7	287.9
C9680000	McAlpine Cr at SC SR 2964 near Camp Cox, SC	58	25.9	230.5
C9790000	Sugar Cr at SC 160 near Fort Mill, SC	58	32.8	325.0
03-08-35				
C4800000	Clark Cr at SR 1008 Grove St at Lincolnton	59	42.4	361.7
03-08-36				
C5900000	Long Cr at SR 1456 near Bessemer City	58	37.9	349.6
03-08-37				
C8660000	Crowders Cr at SC 564 near Bowling Green, SC	58	22.4	224.1
03-08-38				
C9819500	Twelvemile Cr at NC 16 near Waxahaw	57	31.6	285.9

[1] Stations sorted first by subbasin number, then by station number.

3.4 Other Water Quality Research

North Carolina actively solicits "existing and readily available" data and information for each basin as part of the basinwide planning process. Data meeting DWQ quality assurance objectives are used in making use support determinations. Data and information indicating possible water quality problems are investigated further. Both quantitative and qualitative information are accepted during the solicitation period.

High levels of confidence must be present in order for outside quantitative information to carry the same weight as information collected from within DWQ, particularly when considering waters for the 303(d) list. Methodology for soliciting and evaluating outside data is presented in Appendix III, Part D and in *North Carolina's 2002 Integrated 305(b) and 303(d) Report* (NCDENR-DWQ, February 2003). Mecklenburg County, Winthrop

DWQ data solicitation includes the following:

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

Contact information must accompany all data and information submitted.

University and several citizens submitted data during the open solicitation period in October 2001. The next data solicitation period for the Catawba River basin is planned for fall 2007.

3.5 Use Support Summary

3.5.1 Introduction to Use Support Assessment

Surface waters are classified according to their best-intended uses as described earlier in Part 3.2 of this chapter. Determining how well a waterbody supports the best-intended uses (use support assessment) is an important method of interpreting water quality data. A use support rating is assigned during use support assessment and refers to whether the best-intended uses of the water (such as water supply, aquatic life protection, shellfish harvesting and recreation) are being supported. For example, waters with a healthy biological community (Excellent, Good or Good-Fair) are *Supporting*, and waters with an unhealthy biological community (Fair or Poor) are *Impaired*. Waters with inconclusive data (biological community Not Rated) are *Not Rated*. Waters lacking data are not assigned a use support rating and listed as *No Data*. Specific details on use support assessment and assigning use support ratings can be found in Appendix III.

There are five use categories: aquatic life, fish consumption, recreation, shellfish harvesting and water supply. A use support rating is assigned to applicable categories depending on the surface water classification or best-intended use. For example, all waters with appropriate data are assigned a use support rating in the aquatic life, recreation and fish consumption categories. Class WS waters are assigned a use support rating for the water supply category as well as for the aquatic life, recreation and fish consumption categories. A single waterbody could potentially be assigned a use support rating in all five categories, though most waters are assigned a use support rating for the aquatic life, recreation and fish consumption categories. For many waters, a category will not be applicable to the best-intended use of that water (e.g., the shellfish harvesting category does not apply to Class C, SC, B, SB or WS waters) and no assessment is made in that category. A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*, online at http://h2o.enr.state.nc.us/admin/rules/.

In previous use support assessments, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. The *2002 Integrated Water Quality Monitoring and Assessment Report Guidance* issued by the EPA requested that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and assigns the following use support ratings: Supporting, Impaired, Not Rated or No Data.

Historically, the Supporting use support rating was also subdivided into fully supporting (FS) and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving water quality conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive

State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arose from this difference, North Carolina no longer subdivides the Supporting category. However, these waters and the specific water quality concerns are identified in the Section B subbasin chapters so that data, management and the need to address the identified concerns are presented.

3.5.2 Comparison of Use Support Rating to Streams on the List of Impaired Waters

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

Waters are placed on North Carolina's 303(d) list primarily due to a use support rating of Impaired. Use support ratings are based on biological and chemical data and, for some categories, human health advisories. When the state water quality standard is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either biological bioclassifications or water quality standards.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list when water quality standards are attained. In other cases, the new data will show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality standards are met. Currently, there are 97 segments listed on the *North Carolina's Water Quality Assessment and Impaired Waters List (2004 Integrated 305(b) and 303(d) Report)* in the Catawba River basin. These waters are listed for variety of reasons including habitat degradation, fecal coliform bacteria, toxicity and unknown causes. Refer to the website at http://h2o.enr.state.nc.us/tmdl/ for the complete listing.

3.5.3 Use Support Assessment in the Catawba River Basin

Aquatic Life Category

The aquatic life category is applied to all waters in North Carolina. Therefore, this category is applied to all 3,048 freshwater miles and 50,764 freshwater acres in the Catawba River basin. Biological, chemical and physical monitoring data collected between September 1997 and August 2002 were used to assign a use support rating in this category. Table A-22 summarizes aquatic life use support ratings in the entire Catawba River basin. Use support ratings by subbasin are summarized in Section B.

Table A-22 Aquatic Life Use Support Ratings Summary for All Waters in the Catawba River Basin (1997-2002)

Aquatic Life Ratings/Basis	Miles	Acres
Impaired/Monitored	174.2	5,868.1
Supporting/Monitored	508.9	40,931.4
Not Rated/Monitored	62.9	3,964.7
Total Monitored	**746.0**	**50,764.2**
Supporting/Evaluated	681.66	0.0
Not Rated/Evaluated	501.1	0.0
No Data	1,119.5	0.0
Total Unmonitored	**2,302.3**	**0.0**
Total	**3,048.3**	**50,764.2**
Percent of Total Monitored	24.5	100.0
Percent of Monitored/Impaired	23.4	11.6
Percent of Total Impaired	5.4	11.6

Recreation Category

Like the aquatic life category, the recreation category is applied to all waters in North Carolina. Therefore, this category is applied to all 3,048 freshwater miles and 50,764 freshwater acres in the Catawba River basin. DWQ fecal coliform monitoring data collected between September 1997 and August 2002 were used to assign use support ratings in this category. Table A-23 summarizes recreation use support ratings in the Catawba River basin. Use support ratings by subbasin are summarized in Section B.

Table A-23 Recreation Use Support Ratings Summary for Waters in the Catawba River Basin (1997-2002)

Recreation Ratings and Basis	Miles	Acres
Impaired/Monitored	24.4	0.0
Supporting/Monitored	121.5	41,255.1
Not Rated/Monitored	89.2	0.0
Total Monitored	**235.1**	**41,255.1**
Supporting/Evaluated	0.0	0.0
Not Rated/Evaluated	0.0	0.0
No Data	2,813.1	9,509.0
Total Unmonitored	**2,813.1**	**9,509.0**
Total	**3,048.2**	**50,764.1**
Percent of Total Monitored	7.7	81.3
Percent of Monitored/Impaired	10.4	0.0
Percent of Total Impaired	0.8	0.0

Fish Consumption Category

Like the aquatic life and recreation categories, the fish consumption category is applied to all waters in North Carolina. Therefore, this category is applied to all 3,048 freshwater miles and 50,764 freshwater acres in the Catawba River basin. The Department of Health and Human Services fish consumption advice was used to assign a use support rating in this category. 705 miles and 4,395 acres are Impaired in the Catawba River basin based on this advice. Refer to Section A, Chapter 4, Part 4.10 for a detailed discussion of the NCDHHS advice. Use support ratings by subbasin are summarized in Section B.

Water Supply Category

There are 997.7 freshwater stream miles and 47,081.9 freshwater acres currently classified for water supply in the Catawba River basin. All water supply waters have been assigned a use support rating of Supporting on an Evaluated basis based on reports from DEH regional water treatment consultants. The reports are used to evaluate the ability of water treatment plants to provide potable water to consumers for Class WS waters. Raw water quality is not assessed in this category.

Impaired Waters

Table A-24 presents Impaired waters (in all categories) in the Catawba River basin that were monitored by DWQ within the last five years. The category for which a water is Impaired is indicated in the table. Descriptions of Impaired segments, as well as problem parameters, are outlined in Appendix III. Current status and recommendations for restoration of water quality for each water and maps showing current use support ratings for waters in the Catawba River basin are presented in each subbasin chapter in Section B.

Table A-24 Impaired Monitored Waters within the Catawba River Basin (1997 to 2002)

Name	Assessment Unit	Class	Subbasin	Miles	Acres	Category
Youngs Fork (Corpening Creek)	11-32-1-4b	C	03-08-30	1.9		Aquatic Life
Youngs Fork (Corpening Creek)	11-32-1-4a	C	03-08-30	3.6		Aquatic Life
Jacktown Creek	11-32-1-4-1	C	03-08-30	2.4		Aquatic Life
North Fork Catawba River	11-24-(2.5)b	B- TR	03-08-30	3.5		Aquatic Life
Irish Creek	11-35-3-(2)b	WS-III	03-08-31	3.0		Aquatic Life
Hunting Creek	11-36-(0.7)	WS-IV	03-08-31	7.4		Aquatic Life
CATAWBA RIVER (Rhodhiss Lake below elevation 995)	11-(37)	WS-IV & B CA	03-08-31		1,848.5	Aquatic Life
Lower Creek	11-39-(0.5)a	C	03-08-31	8.8		Aquatic Life
Lower Creek	11-39-(0.5)b	C	03-08-31	5.1		Aquatic Life
Lower Creek	11-39-(6.5)	WS-IV	03-08-31	6.8		Aquatic Life
Spainhour Creek	11-39-3	C	03-08-31	4.7		Aquatic Life
McGalliard Creek	11-44-(3)	WS-IV CA	03-08-31	3.9		Aquatic Life
Horseford Creek	11-54-(0.5)	WS-IV	03-08-32	0.4		Aquatic Life
Lower Little River	11-69-(0.5)	C	03-08-32	14.0		Aquatic Life
McDowell Creek	11-115-(1.5)b	WS-IV	03-08-33	2.9		Aquatic Life
McDowell Creek	11-115-(1.5)a	WS-IV	03-08-33	4.4		Aquatic Life
Killian Creek	11-119-2-(0.5)b	C	03-08-33	3.2		Aquatic Life
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	WS-IV & B CA	03-08-34		601.1	Aquatic Life
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	WS-V & B	03-08-34		3,418.5	Aquatic Life
Long Creek	11-120-(2.5)	WS-IV	03-08-34	11.3		Aquatic Life & Recreation
Sugar Creek	11-137a	C	03-08-34	0.3		Aquatic Life
Irwin Creek	11-137-1	C	03-08-34	11.8		Aquatic Life
Little Sugar Creek	11-137-8a	C	03-08-34	5.5		Aquatic Life
McAlpine Creek (Waverly Lake)	11-137-9c	C	03-08-34	4.6		Aquatic Life

Clark Creek (Shooks Lake)	11-129-5-(0.3)b	C	03-08-35	14.3		Aquatic Life
Clark Creek (Shooks Lake)	11-129-5-(0.3)c(1)	C	03-08-35	2.4		Aquatic Life
Henry Fork	11-129-1-(12.5)a	C	03-08-35	10.3		Aquatic Life
Maiden Creek	11-129-5-7-2-(1)	WS-II	03-08-35	4.9		Aquatic Life
Maiden Creek (Including Maiden reservoir below elevation 842)	11-129-5-7-2-(2.5)	WS-II CA	03-08-35	2.1		Aquatic Life
Clark Creek	11-129-5-(9.5)	WS-IV	03-08-35	1.8		Aquatic Life
Indian Creek	11-129-8-(6.5)b	C	03-08-35	6.0		Aquatic Life
Catawba Creek	11-130c	C	03-08-37	4.9		Aquatic Life
Crowders Creek	11-135c	C	03-08-37	3.3		Aquatic Life & Recreation
Crowders Creek	11-135g	C	03-08-37	1.5		Aquatic Life & Recreation
Crowders Creek	11-135d	C	03-08-37	7.3		Aquatic Life & Recreation
Crowders Creek	11-135a	C	03-08-37	1.9		Recreation
Crowders Creek	11-135b	C	03-08-37	3.1		Recreation
Crowders Creek	11-135e	C	03-08-37	1.5		Recreation
Crowders Creek	11-135f	C	03-08-37	1.4		Recreation
Abernethy Creek	11-135-4b	C	03-08-37	1.8		Aquatic Life
Blackwood Creek	11-135-7	C	03-08-37	4.4		Recreation
Sixmile Creek	11-138-3	C	03-08-38	8.8		Aquatic Life

Section A - Chapter 4
Water Quality Issues Related to Multiple Watersheds in the Catawba River Basin

4.1 Introduction

This section discusses regional issues that are pertinent to multiple watersheds in the Catawba River basin. It includes discussions on stormwater control, drought impacts, interstate agreements, and other issues broad in scope. It also highlights issues that threaten water quality everywhere and offers suggestions for reducing their impacts.

In this chapter:

4.2 Water Quality Issues Related to Drought

Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because the high flows may carry increased loadings of substances like metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients. These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced streamflow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures; algae grow more due to longer periods of sunlight, and streamflows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on land surfaces are quickly delivered to streams. When streamflows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream.

Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As streamflows decrease, there is less habitat available for aquatic insects and fish, particularly around lake shorelines. There is also less water available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increase strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic insects is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount of dissolved oxygen in the water, but at night algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause difficulty in water treatment resulting in taste and odor problems in finished drinking water.

Evidence of these effects was noted across the entire Catawba River basin during the last basinwide assessment period. A few examples include the increased duration and intensity of algal blooms in Lake Rhodhiss and Lake Hickory (Section A, Chapter 4, Part 4.7.2), the increased impact of point source dischargers on conductivity in the Lower Little River (Section B, Chapter 3, Part 3.1), and minor improvements in the bioclassification of Sugar Creek (Section B, Chapter 5, Part 5.1) due to reduced urban runoff.

4.3 Color Reduction Strategy

The South Fork Catawba River watershed (subbasins 03-08-35 and 03-08-36) was identified in previous basin plans as having a high concentration of NPDES permitted textile dischargers, along with public concerns and complaints regarding color from such discharges. According to state regulations [15A NCAC 02B.0211(3)(f)], colored effluent is allowed in "only such amounts as will not render the waters injurious to public health, secondary recreation, or to aquatic life and the wildlife or adversely affect the palatability of fish, aesthetic quality or impair the waters for any designated uses". This color standard is a narrative standard based on aesthetics and not a numeric standard. The advantage of a narrative standard is that it is flexible. The disadvantages are that it is subjective and difficult to enforce. The state has considered developing a numeric standard, but there are many challenges in doing so. Some of these challenges include knowing what the appropriate analytical approach is; what the appropriate numeric standard is; and if a different standard should be used for different regions in the state to reflect variations in background color. In addition, the practical application of this regulation must take into account the various ways in which color is perceived. No narrative definition of color impairment can be specified by a simple set of criteria because individuals under different circumstances perceive color subjectively.

It should be noted that to date, there are no data to show that the colored effluent is posing any human health threat or is the only source of impact on the aquatic life in the river. Color is usually not a toxicological problem. However, under certain conditions it can limit light penetration that may be essential for the growth and existence of instream organisms. All NPDES permitted dischargers with color waste are required to conduct toxicity testing on the effluent to assure the discharge will not adversely impact the organisms in the receiving stream. All of the color discharge facilities conducting toxicity testing have been in compliance with permit limits.

Status of Progress and 2004 Recommendations

Color Study Report Development
In August 1999, the Division met with selected color dischargers in the watershed to address the color issue. As a result of this meeting, eight color dischargers (Pharr Yarns, Delta Mills, Yorkshire, Cramerton, Lincolnton, Gastonia-Long Creek, Hickory and Cherryville) elected to form the South Fork Catawba River Water Quality Alliance and undertake a comprehensive color monitoring study to identify current color problem areas in the watershed. The color monitoring was conducted twice per month from April through November 2000 and included color monitoring of effluent, upstream and downstream stations, as well as reference sites. The study included analytical color measurement (ADMI units), visual observation and photographs. The study period included an extremely dry summer and should represent near worst case conditions. In addition, the study represents the most current assessment of color conditions in the watershed, given the changing nature of the textile industry across the state. The Alliance submitted individual reports to DWQ for each sampling event, as well as a Final Color Study Report (AWARE Environmental, Inc., March 2001). One color discharger in the watershed (City of Newton) elected to evaluate color independently from the Alliance members, using similar monitoring protocols.

Using the data contained in the Final Color Study Report along with field observations, DWQ developed a four-tier action plan to address the varying aesthetic color impacts to receiving waters through the NPDES permitting system. The Tier 1 facility showed no visible color plume during the color study. Tier 2 facilities showed minor color plumes at the outfall and limited downstream color impact. Tier 3 facilities showed significant color plumes at the outfall and at times greater downstream color impact. Finally, the Tier 4 facility showed significant plumes at the outfall and significant downstream color impacts.

Color Permitting Policy
Based on the tier groupings and public comment received at a hearing in August 2001, progressive permitting actions were developed for these facilities, ranging from color monitoring (Tier 1), pollution prevention studies (Tier 2), engineering cost studies for end-of-pipe treatment (Tier 3), and color reduction limits (Tier 4). Color monitoring will remain a baseline condition for all facilities, as long as color remains a component of the discharge. The specific color permitting requirements added to NPDES permit renewals and modifications during 2002-2003 are summarized in Table A-25. The City of Cherryville was removed from color permitting requirements after its only textile input ceased discharge in 2001. Similarly, two facilities (City of Gastonia – Long Creek WWTP and Crowders Creek WWTP) were downgraded to Tier 1 requirements following the termination of several textile inputs. Two facilities (Yorkshire and Delta Apparel) have contested their 2002 permit conditions and still operate in accordance with

their previous permit. Most of the subject color dischargers have NPDES permits that expire in 2005. During this permit renewal process, DWQ will reevaluate the color requirements.

Table A-25 NPDES Color Permitting Imposed During 2002 and 2003 for Catawba River Basin Dischargers in the South Fork Catawba River Watershed

Tier	Facility	Color Permitting Requirement
1	Pharr Yarns Gastonia - Long Creek WWTP Gastonia – Crowders Creek WWTP	Tier 1 facilities will receive color monitoring only, consisting of monthly effluent sampling, and summer only (April-October) instream monitoring (upstream, downstream). If observed, plume descriptions should be recorded. In addition, a Color Reopener Special Condition will be added that allows permits to be reopened and additional requirements imposed if color problems persist.
2	Cramerton Newton Yorkshire	Tier 2 facilities will receive Tier 1 requirements plus preparation of a Pollution Prevention (P2)/Best Management Practices (BMPs) report. This report will address the potential for the facility to reduce effluent color by incorporating P2 measures and/or BMPs prior to treatment. For example, the facility could investigate the dyeing process, looking at the potential for dye substitution, improved dyeing efficiency, etc. The facility could do this work independently with their dye supplier or other resource, or request voluntary assistance from the NC Division of Pollution Prevention and Environmental Assistance. The report will be submitted within 12 months of the permit effective date.
3	Hickory – Henry Fork Lincolnton	Tier 3 facilities will receive Tier 2 requirements plus preparation of a Color Reduction Study. The color reduction study will involve an end-of-pipe treatment evaluation to develop costs to reduce influent color by 75 percent and 90 percent. The reports will be submitted within 24 months of the permit effective date.
4	Delta Apparel	Tier 4 facilities will receive color reduction limits (90 percent color reduction between influent and effluent) to be implemented by the permit effective date.

4.4 South Fork Catawba River Watershed Toxics Review

Current Status and 2004 Recommendations

The South Fork Catawba River Watershed Toxics Review was a screening effort initiated from comments as noted in the 1995 Catawba River Basinwide Water Quality Plan regarding public concern for the river's health. The 1999 plan recommended DWQ evaluate the need for additional monitoring on the South Fork Catawba River and its tributaries.

During the last assessment period, ambient metal concentrations in the watershed did not exceed the state action level at most locations, the exception being Clark Creek. Benthic and fish community data are not available on the middle portion of the South Fork, but a site on the lower section received a Good-Fair bioclassification. Sample sites on two major tributaries, Clark Creek and Indian Creek, received Fair bioclassifications. These impacted biological communities and the presence of several permitted discharges in the general area of Lincolnton and High Shoals indicate that a biological community assessment is necessary in the middle portion of the South Fork between Clark and Long Creek. DWQ will sample this area during the next assessment period.

During the latest assessment period, DWQ began addressing metal toxicity in the watershed by starting the development of a copper Total Maximum Daily Load (TMDL) on Clark Creek. For more information on Clark Creek and the copper TMDL, refer to Section B, Chapter 6, Part 6.3. With regard to point source discharges, DWQ implements metal limits in NPDES permits when a statistical analysis of the effluent data indicates a potential to exceed allowable levels. Should modeling processes determine that a particular metal is a concern and is attributable to a point source, then a limit for that metal can be implemented. Additionally, DWQ currently has a procedure in place to determine if an NPDES limit is necessary for action level standards such as copper and zinc and this procedure is used for all dischargers. NPDES permits in the South Fork Catawba River are scheduled for the review/renewal process beginning in 2005.

4.5 Charlotte-Mecklenburg Utilities Agreement

The Charlotte-Mecklenburg Utilities Agreement applies to all or part of two subbasins: 03-08-34 and 03-08-38. For more information on other issues in these subbasins, refer to Section B, Chapters 5 and 9.

In the summer of 2001, the South Carolina Department of Health and Environmental Control (SCDHEC) filed a Petition for a Contested Case in the North Carolina Office of Administrative Hearings regarding the renewal of Charlotte-Mecklenburg Utilities Department's (CMUD) McAlpine Creek wastewater treatment plant. The primary complaint on the part of SCDHEC has been that the permit was renewed without a phosphorus limit. Several downstream waterbodies in the South Carolina portion of the Catawba River basin are listed as Impaired because total phosphorus (TP) concentrations exceed the South Carolina state standard for TP in lakes. Nearly all of South Carolina's municipal dischargers to the mainstem Catawba River (upstream of Lake Wateree) have been given phosphorus limits, generally equivalent to 1 mg/l. The McAlpine Creek WWTP permit had a phosphorus optimization study special condition that stipulated preparatory requirements for the facility to ready itself for the upcoming phosphorus TMDL.

Since summer 2001, SCDHEC, DWQ and CMUD have been working towards achieving consensus on an appropriate phosphorus limit for the McAlpine Creek WWTP. The parties are on schedule with actions necessary to complete the terms of the settlement agreement. The understanding has been that this decision will also affect DWQ's permitting strategy for three additional municipal permits: CMUD-Irwin WWTP, CMUD-Sugar Creek WWTP, and Union County-Twelvemile Creek WWTP. Construction of phosphorus reduction facilities is currently underway at McAlpine Creek WWTP.

The final settlement agreement includes four main points: phosphorus limits at all three CMUD facilities, a bubble limit, a mass cap, and a TMDL. The phosphorus limit corresponds to 1 mg/l at the permitted flow calculated on a 12-month rolling average. The bubble limit refers to a mass limit for total phosphorus that applies to the combined discharge of all three CMUD plants. This type of limit allows CMUD operational flexibility with regard to phosphorus removal. In order to be protective of water quality in the downstream lakes, SCDHEC requested a maximum combined limit to ensure optimized plant operation at all times. The maximum limit corresponds to a concentration limit of 2 mg/l at maximum permitted flow. In addition, the agreement includes a provision that will include DWQ and all affected NC entities in the TMDL process.

The University of South Carolina completed a Federal Clean Water Act Section 319-funded project in June 2003. The primary goal of this study was to provide a detailed quantitative analysis of data and model simulations to support development of an effective TMDL for phosphorus in the lower Catawba River basin of South Carolina. Simulations were based on the WARMF model, which incorporated phosphorus loadings in the Sugar Creek watershed tributaries, including Sugar Creek, Little Sugar Creek, McAlpine Creek and Irwin Creek.

At the time of this writing, the model is under review. SCDHEC is working closely with the USEPA and DWQ to evaluate its effectiveness. A series of management scenarios will be simulated to predict the effects of reductions in point sources and nonpoint sources on downstream reservoirs. Stakeholder meetings will be held after additional management scenario simulations are available.

4.6 Implementation of NCEEP Watershed Restoration and Local Watershed Plans

Current Status and 2004 Recommendations

For the Catawba River basin, the North Carolina Ecosystem Enhancement Program (EEP, formerly Wetlands Restoration Program) has integrated information normally found separately in EEP Watershed Restoration Plans into this basinwide water quality plan. A separate version of the watershed restoration plan for the Catawba River basin will be available online at the EEP website by the fall 2004. These plans identify Targeted Local Watersheds within which EEP will focus restoration efforts (http://h2o.enr.state.nc.us/wrp/).

DWQ will continue to integrate EEP restoration planning efforts into the basinwide process. An overview of the program is presented in Section C, Chapter 1, Part 1.3.2. Table C-3 lists all the Targeted Local Watersheds selected by the EEP, arranged by DWQ subbasins. This section also includes a description of the EEP Local Watershed Planning initiative. The EEP will continue to use a comprehensive, integrated watershed approach in the identification of high priority local watersheds in North Carolina's river basins. Also, the EEP hopes to expand their Local Watershed Planning efforts into more areas of the state, as additional compensatory mitigation resources become available.

4.7 Chain Lakes Management Challenges

One of the most prominent hydrologic features of the Catawba River basin is the series of hydropower impoundments along the river's mainstem, widely referred to as the Catawba River Chain Lakes (Figure A-14). This chain-like configuration presents a unique challenge to water quality management. The outflows from upstream reservoirs, as well as inputs from the surrounding watershed and direct discharges to the lakes themselves, influence the water quality in each impoundment. Therefore, water quality issues in a particular impoundment cannot be addressed without first considering the influence of watershed conditions, upstream water quality, and releases from upstream reservoirs. Downstream impacts must also be evaluated before any management decisions are implemented.

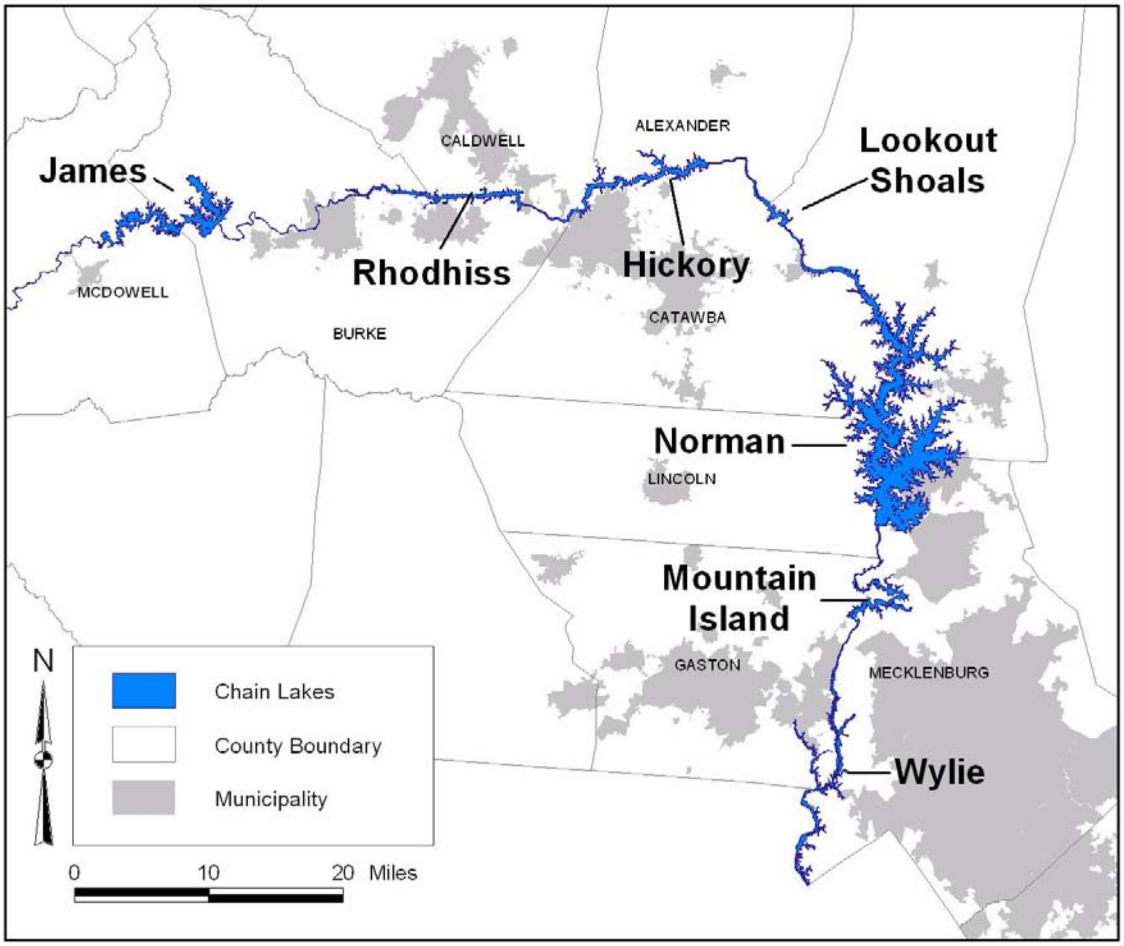


Figure A-14 Catawba River Chain Lakes

Impacts to water quality can also be magnified by the presence of a reservoir. Dams significantly slow the flow of water and create conditions not present in riverine systems. These conditions increase nutrient availability and give algae more time to grow. In theory, a reservoir may suffer the symptoms of excessive nutrient and sediment inputs, while a river receiving the same level of pollutants may not. In this case, the river may be moving pollutants quickly downstream, thus, preventing localized water quality problems. Similarly, two reservoirs receiving the same pollutant load may not exhibit the same symptoms. For example, one reservoir may have many small, isolated coves that allow algae to grow for extended periods of time, while another reservoir may simply act like a wide, slow-flowing portion of a river with a continuous exchange of water and little algal growth.

All seven of the Catawba River Chain Lakes (Catawba-Wateree Project) are owned by Duke Power Company and were created to generate electricity. The chain lakes were completed between 1904 and 1928 with the exception of Lake Norman, which was completed in 1963. These hydro projects provided much of the electrical power base needed to drive the industrial expansion (furniture, textile, etc.) seen in the first half of the 20^{th} century. In some ways, the prosperity enjoyed by this area of North Carolina can be linked to the presence of these dams. In addition to renewable power generation, the lakes are popular recreational areas visited millions of time per year and provide drinking water to the local population. The lakes are also contributing to a recent economic expansion as new residents seek lakefront housing and commercial developments relocate near reliable water supplies. For statistics on the lakes, see Table A-15.

The following sections describe the variety of management issues related directly to the Catawba River Chain Lakes. Table A-26 provides a summary of the many stressors in the lake chain. The entire lakes assessment methodology and results of the chain lakes analysis can be found in Appendix III. With the exception of hydropower relicensing, the following discussion focuses primarily on Lake Rhodhiss, Lake Hickory, Lookout Shoals Lake and Lake Wylie. These impoundments demonstrate more severe water quality stress and, not coincidentally, receive the most direct input from the largest urbanized watersheds.

Table A-26 Lake Stressor Summary

Assessment Parameter	Lake James	Lake Rhodhiss	Lake Hickory	Lookout Shoals	Lake Norman	Mountain Island	Lake Wylie
% Saturation DO	N	**Y**	**Y**	**Y**	N	N	**Y**
Algae	N	**Y**	**Y**	N	N	N	**Y**
Chlorophyll *a*	N	**Y***	N	N	N	N	**Y**
pH	N	**Y**	N	N	N	N	N
Sediment	N	**Y**	**Y**	N	N	**Y**	N
Taste & Odor	N	**Y**	**Y**	N	N	N	N
Macrophytes	**Y**	N	**Y**	**Y**	**Y**	**Y**	N

"**Y**" Indicates parameter is noted within the impoundment.
* Standard exceeded in less than 10% of readings.

4.7.1 Hydropower Relicensing

Part I of the Federal Power Act (FPA) requires that Duke Power's Catawba-Wateree Project has a license in order to operate. Relicensing is the process for obtaining a new license for a hydro project after the existing license expires. Duke Power's current license for the project was issued in 1958 and will expire in 2008.

The FPA provides the Federal Energy Regulatory Commission (FERC) exclusive authority to license all nonfederal hydro projects that are located on navigable waterways or federal lands. Licenses are normally issued for a period of 30-50 years and contain conditions that regulate project operations. To continue to operate project facilities after the expiration of an existing license, a licensee must obtain a new license for its project.

The conditions in the new license are expected to change the way these hydro stations and reservoirs are operated, primarily via rebalancing how the limited water supply is utilized. Changing how this finite resource is used will benefit some interests and negatively impact others. The final decision as to the terms and conditions of the new license is almost exclusively reserved to the FERC and certain government resource agencies, including DWQ through the

401 Certification process, with mandatory conditioning authority. However, there are many opportunities for other organizations, governmental entities and individual stakeholders to substantially influence these decisions. In the end, Duke Power hopes to obtain a new license to operate the project in a manner that comprehensively balances the use of the resource in the best overall public interest (Duke Energy Corporation, 2003).

The North Carolina Department of Environment and Natural Resources (NCDENR) and the North Carolina Wildlife Resources Commission (NCWRC) are actively involved in the relicensing effort. State agencies committed to the multiyear license negotiation process with Duke Power include the Division of Water Quality, Division of Water Resources, Division of Parks and Recreation, and the Wildlife Resources Commission.

NCDENR and NCWRC believe that the relicensing process is an important opportunity to examine environmental and public access issues associated with hydropower projects and to develop strategies to address these issues. Environmental impacts include water quality impairment or degradation as a result of flow release regimes, or issues associated with water availability during extreme weather conditions (i.e., drought and extreme wet weather years). Public access issues include the lack of access to reservoir shorelines for fishing and other recreation.

Duke Power has developed a stakeholder input process that will allow NCDENR and NCWRC, along with their South Carolina counterparts, to hear the ideas, concerns and interests of other stakeholders in the basin and to work collaboratively with others to develop strategies to address these issues. This framework consists of four Regional Advisory Groups (two in each state) and two State Relicensing Teams. The Regional Advisory Groups are intended to hear input on and negotiate management strategies for issues specific to their geographic region, while the State Relicensing Teams do the same for issues that affect the entire basin. NCDENR and NCWRC staffs are participating in both the State Relicensing Teams and the Local Advisory Teams as established by Duke Power.

NCDENR also has some regulatory authorities and requirements that will have to be met through the relicensing process. An example of these regulatory authorities is the 401 Water Quality Certification. The 401 Certification must accompany Duke Power's application for project renewal and contains many regulatory components. One such component requires that water quality standards (temperature, turbidity, dissolved oxygen levels, and the support of aquatic life) downstream of dam outfalls must be met. While the 401 Certification is non-negotiable (state mandatory authority), it should compliment the outcome of the negotiation process in several ways. For example, the 401 Certification will require that flow releases from dams are sufficient for supporting aquatic life standards, while the negotiation process can assure those releases occur at times that accommodate the needs of recreational boaters, fishermen and water supply users.

4.7.2 Lake Rhodhiss, Lake Hickory and Lookout Shoals Lake Watershed Protection

These lakes are perhaps the most closely linked in the lake chain and exhibit some of the most significant water quality trends in the basin. These are the first impoundments below the forested Blue Ridge and are heavily influenced by the urbanized corridor along Interstate 40. Although these lakes are relatively small in volume, compared to Lake James (upstream) and

Lake Norman (downstream), the land area draining to them is quite large. In effect, most of the pollution generated by the urban centers (Morganton, Hickory, Lenoir, etc.) and agricultural operations is concentrated in these reservoirs. The result is heavy inputs of nutrients and sediment. Each impoundment's response to this load is discussed immediately below, and a summary of noted impacts is presented in Table A-26.

DWQ advocates a broad scale management strategy be developed for these lakes collectively. At minimum, this strategy should build upon the local efforts discussed below and will attempt to facilitate regional cooperation among local stakeholders.

Current Status of Lake Rhodhiss

Lake Rhodhiss has been sampled by DWQ since 1981 and is usually found to be eutrophic. This is a run-of-the-river reservoir and has a mean hydraulic retention time of 21 days. Although there were high nutrient concentrations, algal blooms were often limited by the reservoir's short retention time. Drought conditions that increased retention times and nuisance algae (especially blue-greens) blooms were recorded in 2001 and 2002. Public complaints of taste and odor problems in processed lake water resulted in a special study to investigate the extent and nature of the algal blooms. The study determined the existence of 15 well-established algae communities; five of which are known to cause taste and odor problems. The study also stated that blooms would persist as long as conditions favoring growth (low flow, high light and nutrient rich waters) are in place (NCDENR-DWQ, 2001). The presence of algae that create taste and odor problems in treated drinking water made it necessary for water treatment plants to install (at significant cost) activated charcoal to make the water drinkable.

Lake Rhodhiss also receives heavy sediment and/or nutrient inputs from the Muddy Creek, Lower Creek and Johns River watersheds. Within the lake itself, Lake Rhodhiss receives nutrient inputs from the Morganton and Valdese wastewater treatment plants. The Town of Lenoir's wastewater treatment plant discharge enters Lake Rhodhiss via Lower Creek. Algal blooms, taste and odor problems, violation of the pH standard, and percent dissolved oxygen saturation values above 120 percent indicate the reservoir (1,848.5 acres) suffers from eutrophication and is Impaired for aquatic life.

In June 2003, the Western Piedmont Council of Governments, using a grant from NCDENR, published the results of a comprehensive modeling effort to predict sediment and nutrient loads in the Lake Rhodhiss watershed (WPCOG, June 2003). The study consisted of two model simulations, a baseline scenario representing conditions in 2000, and a year 2020 projection based on anticipated growth in the watershed. With regard to sediment, the model produced sediment export coefficients for each drainage area in the watershed that highlight areas with disproportionally high contributions to the overall sediment load to Lake Rhodhiss. The model predicts the overall sediment loads will remain the same or slightly decrease as agriculture land is converted to impervious surfaces.

The study's nutrient analysis revealed a very different trend than that of the sediment analysis. The model predicts that by 2020, nitrogen and phosphorus loads are expected to increase 23 and 43 percent, respectively. The model attempted to determine how much of the nutrient load was originating from point sources in the watershed and found that 21 percent of the nitrogen load and 48 percent of the phosphorus load in 2000 originated from just four point source dischargers.

The contribution of those dischargers to total nitrogen and phosphorus loadings by 2020 is expected to increase to 31 and 62 percent, respectively.

Caldwell County, in cooperation with the municipalities of Granite Falls, Hudson, Cajah Mountain, Sawmills and Gamewell, began development of an NPDES Phase II compliant stormwater management program. The county hired a professional engineer to oversee the program and formed a Stormwater Advisory Group (SWAG) to structure the emerging program and tailor it to the community's needs. Caldwell County has begun a Public Education Program that targets elected officials and civic leaders, the development community, and realtors. Caldwell County has also begun an inventory of its facilities and operations that could potentially have a detrimental impact on water quality.

Caldwell County's Environmental Engineer will be developing Stormwater Pollution Prevention Plans (SWPPP) for priority facilities. A preliminary draft of a Stormwater Quality Management and Discharge Control Ordinance will be reviewed by the SWAG in February and March 2004. The draft ordinance envisions post-construction controls that are more effective than the minimum requirements in the state's proposed permanent NPDES Phase II rules (15A NCAC 2H .0126 and 15A NCAC 2H .1014). It also includes provision for two-zone, 50-foot wide riparian buffers along perennial streams and 30-foot wide buffers along intermittent streams. Finally, Caldwell County staff will give a formal presentation to the Caldwell County Commissioners during 2004 seeking approval for local delegation of the Erosion and Sedimentation Control Program. Local delegation of that program, combined with the remainder of Caldwell County's stormwater management efforts, will ensure more effective review and enforcement, while potentially reducing both the time and expense currently required of Caldwell County's development community.

Burke County has instituted a water protection program since 1998 that protects the shorelines of Lake Rhodhiss and Lake Hickory against uncontrolled development. The program requires 60-75 foot forested buffers, soil and erosion control/ stormwater mitigation plans, and impervious surface limitations for any ground disturbing activity within 250 feet of Lake Rhodhiss, Lake Hickory, and the Catawba River mainstem. The Burke County Subdivision Ordinance also requires that any lot in the area not connected to public water and sewer utilities be at least two acres in size, greatly reducing the density of homes on the lake shorelines.

DWQ applauds the foresight and proactive response to potential water quality threats in Caldwell County, Burke County, and the entire Uni-Four area. These efforts should eventually realize water quality benefits to the lake and surrounding streams.

Current Status of Lake Hickory

Lake Hickory was most recently monitored by DWQ in 2002. Surface dissolved oxygen and pH values were elevated in May, indicating high algal productivity. Chlorophyll *a* values ranged from moderate to elevated but were not greater than the water quality standard (40 µg/l). The reservoir was evaluated as mesotrophic in May and July and eutrophic in August. Because of algal blooms, taste and odor problems, and dissolved oxygen percent saturation values greater than 120 percent, Lake Hickory (3,589 acres) is in danger of becoming Impaired by eutrophication.

A USGS study of Lake Hickory published in 1998 demonstrated the impact of the Lake Rhodhiss release on water quality in Lake Hickory. The majority of nutrients enter Lake Hickory through this discharge. Additionally, Lake Hickory is more sensitive to conditions in Lake Rhodhiss than conditions in its immediate watershed. However, when the model was adjusted to simulate runoff from built up urban streams (by increasing the nutrient input from Snow Creek), the maximum algal concentrations in the lake increased by 100 percent. This result illustrates Lake Hickory's sensitivity to urban development (Bales et al., 1998).

The Town of Hickory experienced taste and odor problems in their drinking water in 2002. Algal samples in May indicated the presence of filamentous blue-green algae, which may have contributed to the problems. Since elevated densities of blue-green algae were also present in Lake Rhodhiss, the problem persisted until the algae died back in both reservoirs.

Current Status of Lookout Shoals Lake

Lookout Shoals Lake, situated between Lakes Hickory and Norman, is one of the smaller Catawba River Chain Lakes. The watershed draining to the impoundment is relatively small, its largest tributary being the Lower Little River. The Lower Little River drains a predominantly forest and agriculture area and carries a significant sediment load. The lake's water quality is more reflective of releases from upstream impoundments (Lakes Hickory, Rhodhiss and James) than conditions in the immediate watershed.

Lookout Shoals Lake's primary water quality concerns are nutrient enrichment, indicated by increased photosynthetic activity and elevated dissolved oxygen levels recorded during 1997 sampling by DWQ, and a Parrot Feather (aquatic weed) infestation that is well established in the upper portion of the reservoir (see Part 4.7.4). Low dissolved oxygen was also observed at the upper end of the impoundment, likely due to low quality discharge from Lake Hickory.

2004 Recommendations for Lake Rhodhiss, Lake Hickory and Lookout Shoals Lake

The current conditions indicated above and the results of the WPCOG model evaluation demonstrate the variety of stressors in the Rhodhiss-Hickory-Lookout Shoals system and the corresponding management challenges. Additionally, they highlight the tight link between the water quality in Lake Rhodhiss to that observed in Lake Hickory and Lookout Shoals. Because of this link and the clearly degraded conditions in Lake Hickory and to a lesser extent, Lookout Shoals Lake, DWQ is concerned that they may too become Impaired if conditions in Lake Rhodhiss are not mitigated. DWQ has determined that a local watershed management planning initiative including input and cooperation at local, state and federal levels will be necessary to develop an achievable and cost-effective management strategy for the Rhodhiss-Hickory-Lookout Shoals system. Duke Power, the owner/operator of these hydropower developments must also be an active collaborator. The results of this initiative would compliment the development of a Lake Rhodhiss Watershed TMDL developed by DWQ. It is also possible that implementation of this initiative may improve conditions in Lake Rhodhiss and Lake Hickory to the point that impairment is reversed and a TMDL is not necessary. DWQ recommends that initiative should include at least the following objectives:

- NPDES Permit reevaluations: As part of DWQ permitting policy, no new nutrient loads from point sources will be allowed to nutrient Impaired waters until a TMDL is complete, and applications for new or expanding nutrient discharges to **all** mainstem reservoirs in the Catawba River basin must be accompanied by an analysis of nutrient

related impacts using a DWQ approved nutrient response model for the receiving reservoir.
- Optimization should occur at existing discharges with large nutrient loads.
- Plan for implementing BMPs at remaining agriculture operations.
- Plan for preservation and protection of intact riparian vegetation.
- Plan for restoration of severely impacted stream habitats.
- Integration with ongoing restoration activities including Lower and Muddy Creeks.
- Multiagency integration: local governments, DSWC, WRC, USFWS, DWQ, etc.
- Assistance for local Soil and Erosion Control ordinance development.
- Smart growth that incorporates Low Impact Development (LID) principles. See Section A, Chapter 4, Part 4.11.

The community-based efforts of Caldwell County, Burke County, the WPCOG Water Quality Committee and others (refer to Section C, Chapter 1, Part 1.4) offer excellent starting points for a watershed wide management plan. DWQ will support these efforts in whatever ways possible, but funding from a wide variety of sources must be made available to ensure their long-term success.

4.7.3 Nutrient Management for Lake Wylie

Lake Wylie is the most downstream reservoir in the Catawba River basin. The lake is operated by Duke Power and was formed by the impoundment of the Catawba River in 1904 by a hydroelectric dam located near Fort Mills, SC. There are more than 327 miles of shoreline, and the majority of the reservoir lies within South Carolina. The immediate watershed of Lake Wylie is being converted from forested and agricultural areas to more urban land uses.

Eutrophic conditions in Lake Wylie and several of its major tributaries have been evident for many years. To address eutrophication in Lake Wylie, DWQ and South Carolina DHEC developed a nutrient control strategy for the Lake Wylie watershed. In 1991, EPA approved the Lake Wylie TMDL, including the point source allocation included in the Lake Wylie Nutrient Management Plan. The Lake Wylie Nutrient Management Area is considered to be Lake Wylie and its tributaries including: the Catawba River and its tributaries below Mountain Island Dam and the South Fork Catawba River below its confluence with Long Creek.

Current Conditions and 2004 Recommendations
Data from the most recent lake assessment period indicate that nutrient enrichment continues to be a major concern in (both) the North and South Carolina portions of the lake. Out of 90 samples collected between 1997 and 2002, over 40 percent demonstrated elevated dissolved oxygen concentrations. Although elevated dissolved oxygen concentrations were noted lake-wide, the highest concentrations were located in the Crowders, Catawba and Allison Creek arms. Because of chlorophyll *a* standard violations, algal blooms and dissolved oxygen percent saturation values greater than 120 percent, Lake Wylie (4,020 acres, NC portion) is Impaired by eutrophication.

Continued eutrophication concerns within Lake Wylie suggest that the nutrient management strategy may not be sufficient to address the problem. Therefore, improvements to the strategy may be warranted. For example, in the original strategy, discharges above Long Creek (a South Fork Catawba River tributary) and, perhaps more significantly, nonpoint sources were not included. In addition, a nutrient mass cap was not built into the discharge permits, allowing dischargers to increase their overall nutrient load as long as instantaneous concentration limits are not violated.

Over the next basinwide cycle, DWQ will appropriately place Lake Wylie in Section 4(a) of the *Integrated Report of Impaired Waters* to the EPA in order to reflect the existing TMDL. Given the continued evidence of nutrient enrichment problems, DWQ will also reevaluate the TMDL to determine if additional nutrient reductions or controls are needed. This reevaluation will occur on the standard 8 to13-year TMDL cycle. Until this TMDL is re-approved, no new nutrient loads from point sources will be allowed, as per DWQ's existing permitting policy to impaired waters. This policy includes the South Fork Catawba River watershed. Because this TMDL involves both North and South Carolina jurisdictions, both states will be involved in decision-making. In the meantime, DWQ supports and encourages the continued efforts of municipalities and county governments to identify and implement local nonpoint source reduction plans and wastewater treatment plant upgrades.

4.7.4 Aquatic Weed Infestation

During the assessment period, nuisance aquatic weeds rapidly established themselves in most of the Catawba River Chain Lakes. Introduction by boat trailers and intentional planting for sport fish habitat seem to be the most likely sources. The growth rate and probability of transporting are so great that in Lakes James, Norman and Mountain Island the occurrence of *Hydrilla* sp. and the potential for Parrot Feather, *Myriophyllum aquaticum*, infestation pose a more immediate threat to recreation, water supply use, and power generation uses in the lake than water quality standards violations.

Aquatic weeds present an additional and somewhat different management challenge than the nutrient reduction approach discussed in Parts 4.7.2 and 4.7.3 above. Nutrient enrichment certainly influences the growth rate of Parrot Feather, *Hydrilla* and other aquatic weeds, but the extent of that influence is not documented. It is a reasonable assumption that reducing nutrient loads will positively contribute to the effective management of infestations. In addition, control (reduction) of aquatic weed beds may reduce the rate at which sediment is deposited around them. Currently, however, biological control via grass carp, chemical treatment and habitat elimination via water level drawdowns are the most viable management options.

In addition to the management efforts led by Duke Power and NC Aquatic Weeds Council, all citizens must diligently reduce the probability of further infestations by removing weeds from boat props and trailers between launches and never disposing of ornamental pond/aquarium plants into the lakes. More information on aquatic weeds can be found at NCSU Crop Science Department's aquatic weed webpage at http://www.weedscience.ncsu.edu/aquaticweeds. Below is a summary of control efforts in the lakes to date.

LAKE JAMES: Duke Power discovered the nuisance aquatic plant, *Hydrilla*, in the Catawba River arm of Lake James in 1999. This plant has the potential of spreading rapidly throughout the lake, reducing available boating and swimming areas, and decreasing the lake's aesthetic appearance. In 2002, the NC Wildlife Resources Commission stocked 21,500 grass carp to control the spread of *Hydrilla*.

LAKE HICKORY: In 2001, Duke Power staff discovered Parrot Feather in the reservoir. Since 2001, the original ten-acre infestation has spread to 84 acres near the NC 321 bridge. Two drinking water intakes are located nearby and have the potential of becoming clogged by this plant. Businesses relying on water-based recreation are also concerned because the infestation can make boating and swimming impossible. Duke Power, along with stakeholders and DWQ, will work to develop and implement a Parrot Feather management program for the reservoir.

LOOKOUT SHOALS LAKE: To control the spread of Parrot Feather, Duke Energy drew down the water level to a target of 20 feet below full pool in November 2002. But due to rainfall in December, the water level rose to 14.3 feet below full pool in early January 2003. The pool level was brought to its normal operation level of three feet below full pool by February 2003 to accommodate annual fish spawning. Thus, the efficacy of the drawdown will probably be minor.

LAKE NORMAN: In 1999, Duke Energy staff discovered approximately 25 acres of *Hydrilla* in the reservoir. This invasive macrophyte has the potential for rapid growth with the subsequent loss of swimming and boating areas. It also has the potential to clog intakes of water treatment and power generation plants. A survey conducted in October 2002 by Duke Energy staff found *Hydrilla* as far upstream as the NC 150 bridge. There is also the potential for Parrot Feather to become established in Lake Norman via introduction from contaminated boat trailers or from plant fragments floating downstream from Lookout Shoals Lake. Grass Carp were stocked in Lake Norman as part of a joint effort between the Lake Norman Marine Commission, Duke Power, NC DWQ, and Charlotte-Mecklenburg Utilities Department to control the spread of *Hydrilla*.

MOUNTAIN ISLAND LAKE: *Hydrilla* sp. was first noted in the reservoir in 2000 and now covers more than 625 acres (Bonham, 2001). The exotic macrophyte was observed in the upper end of the reservoir in 2002. Grass carp were first stocked in 2000 as a possible biological control agent for this plant. In 2002, an additional 20,000 fish were stocked and maintenance stocking continues.

4.8 The Importance of Local Initiatives

As the Basinwide Planning Program completes its third cycle of plan development, there are many efforts being undertaken at the local level to improve water quality. The Division of Water Quality encourages local agencies and organizations to learn about these efforts and determine how similar programs may be implemented in their own watersheds. Funding organizations are also encouraged to seek out these programs and support them whenever possible.

Local people making decisions that affect change in their own communities is an important benefit of local initiatives. There are a variety of limitations local initiatives can overcome through collaboration including: restrictive budgets, staff resources, insufficient regulations, and North Carolina's rule-making process, among others.

These local organizations and agencies are able to combine professional expertise and local knowledge not present at the state and federal level. This allows groups to holistically understand the challenges and opportunities of local water quality concerns. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests and encourages others to become involved and invested in these projects. Working in cooperation across jurisdictional boundaries and agency lines opens the door to additional funding opportunities and eases the difficulty of generating matching or leveraged funds. This will potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of these local efforts is key to water quality improvements, and DWQ applauds the foresight and proactive response by locally based organizations and agencies to potential water quality problems. There are many excellent examples of local agencies and groups using these cooperative strategies throughout the state. Please refer to Section C, Chapter 1, Parts 1.4 and 1.5 for a discussion of local initiatives already underway in the Catawba River basin.

4.9 Biological Criteria for Assessment of Aquatic Life

DWQ strives to properly evaluate the health of aquatic biological communities throughout the state. Swamp stream systems, small streams and estuarine waters have presented unique challenges for benthic macroinvertebrate evaluation, while nonwadeable waters and trout streams have done the same for fish community evaluations. This section discusses some of the challenges in assessing benthic macroinvertebrate communities in small streams. Refer to Appendix II for further information.

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated, and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned.

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

4.10 Fish Consumption Advice

The presence and accumulation of mercury in North Carolina's aquatic environment are similar to contamination observed throughout the country. Mercury has a complex life in the environment, moving from the atmosphere to soil, to surface water and into biological organisms. Mercury circulates in the environment as a result of natural and human (anthropogenic) activities. A dominant pathway of mercury in the environment is through the atmosphere. Mercury that has been emitted from industrial and municipal stacks into the ambient air can circulate across the globe. At any point, mercury may then be deposited onto land and water. Once in the water, mercury can accumulate in fish tissue and humans. Mercury is also commonly found in wastewater.

The NC Department of Health and Human Services issues fish consumption advisories and advice for those fish species which have median and/or average methyl mercury levels at 0.4 mg/kg or greater. These fish include shark, swordfish, king mackerel, tilefish, as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) in North Carolina waters south and east of Interstate 85. See *Fish Consumption Advice* below. As a result of this guidance and the natural movement of fish back and forth across the I-85 boundary, DWQ considers all waters draining to the Catawba River below I-85 Impaired in the fish consumption use support category. Refer to Appendix III for more information regarding use support ratings and assessment methodology.

Fish Consumption Advice

Fish is an excellent source of protein and other nutrients. However, several varieties of freshwater fish may contain high levels of mercury, which may pose a risk to human health. These guidelines will help you make healthy food choices. A "meal" is defined as six ounces of cooked fish for adults and children 15 years or older and two ounces of cooked fish for younger children.

FDA and EPA Advisory

On March 19th, 2003, the Food and Drug Administration and EPA issued a joint consumer advisory about mercury in fish and shellfish. The advice is for women who might become pregnant, women who are pregnant, nursing mothers, and young children. Aside from being issued jointly by two federal agencies, this advisory is important because it emphasizes the positive benefits of eating fish and gives examples of commonly eaten fish that are low in mercury. In the past, FDA issued an advisory on consumption of commercially caught fish, while EPA issued advice on recreationally caught fish.

By following these three recommendations for selecting and eating fish or shellfish, women and young children will receive the benefits of eating fish and shellfish and be confident that they have reduced their exposure to the harmful effects of mercury:

- **Do not eat** shark, swordfish, king mackerel or tilefish because they contain high levels of mercury.
- Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
- Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock and catfish.
- Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
- Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers and coastal areas. If no advice is available, eat up to 6

ounces (one average meal) per week of fish you catch from local waters, but do not consume any other fish during that week.

For more detailed information, visit EPA's internet site at http://www.epa.gov/waterscience/fish/ or visit http://www.cfsan.fda.gov/seafood1.html or call the FDA's food information line toll-free at 1-888-SAFEFOOD.

NCDHHS Advice
The NC Department of Health and Human Services updated the following advice on April 16th, 2002.

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

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

Other Women, Men, and Children 15 years and older:

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

* A meal is 6 ounces of cooked fish for adults and 2 ounces of cooked fish for children under 15.

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

2004 Recommendations

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

NC Eastern Regional Mercury Study
In an effort to better manage state waters that may have methyl mercury issues, DWQ initiated a study using grant funding from EPA Region IV. The study aims to provide information that may be used in water quality standard and TMDL development. The study goals include:

- Determining levels of ambient mercury in the surface water system.
- Estimating site-specific total mercury: methyl mercury translators to evaluate water quality criteria.
- Develop site-specific water to fish bioaccumulation factors.
- Determine levels of mercury in treatment plant effluent.

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

DWQ Mercury Workgroup

DWQ is committed to characterizing methyl mercury exposure levels and determining if NPDES sources need to be controlled. DWQ formed an internal Mercury Workgroup to improve communication from all programs that directly affect mercury issues (i.e., Pretreatment, Environmental Sciences, Basinwide Planning, etc.). The workgroup meets as needed to share information and determine next steps in addressing mercury issues associated with the aquatic environment.

DWQ will continue to host an internal workgroup to stay abreast of current mercury issues. The public has voiced concerns that DWQ should be working on the ecological components and consequences of mercury bioavailability to biota in these areas and the biogeochemical cycling and production of methyl mercury from associated wetlands along these streams.

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

NPDES Mercury Requirement, Implementation of EPA Method 1631

NPDES permittees have worked with the state to reduce potential risks from this pollutant, including tasks associated with collecting and reporting more accurate data. The most commonly used laboratory analysis for total mercury (EPA Method 245.1) has a method detection level of 0.2 µg/l, while the current water quality standard is an order of magnitude lower at 0.012 µg/l. Thus, true compliance with the water quality standard could not be judged. A more recently approved laboratory method (EPA Method 1631) has a detection level below the water quality standard (0.0005 µg/l), which would allow the Division to assess potential water quality impacts from dischargers more accurately.

A total of 155 facilities statewide will be required to use EPA Method 1631 (or subsequent low level mercury methods approved by EPA in 40 CFR 136) when analyzing for total mercury beginning September 1, 2003. These facilities are subject to this new requirement because of either criteria: 1) the facility has a current total mercury limit in its NPDES permit that is <0.20 µg/l; or 2) the facility has limited instream dilution (i.e., the instream waste concentration (IWC) is >6 percent). This requirement complies with 15 A NCAC 2B.0505(e)(4), which requires that "test procedures must produce detection and reporting levels below the permit discharge requirements".

The State of North Carolina alone cannot eliminate the atmospheric deposition of mercury over surface waters. Actions for reducing atmospheric mercury will also be needed at the national and international levels. The Mercury Report to Congress (EPA, 1997) lists initiatives under the Clean Air Act that may reduce atmospheric mercury emissions from industrial sources. The most significant initiative is emission limits for municipal waste combustors and medical waste incinerators.

4.11 Managing the Impacts of Growth and Development and Stormwater Runoff

Introduction
Urban growth poses one of the greatest threats to aquatic resources than any other human activity. The impacts on rivers, lakes and streams as development surrounding metropolitan areas consumes neighboring forests and fields can be significant and permanent if stormwater runoff is not controlled. Greater numbers of homes, stores and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

In addition, as watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and driveways, the ability of the environment to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak streamflows after rainfall. Flooding frequency is also increased. These effects are compounded when small streams are channelized (straightened) or piped and storm sewer systems are installed to increase transport of drainage waters downstream. Bank scour from these frequent high flow events tends to enlarge urban streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams, leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

Most of the impacts result in habitat degradation (Section A, Chapter 4, Part 4.13), but urban runoff also carries a potentially toxic cocktail including oil and grease from roads and parking lots, street litter and pollutants from the atmosphere. Cumulative impacts from developing and urban areas can cause severe impairment to urban streams.

4.11.1 Effects of Growth and Development in the Catawba River Basin

The above effects are perhaps more evident in the Catawba River basin than any other basin in the state. A cursory look at population in the Catawba River basin reveals that approximately 10 percent of the state's population resides within its boundaries, and fully four of 11 counties experienced growth rates in excess of 20 percent in the last decade of the 20^{th} century. The total projected population density in 2030 of the counties in the lower Catawba River basin ranges from 525 persons/square miles in Catawba County to more than 2,000 persons/square miles in Mecklenburg County. The current effects of this growth on water quality can be seen in the map of Impaired streams in the Catawba River basin (Figure A-3). The sparsely developed watersheds of the northwestern portion of the basin generally contain streams with high water quality, excellent aquatic species populations, and Supporting use support ratings. Water quality declines dramatically in streams in the central and southern watersheds, where urbanization is focused around urban centers and interstate corridors. It is no surprise then the greatest concentration of Impaired streams lies in the areas of Gaston, Mecklenburg and Union counties around Charlotte and the urbanizing corridors along interstate highways.

In the past, the Catawba River basin was blessed with an abundance of surface water that supported the industrial expansion of the mid-20th century and the current domestic expansion. Even today, there is sufficient water to serve its diverse domestic, agricultural, industrial, energy production and recreational needs except in periods of severe drought. But, it is those periods of drought that point to the impending threats to the availability of good quality water. Clean water can likely be provided in sufficient quantity to supply the future needs of the basin, but only with inspired foresight, planning and management.

4.11.2 The Role of Local Governments

A summary of necessary management actions needed by local authorities is provided here, followed by discussions on large, watershed management issues. These actions are necessary to address current sources of impairment and to prevent future degradation in all streams. The intent of these recommendations is to describe the types of actions necessary to improve stream conditions, not to specify particular administrative or institutional mechanisms for implementing remedial practices. Those types of decisions must be made at the local level.

Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how aquatic organisms will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management approach is implemented. Management actions are suggested below to address individual problems, but many of these actions are interrelated (NCDENR-DWQ, June 2003).

Actions one through five are important to restoring and sustaining aquatic communities in a watershed, with the first three recommendations being the most important.

1. **Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development** (increased stormwater volumes and increased frequency and duration of erosive and scouring flows). This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.
    a. Over the short-term, currently feasible retrofit projects should be identified and implemented.
    b. In the longer term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
    c. Priorities should include evaluating the retrofit potential of existing instream impoundments.

   d. Grant funds for these retrofit projects may be available from EPA initiatives, such as Section 319 funds or the North Carolina Clean Water Management Trust Fund.
2. **A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods.** As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:
   a. Implementation of available BMP opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
   b. Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
   c. Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
   d. Development and implementation of a broad set of source reduction activities focused on: reducing nonstorm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.
3. **Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat.** Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would probably be advantageous to implement retrofit BMPs before embarking on stream channel restoration, as restoration is probably best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt et al., 2002; and Weinkam et al., 2001). Grant funds for these retrofit projects may be available from federal sources, such as EPA's Section 319 funds or state sources including North Carolina Clean Water Management Trust Fund.
4. Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading and its impacts to some extent. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting BOD and nutrient removal at appropriate sites.
5. Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.
6. Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may be beneficial.
7. Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:
   a. redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters;
   b. protecting existing woody riparian areas on all streams;
   c. replanting native riparian vegetation on stream channels where such vegetation is absent; and
   d. reducing and properly managing pesticide and fertilizer use.

4.11.3 Maintain and Develop Riparian Buffers

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

Catawba River Basin Buffer Rules

On July 7, 2003, the Environmental Management Commission completed a stakeholder process to protect mainstem riparian habitat on the Catawba River by finalizing the "Catawba River Basin Buffer Rules" (§15A NCAC 02B.0243). The temporary rule became permanent in August 2004.

The Catawba River basin buffer rules apply to a 50-foot wide riparian buffer directly adjacent to surface waters along the Catawba River mainstem below Lake James and along mainstem lakes in the Catawba River basin. The rules create a two-zone protection area that allows for all existing uses that were in place on June 30, 2001. As long as the current land use was in place on that date, the Catawba River basin buffer rules do not apply. Otherwise, zone one is the 30-foot wide strip closest to the waterline that must remain generally undisturbed. Zone two constitutes the remaining 20 feet of buffers and allows for grading and revegetating as long as the health of zone one is not impacted. There are many exemptions and activities that are allowable with mitigation inside the buffer zone. Those include, but are not limited to, access roads, view corridors and timber harvesting. For a complete copy of the rule and the list of all exemptions, please refer to §15A NCAC 02B.0243 http://h2o.enr.state.nc.us/admin/rules/. For more discussion on the process used to develop the rule, visit the webpage at http://h2o.enr.state.nc.us/nps/catawba.htm.

In addition to the rules discussed above, several other programs are implemented in the basin to protect riparian habitat. Protective zoning ordinances are in effect in all or part of Burke, McDowell and Mecklenburg counties. In addition, special protection is given to riparian habitat in water supply watersheds, high quality waters, outstanding resource waters, and trout waters throughout the basin (see Section A, Chapter 3, Part 3.2).

4.11.4 Protect Headwater Streams

The Catawba River basin buffer rules described above are an effective way to reduce nonpoint pollution impacts to the mainstem river and lakes, but is only part of a holistic, basinwide management approach. Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. However, impacts to headwater streams can (and do) affect the larger stream or river.

Headwater areas are found from the mountains to the coast along all river systems and drain all of the land in a river basin. Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed.

For a more detailed description of watershed hydrology, please refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

Planning Recommendations for New Development

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

4.11.5 Reduce Impacts of Future Development

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

Areas adjacent to the high growth areas of the basin are at risk of developing Impaired biological communities. These biological communities are important to maintaining the ecological integrity in the Catawba River basin. These streams will be important as sources of benthic macroinvertebrates and fishes for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

To prevent further impairment to aquatic life in streams in urbanizing watersheds local governments should:

1. Identify waters that are threatened by development.
2. Protect existing riparian habitat along streams.
3. Implement stormwater BMPs during and after development.
4. Develop land use plans that minimize disturbance in sensitive areas of watersheds.
5. Minimize impervious surfaces including roads and parking lots.
6. Develop public outreach programs to educate citizens about stormwater runoff.

Action should be taken at the local level to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box (above), refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at www.lowimpactdevelopment.org. Additional public education is also needed in the Catawba River basin in order for citizens to understand the value of urban planning and stormwater management. DWQ recently developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water*

Quality In Your Own Backyard. To obtain a free copy, call (919) 733-5083, ext. 558. For an example of local community planning, visit the website at http://www.charmeck.org/Home.htm for more information on the Town of Huntersville's water quality ordinance and other programs in the Charlotte-Mecklenburg area.

4.12 DWQ Stormwater Programs

Introduction

There are many different stormwater programs administered by DWQ. One or more of these programs affect many communities in the Catawba River basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. Those programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Local governments that are or may be affected by these programs are presented in Table A-27.

4.12.1 NPDES Phase I

Current Status and 2004 Recommendations

In the Catawba River basin, only the City of Charlotte has a Phase I stormwater permit. Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I required NPDES permit coverage to address stormwater runoff from medium and large stormwater systems serving populations of 100,000 or more people. Phase I also had requirements for ten categories of industrial sources to be covered under stormwater permits. Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of the EPA stormwater program.

Throughout the Catawba River basin, various types of activities with point source discharges of stormwater are required to be permitted under the state NPDES stormwater program. These include industrial discharges related to manufacturing, processing and materials storage areas, and construction activities with greater than five acres of disturbance. Most of those areas requiring permits must develop Stormwater Pollution Prevention Plans (SPPP) to minimize and control pollutants discharged from their stormwater systems. Refer to Section A, Chapter 2, Part 2.6 for more information on permitting policy and procedure.

DWQ recommends continued implementation of the current stormwater programs as well as implementation of the Phase II requirements. Many of the Impaired stream miles in the Catawba River basin are Impaired at least in part because of runoff from urbanized areas. Development and implementation of local programs that go beyond the minimum requirements will be needed to restore aquatic life to these streams.

4.12.2 NPDES Phase II

Current Status and 2004 Recommendations

Thirty municipalities and seven counties (Table A-27) in the basin are automatically required (1990 and 2000 US Census designated Urban Areas) to obtain a NPDES stormwater permit under the Phase II rules. Local governments designated on the 1990 US Census were required to submit applications for NPDES stormwater permits by March 2003. Those designated based on the 2000 US Census had until May 2004 to submit applications.

The Environmental Management Commission (EMC) previously adopted temporary and permanent rules addressing implementation of the Phase II stormwater program in North Carolina. However, in January 2004, the Rules Review Commission (RRC) objected to and returned the permanent rules to the EMC. The EMC and other parties have challenged the RRC's decision.

The RRC's return of the permanent stormwater management rules caused the earlier temporary rules to expire and prevented the permanent rules from becoming effective. This left the state with no formal program outlining the requirements for implementation of the federally mandated NPDES stormwater Phase II program.

On July 12, 2004, the North Carolina General Assembly ratified Senate Bill 1210 (S1210) - Phase II Stormwater Management. The Governor signed the bill on August 2, 2004. This bill addresses implementation of the federal NPDES Phase II stormwater program in North Carolina. The following is a summary of the bill's major points. Updates on the Phase II program will be posted as they become available at http://h2o.enr.state.nc.us/su/Hot_Topics.htm.

Senate Bill 1210 Summary

Permit Applications. The bill provides that Phase II permit applications received from a local government according to the schedule established by the EMC in its rule making will be considered timely received. It requires the federally designated Phase II communities to develop, implement and enforce a stormwater management program approved by DENR. The programs must include the six minimum measures set out in the federal Phase II stormwater rules. The post-construction stormwater standards to be applied are those set out in the temporary rule adopted by the Environmental Management Commission except as modified in some minor respects by the legislation. The bill exempts municipalities with populations less than 1,000 from the Phase II permit requirement unless shown to be contributing to water quality impairment.

County Coverage. New development in the unincorporated areas surrounding federally designated Phase II municipalities must meet stormwater management requirements if the development is located:

1. In an area that is considered an "urbanized area" under the federal Census.
2. Within the potential extraterritorial jurisdiction (ETJ) of a Phase II municipality (the area outside the city limits in which the city may exercise planning and zoning authority).

A city's potential ETJ will extend 1-3 miles beyond its boundaries, depending on the population of the city. If the municipality is not actually exercising its planning and zoning authority throughout the entire area allowed by statute, then DENR is to implement the stormwater management requirements in the area not regulated by the municipality.

If the combination of area covered by Phase II municipalities, potential extraterritorial jurisdiction and urbanized areas totals at least 85% of the entire area of the county, then stormwater requirements apply to new development in the entire county. As additional cities come into the Phase II program by state designation, the EMC may require stormwater controls in unincorporated areas surrounding those cities. Only unincorporated areas falling within a designated city's potential ETJ may be added; newly urbanized areas outside a designated city's potential ETJ would not be regulated except to the extent that they are served by a storm sewer system that is required to obtain a permit. The decision to regulate some or all of the potential ETJ must be based on finding that stormwater discharges from the area will harm water quality or result in a significant contribution of pollutants to sensitive waters. The bill directs DENR to implement the Phase II stormwater program in the delineated unincorporated areas, but counties may voluntarily accept delegation of the program from DENR. If a county takes on implementation of the program, the county may apply stormwater standards only in the delineated areas or may chose to apply those standards throughout the county.

Overlapping stormwater programs. In cases where conflicting or overlapping stormwater requirements are in effect, the more stringent standards will apply. (An example would be a Phase II municipality located in a county subject to the EMC's coastal stormwater rules.) The bill authorizes the Secretary to settle disputes over application of overlapping requirements.

General Permit. The Bill directs the EMC to develop and implement a general permit for Phase II stormwater coverage. The bill provides that the general permit requirements for post-construction stormwater control may be no more stringent than those set out in the temporary rule adopted by the EMC (as modified by the bill). A local government may choose to be covered under the general permit rather than an individual permit.

Permitting. The Bill directs DENR to send a draft NPDES stormwater permit to public notice by November 1, 2004 for all applications from municipal separate storm sewer systems located in cities and counties designated under the 1990 census. It also requires that DENR send a draft permit to public notice by May 1, 2005 for applications from those located in cities and counties designated under the 2000 census. The permitted storm sewer systems must implement post-construction stormwater requirements within 24 months after receiving the NPDES permit. Municipalities (or other public entities) regulated later under the state designation process must implement post-construction stormwater requirements within 36 months after receiving an NPDES stormwater permit.

State Designation and Petition Process. Federal rules require that the state consider regulating additional publicly owned storm sewer systems under Phase II based on water quality impacts. The bill basically incorporates the process adopted by the EMC in the Phase II rule making. The major difference is that the bill does not provide for state designation of counties. Designation would be focused on cities (or other publicly owned or operated storm sewer systems); delineating areas around the newly designated cities for regulation would add unincorporated areas. Federal rules also allow any person to petition the state to require a Phase II stormwater permit for an unregulated storm sewer system or for an individual stormwater discharge. The bill sets out the process for receiving and acting on petitions as required by the federal rules, codifying the process adopted by the EMC in the final Phase II rule.

Model Ordinance and Design Manual. The bill directs the EMC to develop a model stormwater ordinance and an updated stormwater design manual by July 1, 2005.

Federal and State Development Projects. The bill provides that state and federal agencies may apply to DENR for an NPDES stormwater permit covering all of the agency's activities or for a specific development project. To the extent a state or federal agency receives an NPDES stormwater permit, it will not be subject to additional regulation under stormwater programs implemented by local government under Phase II. State and federal activities or projects that are not covered by an NPDES stormwater permit are subject to stormwater requirements of the bill, as implemented by DENR or a permitted local government.

Interpretation, Effective Date and Sunset. The bill provides that the act should not be interpreted to alter the authority of the EMC or a local government, affect pending litigation, or give effect to any rules. The bill also states that it is not intended to affect vested rights or the delegation of powers or duties to the EMC or DENR as established under existing law. Agriculture and forestry exemptions from NPDES stormwater regulation apply. The bill will be effective when it becomes law and sunset on October 1, 2011. The provisions of the bill will not be codified.

4.12.3 State Stormwater Program

Current Status and 2004 Recommendations
The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program, codified in 15A NCAC 2H .1000, affects development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW).

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintaining vegetative buffers, and transporting runoff through vegetative conveyances. Low density development thresholds vary from 12-30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low density design criteria cannot be met, then high density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High density BMPs must control the runoff from the 1 or 1.5-inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Table A-27 shows the four counties in the Catawba River basin where permits may be required under the state stormwater management program under HQW or ORW stormwater rules. All development requiring an Erosion and Sediment Control Plan (for disturbances of one or more acres) must obtain a stormwater permit.

DWQ will continue implementing the state stormwater program with the other NCDENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. Communities should integrate state stormwater program requirements, to the extent possible, with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life. For example, the Mecklenburg County Water Quality Program in cooperation with the City of Charlotte and towns has initiated a stakeholders' process that began in April and will continue through December 2004 with the goal of developing a post-construction ordinance for new development that will be considered for adoption by elected officials in the city, county and towns in the spring of 2005. The purpose of the ordinance will be to control and manage stormwater runoff and associated negative water quality impacts resulting from post-construction stormwater discharges through the use of a combination of structural and non-structural best management practices (BMPs). The ordinance will fulfill the following objectives:

- Achieve compliance with the Phase I and Phase II NPDES Stormwater Permit requirements for post-construction pollution control, as applied to the respective jurisdictions.
- Satisfactorily address the stormwater pollution control criteria specified by the NC Wildlife Resources Commission (NCWRC) and the US Fish and Wildlife Services (USFWS) for the Rocky River watershed.
- Satisfactorily address the causes of water quality impairment associated with stormwater runoff in Charlotte-Mecklenburg.
- Satisfactorily address detention measures for the control of stormwater volumes and peaks associated with new construction.

Local governments facing rapid development should follow the lead of towns like Huntersville and develop zoning ordinances that augment and enhance the effect of regional programs by requiring the use of Low Impact Development (LID) technologies that replicate predevelopment runoff characteristics (Section B, Chapter 4, Part 4.3.1).

4.12.4 Water Supply Watershed Stormwater Rules

Current Status and 2004 Recommendations

The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution. The program attempts to minimize the impacts of stormwater runoff by utilizing low density development or stormwater treatment in high density areas.

There are 23 surface water supply watersheds in the Catawba River basin. Local governments that have land use jurisdiction within these watersheds are responsible for the adoption, implementation and enforcement of the state's water supply watershed minimum requirements. Table A-27 is a list of the local governments responsible for a WSWP Program in the Catawba River basin.

Local governments can adopt and enforce more stringent water supply watershed protection ordinances if they choose. For example, the state's rules require the use of a 30-foot vegetated buffer (for low density development) along all waters in the water supply watershed that appear as solid blue lines on USGS 1:24,000 scale topographical maps. The state's rules allow the buffer's vegetation to consist entirely of grass rather than natural vegetation. However, a local government can require a larger and undisturbed (natural vegetation) buffer. If a local government adopts a more stringent ordinance, the state cannot require the local government to enforce anything more stringent than the state's minimum requirements. However, the state does have statutory authority to assess civil penalties for local governments or developers for not administering the state's minimum requirements.

DWQ is currently reviewing local water supply watershed protection programs. This entails conducting site visits to local governments, assessing their land use ordinances and checking compliance with stormwater management, such as installation and maintenance of engineered stormwater control ponds, buffers and built-upon surface area. DWQ staff also continues to provide technical assistance through site visits, website (http://h2o.enr.state.nc.us/wswp/index.html), newsletter and correspondence.

DWQ recommends continued implementation of local water supply protection ordinances to ensure safe and economical treatment of drinking water. Communities should also integrate water supply protection ordinances with other stormwater programs, to the extent possible, in order to be more efficient and gain the most water quality benefits for both drinking water and aquatic life.

Table A-27 Communities in the Catawba River with Stormwater Requirements

	NPDES		TR Water Requirements	State Stormwater Program	Water Supply Watershed Stormwater Requirements
Local Government	Phase I	Phase II*			
Municipalities					
Belmont		**X**			**X**
Bessemer City		**X**			**X**
Blowing Rock			**X**		
Cajah Mountain		**X**			**X**
Catawba					**X**
Charlotte	**X**				**X**
Claremont		**X**			**X**
Connelly Springs		**X**			**X**
Conover		**X**			**X**
Cornelius		**X**			**X**
Dallas		**X**			**X**
Davidson		**X**			**X**
Drexel		**X**			**X**
Gamewell		**X**			**X**
Glen Alpine		**X**			**X**
Grandfather Village			**X**		

Granite Falls		X			X
Hickory		X			X
High Shoals					X
Hildebran		X			X
Hudson		X			X
Huntersville		X			X
Lenoir		X			X
Linville			X		
Lincolnton					X
Longview		X			X
Lowell		X			X
Maiden		X			X
Mooresville					X
Morganton		X			X
Mt. Holly		X			X
Old Fort			X		
Newton		X			X
Ranlo		X			X
Rhodhiss		X			X
Rutherford College		X			X
Sawmills		X			X
Stanley		X			X
Sugar Mountain			X		
Troutman					X
Valdese		X			X
Counties					
Alexander		X	X		X
Avery			X	X	X
Burke		X	X	X	X
Caldwell		X	X	X	X
Catawba		X			X
Cleveland					X
Gaston		X			X
Iredell					X
Lincoln					X
McDowell			X	X	X
Mecklenburg	X	X			X
Rutherford					X
Union		X			X

* More local governments may be designated, once designation criteria are developed, in addition to those that may be automatically designated based on 2000 Census.

4.12.5 Trout Stream Protection

Current Status and 2004 Recommendations

Many of the coldwater streams in the Catawba River basin's mountainous areas are home to healthy trout populations. DWQ gives supplemental trout (Tr) classification to those streams that are capable of supporting natural trout reproduction and survival of stocked trout. In order to protect the high quality water found in these streams, DWQ and the Division of Land Resources (DLR) enforce special regulations. For example, turbidity and dissolved oxygen standards are more stringent in trout waters than in Class C waters. DLR also requires a 25-foot, undisturbed vegetated buffer between the streambank and any land-disturbing activity (grading). In addition to these requirements, DWQ recommends developers and contractors diligently maintain erosion control structures when building near trout streams and encourages local citizens to report erosion problems to regional DWQ and DLR offices. The contact information for these offices can be found in Appendix VI, and North Carolina's surface water classification system is described in detail in Section A, Chapter 3.2.

4.13 Habitat Degradation

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a discharge quantity that is much greater than the natural flow in the stream often have degraded habitat as well.

Some Best Management Practices

Agriculture

- No till or conservation tillage practices
- Strip cropping and contour farming
- Leaving natural buffer areas around small streams and rivers

Construction

- Using phased grading/seeding plans
- Limiting time of exposure
- Planting temporary ground cover
- Using sediment basins and traps

Forestry

- Controlling runoff from logging roads
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

Determining the cause and quantifying amounts of habitat degradation is very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream. Although DWQ and other agencies are starting to address this issue, local efforts are needed to prevent further instream habitat degradation and to restore streams that have been Impaired by activities that cause habitat degradation. As point sources become less of a source of water quality impairment, nonpoint sources that pollute water and cause habitat degradation need to be addressed to further improve water quality in North Carolina's streams and rivers.

4.13.1 Sedimentation

Introduction

Soil erosion, transport and redeposition are among the most essential natural processes occurring in watersheds. However, land-disturbing activities such as the construction of roads and buildings, crop production, livestock grazing and timber harvesting can accelerate erosion rates by causing more soil than usual to be detached and moved by water. If best management practices (BMPs) are not used effectively, accelerated erosion can strip the land of its topsoil, decreasing soil productivity and causing sedimentation in streams and rivers (NCDENR-DLR, 1998). Sedimentation is the process by which eroded soil is deposited into waters. Sediment that accumulates on the bottom of streams and rivers smothers aquatic insects that fish feed upon and buries fish habitat that is vital to reproduction. Sediment filling rivers and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998).

Suspended sediment can decrease primary productivity (photosynthesis) by shading sunlight from aquatic plants, affecting the overall productivity of a stream system. Suspended sediment also has several effects on various fish species including avoidance and redistribution, reduced feeding efficiency, and therefore, reduced growth by some species, respiratory impairment, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, June 1999). Suspended sediment also increases the cost of treating municipal drinking water.

During 1999 basinwide monitoring, DWQ aquatic biologists reported streambank erosion and sedimentation throughout the Catawba River basin that was moderate to severe. Lower bioclassification ratings were assigned because of sedimentation; bottom substrate was embedded by silt and/or pools were partially filled with sediment. Unstable and/or undercut (eroding) streambanks were also noted in explanation of lower ratings (NCDENR-DWQ, June 2003).

Land Clearing Activities

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, substantial amounts of erosion can be prevented by planning to minimize the (1) amount and (2) time the land is exposed. DWQ's role in sediment control is to work cooperatively with those agencies that administer sediment control programs in order to maximize the effectiveness of the programs and to protect water quality. Where programs are not effective, as evidenced by a violation of instream water quality standards, and where DWQ can identify a source, then appropriate enforcement action can be taken. Generally, this entails requiring the landowner or responsible party to install acceptable BMPs.

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit. An erosion and sediment control plan must also be developed and approved for these sites under the state's Sedimentation Pollution Control Act (SPCA) administered by the NC Division of Land Resources. Site disturbances of less than one acre are required to use BMPs, but a plan is not required.

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (G.S. Chapter 113A, Article 4 referred to as "SPCA"). However, forestry operations may be exempted from the permit requirements in the SPCA, if the operations meet compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A NCAC 1I .0101-.0209, referred to as "FPGs") and General Statutes regarding stream obstruction (G.S. 77-13 and G.S. 77-14). Detailed information is available on the Water Quality Section of the DFR's website at http://www.dfr.state.nc.us.

For agricultural activities which are not subject to the SPCA, sediment controls are carried out on a voluntary basis through programs administered by several different agencies (see Appendix VI for further information).

Stronger Rules for Sediment Control

The Division of Land Resources (DLR) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced. In February 1999, the NC Sedimentation Control Commission adopted significant changes for strengthening the Erosion and Sedimentation Control Program. The following rule changes were filed as temporary rules, subject to approval by the Rules Review Commission and the NC General Assembly (NCDENR-DLR, July-September 1999):

- Allows state and local erosion and sediment control programs to require a preconstruction conference when one is deemed necessary.
- Reduces the number of days allowed for establishment of ground cover from 30 working days to 15 working days and from 120 calendar days to 90 calendar days. (Stabilization must now be complete in 15 working days or 90 calendar days, whichever period is shorter.)
- Provides that no person may initiate a land-disturbing activity until notifying the agency that issued the plan approval of the date the activity will begin.
- Allows assessment penalties for significant violations upon initial issuance of a Notice of Violation (NOV).

Additionally, during its 1999 session, the NC General Assembly passed House Bill 1098 to strengthen the Sediment Pollution Control Act of 1973 (SPCA). The bill made the following changes to the Act (NCDENR-DLR, July-September 1999):

- Increases the maximum civil penalty for violating the SPCA from $500 to $5000 per day.
- Provides that a person may be assessed a civil penalty from the date a violation is detected if the deadline stated in the Notice of Violation is not met.
- Provides that approval of an erosion control plan is conditioned on compliance with federal and state water quality laws, regulations and rules.
- Provides that any erosion control plan that involves using ditches for the purpose of dewatering or lowering the water table must be forwarded to the Director of DWQ.
- Amends the General Statutes governing licensing of general contractors to provide that the State Licensing Board for General Contractors shall test applicants' knowledge of requirements of the SPCA and rules adopted pursuant to the Act.
- Removes a cap on the percentage of administrative costs that may be recovered through plan review fees.

For information on North Carolina's Erosion and Sedimentation Control Program or to report erosion and sedimentation problems, visit the new website at http://www.dlr.enr.state.nc.us/ or you may call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

Recent Review of Sediment Control Research

The two most popular sediment control devices are silt fences and sediment basins. In 2001, DWQ staff conducted a review of peer-reviewed research publications and consulted with experts at NC State University (NCSU) to investigate the effectiveness of current sediment and erosion control practices. In addition, engineering calculations have been conducted to obtain theoretical effectiveness of sediment basins and silt fences. Research conducted in North Carolina showed that construction sites in North Carolina produce 10-188 tons per acre per year of sediment. Such wide variation might be attributed to the significant spatial and temporal differences in rainfall intensity and duration, soil characteristics, slope, and the type of soil cover. DLR currently uses the assumption that (on average) construction sites produce 84 tons/acre-year. For comparison, erosion in undisturbed natural systems is only 0.1-0.2 tons/acre-year.

Currently, sediment basins are designed to have 1,800 cubic feet of storage space for each acre of disturbed land. Based on the reference review and consultation, DWQ has concluded that these basins have numerous deficiencies, including:

1. Insufficient volume. [Pennsylvania requires 5,000 cubic feet; Maryland and Virginia require 3,600 cubic feet.]
2. Inadequate cleaning frequency. [In many cases, effectiveness of the basins is significantly reduced because they are only cleaned once a year.]
3. Short-circuiting. [In many cases, inlet and outlet in basins are constructed in very close proximity, which results in a shorter than predicted retention time.]
4. Water is not being removed from the surface where concentration of the sediment is the lowest.
5. Basins are designed with consideration of only cleared land. [In many cases, basins are treating runoff from the entire drainage area, which is significantly larger than that of cleared land.]

A sedimentation basin that is ideally designed and constructed is only able to capture 55 percent of all sediment in runoff. As a result, each acre of cleared land will deliver 38 tons of sediment to the waterways each year. After six months of operation, the effectiveness of the sediment basin will be reduced to 33 percent and the loss of sediment will approach 56 tons/acre-year.

Silt fences are even less effective. A typical silt fence can capture only 22 percent of all particles in runoff. Very often, they are improperly installed and receive inadequate maintenance that results in further reduction in their effectiveness.

New research indicates that use of new technologies such as installation of baffles in the sediment basins, application of flocculents, and use of skimmers can significantly increase efficiency of sedimentation basins. Experiments conducted at NCSU demonstrated that the current turbidity standard of 50 NTU (for waters not classified Tr) can be achieved in runoff if these devices are used. However, the most important factor in reducing sedimentation is timely cover of cleared land with mulches or use of the flocculent solutions to prevent erosion. It has been conclusively proven that use of ground cover (temporary or permanent) dramatically reduces erosion rates.

4.13.2 Loss of Riparian Vegetation

During 2002 basinwide sampling, DWQ biologists reported degradation of aquatic communities at numerous sites throughout the Catawba River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in rural and residential areas as well as in urban areas (NCDENR-DWQ, June 2003).

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a bank absorb the sun's heat and warm the water. Some fish require cooler water temperatures as well as the higher levels of dissolved oxygen cooler water provides. Trees, shrubs and other native vegetation cool the water by shading it. Straightening a stream, clearing streambank vegetation, and lining the banks with grass or rock severely impact the habitat that aquatic insects and fish need to survive.

Livestock grazing with unlimited access to the stream channel and banks can cause severe streambank erosion resulting in degraded water quality. Although they often make up a small percentage of grazing areas by surface area, riparian zones (vegetated stream corridors) are particularly attractive to cattle that prefer the cooler environment and lush vegetation found beside rivers and streams. This concentration of livestock can result in increased sedimentation of streams due to "hoof shear", trampling of bank vegetation, and entrenchment by the destabilized stream. Despite livestock's preference for frequent water access, farm veterinarians have reported that cows are healthier when stream access is limited (EPA, 1999).

Establishing, conserving and managing streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, February 2002). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

4.13.3 Loss of Instream Organic Microhabitats

Organic microhabitat (leafpacks, sticks and large wood) and edge habitat (root banks and undercut banks) play very important roles in a stream ecosystem. Organic matter in the form of leaves, sticks and other materials serve as the base of the food web for small streams. Additionally, these microhabitats serve as special niches for different species of benthic macroinvertebrates, providing food and/or habitat. For example, many stoneflies are found almost exclusively in leafpacks and on small sticks. Some beetle species prefer edge habitat, such as undercut banks. If these microhabitat types are not present, there is no place for these specialized macroinvertebrates to live and feed. The absence of these microhabitats in some streams in the Catawba River basin is directly related to the absence of riparian vegetation (refer to Part 4.13.2 above). Organic microhabitats are critical to headwater streams, the health of which is linked to the health of the entire downstream watershed.

4.13.4 Channelization

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Typical modifications are described in the text box. Although increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduced erosion, increased usable land area, greater navigability and more efficient drainage are frequently cited as the objectives of channelization projects.

> ***Typical Channel Modifications***
>
> - Removal of any obstructions, natural or artificial, that inhibit a stream's capacity to convey water (clearing and snagging).
> - Widening, deepening or straightening of the channel to maximize conveyance of water.
> - Lining the bed or banks with rock or other resistant materials.

Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat.

Restoration or recovery of channelized streams may occur through processes, both naturally and artificially induced. In general, streams that have not been excessively stressed by the channelization process can be expected to return to their original forms. However, streams that have been extensively altered may establish a new, artificial equilibrium (especially when the channelized streambed has been hardened). In such cases, the stream may enter a vicious cycle of erosion and continuous entrenchment. Once the benefits of a channelization project become outweighed by the costs, both in money and environmental integrity, channel restoration efforts are likely to be taken.

Channelization of streams within the continental United States is extensive and promises to become even more so as urban development continues. Overall estimates of lost or altered riparian habitats within US streams are as high as 70 percent. Unfortunately, the dynamic nature of stream ecosystems makes it difficult (if not impossible) to quantitatively predict the effects of channelization. Channelization has occurred historically throughout the Catawba River basin and continues to occur in some watersheds, especially in small headwater streams.

4.13.5 Recommendations for Reducing Habitat Degradation

In March 2002, Environmental Management Commission (EMC) sent a letter to the Sedimentation Control Commission (SCC) expressing seven recommendations for improving erosion and sedimentation control, based on a comprehensive performance review of the turbidity standard conducted in 2001 by DWQ staff. Specifically, the recommendations are that the EMC and SCC:

1. Evaluate, in consultation with the Attorney General's Office, whether statutory authority is adequate to mandate temporary ground cover over a percentage of the uncovered area at a construction site within a specific time after the initial disturbance of the area. If it is found that statutory authority does not exist, then the EMC and SCC should prepare resolutions for the General Assembly supporting new legislation to this effect.

2. Prepare resolutions supporting new legislation to increase the maximum penalty allowed in the Sedimentation Pollution Control Act from $5,000 to $25,000 for the initial response to a noncompliant site.
3. Jointly support a review of the existing Erosion and Sediment Control Planning and Design Manual by DLR. This review should include, but not be limited to, a redesign of the minimum specifications for sedimentation basins.
4. Evaluate, in consultation with the Attorney General's Office, whether the statutory authority is adequate for effective use of the "Stop Work Order" tool and, if found not to be adequate, to prepare resolutions for the General Assembly supporting new legislation that will enable staff to more effectively use the "Stop Work Order" tool.
5. Support increased research into and experimentation with the use of polyacrylamides (PAMs) and other innovative soil stabilization and turbidity reduction techniques.
6. Jointly support and encourage the awarding of significant monetary penalties for all activities found to be in violation of their Stormwater Construction General Permit, their Erosion and Sediment Control Plan, or the turbidity standard.
7. Hold those individuals who cause serious degradation of the environment through excessive turbidity and sedimentation ultimately responsible for restoration of the area.

DWQ will continue to work cooperatively with DLR and local programs that administer sediment control in order to maximize the effectiveness of the programs and to take appropriate enforcement action when necessary to protect or restore water quality. However, more voluntary implementation of BMPs is needed for activities that are not subject to these rules in order to substantially reduce the amount of widespread sedimentation present in the Catawba River basin.

Additionally, more public education is needed basinwide to educate landowners about the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life. Funding is available through numerous federal and state programs for landowners to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources for livestock, and fence animals out of streams (refer to Section C). EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines some of these and other programs aimed at protecting water quality. A copy may be obtained by calling the National Center for Environmental Publications and Information at (800) 490-9198 or by visiting the website at http://www.epa.gov/OWOW/watershed/wacademy/fund.html. Local contacts for various state and local agencies are listed in Appendix VI.

4.14 Fecal Coliform Bacteria

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present, and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of fecal coliform bacteria can indicate high levels of sewage or animal wastes which could make water unsafe for human contact (swimming) or the harvesting and consumption of shellfish. Fecal coliform bacteria and other potential pathogens associated with waste from warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of fecal coliform bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters. There are many waters that have high levels of fecal coliform bacteria associated mostly with stormwater runoff in urban areas. To view the list of DWQ ambient monitoring stations showing high concentrations of fecal coliform bacteria, refer to Section A, Chapter 3, Part 3.3.6. DWQ is currently developing TMDLs (see Appendix IV) for waters that are on the 303(d) list of Impaired waters.

Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

Under favorable conditions, fecal coliform bacteria can survive in bottom sediments for an extended period (Howell et al., 1996; Sherer et al., 1992; Schillinger and Gannon, 1985). Therefore, concentrations of bacteria measured in the water column can reflect both recent inputs as well as the resuspension of older inputs.

Reducing fecal coliform bacteria in wastewater requires a disinfection process, which typically involves the use of chlorine and other disinfectants. Although these materials may kill the fecal coliform bacteria and other pathogenic disease-causing bacteria, when they are introduced to the natural environment, they also kill bacteria essential to the proper balance of the aquatic environment, and thereby, endanger the survival of species dependent on those bacteria.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation and shellfish harvesting (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and not to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period.

Sources of Fecal Coliform in Surface Waters

- Urban stormwater
- Wild animals and domestic pets
- Improperly designed or managed animal waste facilities
- Livestock with direct access to streams
- Improperly treated discharges of domestic wastewater, including leaking or failing septic systems and straight pipes

A number of factors beyond the control of any state regulatory agency contribute to elevated levels of disease-causing bacteria. Therefore, the state does not encourage swimming in surface waters. To assure that waters are safe for swimming indicates a need to test waters for pathogenic bacteria. Although fecal coliform standards have been used to indicate the microbiological quality of surface waters for swimming and shellfish harvesting for more than 50 years, the value of this indicator is often questioned. Evidence collected during the past several decades suggests that the coliform group may not adequately indicate the presence of pathogenic viruses or parasites in water.

The detection and identification of specific pathogenic bacteria, viruses and parasites such as *Giardia*, *Cryptosporidium* and *Shigella* are expensive, and results are generally difficult to reproduce quantitatively. Also, to ensure the water is safe for swimming would require a whole suite of tests for many organisms, as the presence/absence of one organism would not document the presence/absence of another. This type of testing program is not possible due to resource constraints.

4.15 Addressing Waters on the State's Integrated 305(b) and 303(d) Report

Introduction

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

Current Status and 2004 Recommendations

In 2002, per EPA guidance, DWQ submitted required information on a format similar to that specified in the *2002 Integrated Water Quality Monitoring and Assessment Report* (EPA, 2001b). This integrated report is considered a hybrid report, incorporating elements of old and new EPA guidance on 305(b) and 303(d) reporting. EPA confirms this report satisfies Clean Water Act (CWA) requirements for both the 2002 Section 305(b) water quality report and the 2002 Section 303(d) priority ranking of Impaired waterbodies, commonly referred to as the Section 303(d) list. DWQ has now submitted and is waiting EPA approval on the *2004 Integrated Report*.

The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters. The waters in the Catawba River basin that are on this list are presented in the individual subbasin descriptions in Section B and in Table A-24. Waters listed as Impaired for the first time in this report will be listed in the *2006 Integrated Report*. For information on listing requirements and approaches, refer to Appendix IV.

Section B

Water Quality Data
and
Information by Subbasin

Section B - Chapter 1
Catawba River Subbasin 03-08-30
Corpening Creek, Mackey Creek, North Fork Catawba River, Muddy Creek, Linville River and Lake James

1.1 Subbasin Overview

Subbasin 03-08-30 at a Glance

Land and Water Area
Total area: 526 mi^2
Land area: 516 mi^2
Water area: 10 mi^2

Population
2000 Est. Pop.: 57,046 people
Pop. Density: 108 persons/mi^2

Land Cover (percent)
Forest/Wetland: 87%
Surface Water: 3%
Urban: 1%
Agriculture: 9%

Counties
Avery, Burke and McDowell

Municipalities
Crossnore, Glen Alpine, Grandfather Village, Marion, Morganton, Old Fort and Sugar Mountain

This subbasin contains the headwaters of the Catawba River from its source near Old Fort to the confluence with Silver Creek in Burke County and includes the entire watershed of Lake James. Approximately one-half of the subbasin is within the Pisgah National Forest.

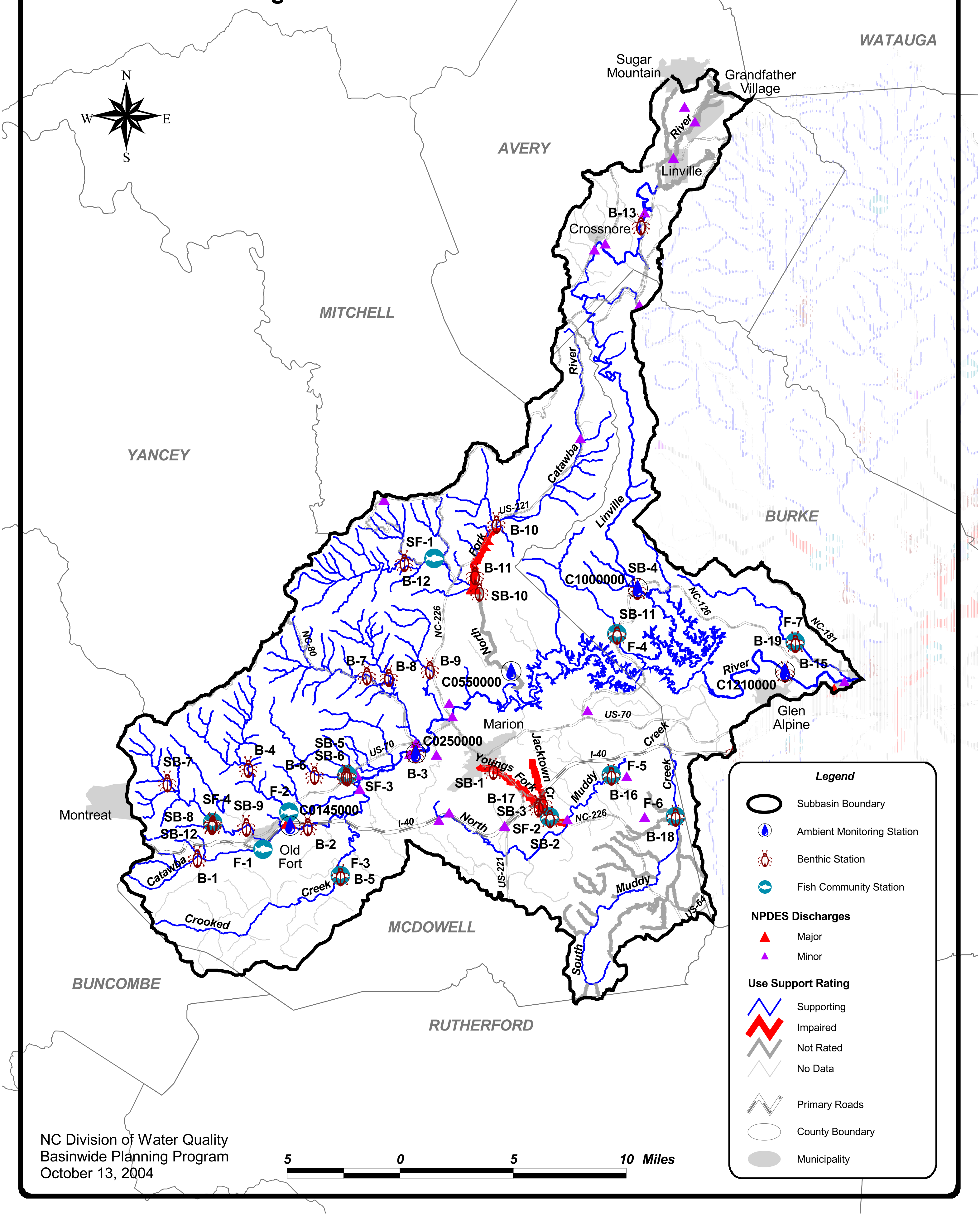
The Catawba River flows generally eastward with the largest tributaries flowing south from mountainous headwaters. These northern tributaries are typically swift flowing, coldwater streams capable of supporting trout populations. There are 26 NPDES discharges in this subbasin.

There were 31 benthic macroinvertebrate community sites, 11 fish community sites, and five ambient monitoring stations (Figure B-1 and Table B-1) evaluated during this assessment period. Sites on Canoe Creek, the Catawba River, Linville River and Swannanowa Creek improved. Declines were noted on Buck Creek, Little Buck Creek, Crooked Creek, North Fork Catawba River and North Muddy Creek. The drought appeared to be the major stressor that affected benthic communities. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

Overall, water quality is high in this subbasin. Almost the entire segment of the Catawba River in this subbasin (except for the headwater portion, which was Good-Fair) was given a Good bioclassification, but the low flows produced prolific growths of the rooted aquatic plant *Elodea canadensis* in some areas.

The North Fork Catawba River below the Baxter Healthcare Corporation discharge declined from Excellent to Good between 1997 and 2002, but there was a dramatic decline from Good to Fair further downstream, where the river was wider with slower flow. Mackey Creek below a metal plating discharge whose permit was rescinded in June 2001 showed the greatest change in water quality, its bioclassification improving from Poor to Good. Poor benthic and fish bioclassifications were found prior to removal of the discharge.

Figure B-1 Catawba River Subbasin 03-08-30



NC Division of Water Quality
Basinwide Planning Program
October 13, 2004

Table B-1 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-30

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Armstrong Creek	11-24-14-(1)	C Tr HQW	10.8 mi.	AL	B-12 E--97 B-12 E--02 SF-1 E-99			S	FS
Buck Creek (Lake Tahoma)	11-19-(1)	WS-II & B Tr	166.4 ac.	AL	B-7 E--97 B-7 G--02			S	FS
Canoe Creek	11-33-(2)	WS-IV	5.6 mi.	AL	B-19 GF--97 B-19 G--02			S	ST
CATAWBA RIVER	11-(1)	C Tr	7.6 mi.	AL	B-1 GF--02 F-1 GF--97			S	ST
CATAWBA RIVER (including backwaters of Lake James below elevation 1200)	11-(8)	C	23.5 mi.	AL	B-2 GF--97 B-2 G--97	C0145000 nce C0250000 nce		S	ST
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31.5)	WS-IV	9.8 mi.	AL	B-15 G--97 B-15 G--02	C1210000 nce		S	FS
CATAWBA RIVER (Lake James below elevation 1200)	11-(23)	WS-V & B	2,040.9 ac.	AL			L-1 nce	S	FS
CATAWBA RIVER (Lake James below elevation 1200)	11-(27.5)	WS-V & B	3,769.5 ac.	AL			L-1 nce	S	FS
Crooked Creek	11-12	C	16.0 mi.	AL	F-3 E--02 B-5 G--97			S	FS
Curtis Creek	11-10	C Tr	9.7 mi.	AL	F-2 G--02 B-4 G--97			S	FS
Jacktown Creek	11-32-1-4-1	C	2.4 mi.	AL	SB-3 F--01			I	-
Linville River	11-29-(19)	B HQW	7.1 mi.	AL	SB-4 E--97 SB-4 E--02	C1000000 nce		S	FS
Linville River	11-29-(4.5)	B Tr	15.3 mi.	AL	B-13 GF--97 B-13 G--02			S	ST
Little Buck Creek	11-19-11	WS-II & B Tr	4.4 mi.	AL	B-8 E-97 B-8 G--02			S	FS
Mackey Creek	11-15-(3.5)a	C	1.8 mi.	AL	SB-5 G--98 SF-3 G--02			S	FS
Mackey Creek	11-15-(3.5)b	C	0.8 mi.	AL	B-6 G--97			S	PS

Table B-1 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-30

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results: Biological	Ambient	Other	Use Support Rating: 2004	1998
Mill Creek	11-7-(0.5)	C Tr HQW	5.0 mi.	AL	SF-4 E--99 SB-8 G--98			S	FS
North Fork Catawba River	11-24-(2.5)a	B Tr	7.1 mi.	AL	B-10 E-97 B-10 G--02			S	FS
North Fork Catawba River	11-24-(2.5)b	B Tr	3.5 mi.	AL	B-11 G--97 B-11 F--02			I	FS
North Fork Catawba River	11-24-(13)	C	7.0 mi.	AL		C0550000 nce		NR	FS
North Muddy Creek	11-32-1	C	18.4 mi.	AL	B-16 G--97 B-16 GF--02			S	ST
Paddy Creek	11-28	C Tr	4.6 mi.	AL	F-4 GF--02 SB-11 G--99			S	ST
South Muddy Creek	11-32-2	C	16.1 mi.	AL	B-18 GF-97 B-18 GF--02			S	ST
Swannanoa Creek	11-7-9	C Tr	3.2 mi.	AL	SB-12 F--98 SB-12 E--02			S	FS
Toms Creek	11-21-(2)	C HQW	6.6 mi.	AL	B-9 G--97 B-9 NI--02			S	FS
Youngs Fork (Corpening Creek)	11-32-1-4a	C	3.6 mi.	AL	SB-1 P--01			I	PS
Youngs Fork (Corpening Creek)	11-32-1-4b	C	1.9 mi.	AL	B-17 F--97 B-17 F--01 B-17 F--02 SF-2 F-01 SB-2 F--01			I	PS
CATAWBA RIVER (including backwaters of Lake James below elevation 1200)	11-(8)	C	23.5 mi.	REC		C0145000 nce C0250000 nce		S	-
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31)	WS-V	1.1 mi.	REC		C1210000 nce		S	-
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31.5)	WS-IV	9.8 mi.	REC		C1210000 nce		S	-

Table B-1 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-30

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Linville River	11-29-(19)	B HQW	7.1 mi.	REC		C1000000 nce		S	-
North Fork Catawba River	11-24-(13)	C	7.0 mi.	REC		C0550000 nce		S	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SF - Special Fish Community Study
SB - Special Benthic Community Study
L - Lakes Assessment

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
NR - Not Rated

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting, ST - supporting but threatened
PS - partially supporting, NS - not supporting
NR - not rated, N/A - not applicable

Waters in the following sections are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 1.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 1.3 below. Supporting waters with noted water quality impacts are discussed in Part 1.4 below. Water quality issues related to the entire subbasin are discussed in Part 1.5. Refer to Appendix III for use support methods and more information on all monitored waters.

1.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-30 were assigned for aquatic life, fish consumption, recreation and water supply. There is no fish consumption advice for waters in this subbasin; therefore, all waters are rated No Data for Fish Consumption. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-2 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-2 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-30

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	186.9 mi 5,976.9 ac	0	48.4 mi	0
Impaired	11.4 mi	0	0	0
Not Rated	7.0 mi	0	0	0
Total	**205.3 mi 5,976.9 ac**	**0**	**48.4 mi**	**0**
Unmonitored Waters				
Supporting	238.0 mi	0	0	59.1 mi. 5,976.9 ac.
Impaired	0	0	0	0
Not Rated	62.6 mi	0	0	0
No Data	152.4 mi	658.2 mi 5,976.9 ac	609.8 mi. 5,976.9 ac.	0
Total	**453.0 mi**	**658.2 mi 5,976.9 ac**	**609.8 mi 5,976.9 ac**	**59.1 mi 5,976.9 ac**
Totals				
All Waters*	**658.2 mi 5,976.9 ac**	**658.2 mi 5,976.9 ac**	**658.2 mi 5,976.9 ac**	**59.1 mi 5,976.9 ac**

Note: All waters includes monitored, evaluated and waters that were not assessed.

1.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

1.3.1 Corpening Creek (Youngs Fork) [AU# 11-32-1-4a and 11-32-1-4b] Jacktown Creek [AU# 11-32-1-4-1]

Current Status and 2004 Recommendations

Approximately 4.7 miles of Corpening Creek, from its source to North Muddy Creek, were listed as Impaired due to nonpoint sources and the Marion WWTP, based on biological data collected in 1990. The 1999 basin plan recommended that efforts to address water quality issues in the Corpening Creek watershed should concentrate on nonpoint source pollution reduction, and several recommendations were made to address urban stormwater pollution. Its headwaters include the southeastern section of the Town of Marion and its lower reaches include the 2.4-mile tributary, Jacktown Creek. The water quality problems seen in the creek are typical of urban streams. The 1999 Catawba River Basinwide Plan noted that there was not enough information to determine what efforts should be undertaken to restore Corpening Creek and suggested a more in-depth study be conducted to identify the land use activities and streambank problems that are causing degradation in this creek.

In 2001, DWQ initiated a Collaborative Assessment for Watersheds and Streams (CAWS) Project on Corpening Creek. This EPA funded project sought to provide the foundation for future water quality restoration activities in the Corpening Creek watershed by: 1) identifying the most likely causes of the impairment; 2) identifying the major watershed activities and pollution sources contributing to those causes; and 3) outlining a general watershed strategy that recommends restoration activities and best management practices (BMPs) to address the identified problems.

The project team collected a wide range of data to evaluate potential causes and sources of impairment. Data collection activities included: benthic macroinvertebrate sampling at sites SB-1, 2, 3 and B-17; assessment of stream habitat, morphology and riparian zone condition; water quality sampling to evaluate stream chemistry and toxicity; sediment quality sampling to evaluate sediment toxicity and provide a longer term record of the pollutants the stream carries; and characterization of watershed land use, conditions and pollution sources.

The study concluded that multiple stressors associated mostly with development in the watershed heavily impact aquatic organisms in the entire length of both Corpening Creek and Jacktown Creek. The results suggest the primary cause of impairment is toxic impacts. Other cumulative causes that contribute to the impairment are habitat degradation due to sedimentation and lack of microhabitat, hydromodification due to scour, and nutrient enrichment.

Because of the widespread nature of biological degradation and the highly developed character of the watershed, DWQ recognizes that bringing about substantial water quality improvement will be a tremendous challenge. While a return to the relatively unimpacted conditions that existed prior to urbanization is not possible, Corpening and Jacktown Creeks can support a healthier biological community than they do today. For DWQ's recommendations on how to meet these challenges, please refer to Section A, Chapter 4, Parts 4.11 and 4.13.

1.3.2 Mackey Creek [AU# 11-15-(3.5)b]

Current Status and 2004 Recommendations
Mackey Creek, from US 70 to the Catawba River (0.6 miles), was Impaired due to impacts from Metal Industries discharge. The 1999 Catawba River Basinwide Plan recommended that DWQ continue to work with the discharger to ensure process improvements.

The fish community of Mackey Creek (at US 70, McDowell County) above and below Metal Industries metal plating discharge was investigated in 1998 and in 2002 (below only, site SF-3). The discharge was discontinued in July 2000 and the permit was rescinded in June 2001. Prior to its discontinuance, the fish community bioclassification in 1998 was rated Good above and Poor below the discharge. In April 2002, the community below the discharge was Good and the community had recovered due to the removal of the toxic discharge. The fish community and its components are now typical of those found in mountains and foothills streams in the upper Catawba River basin. The benthic macroinvertebrate community at site SB-6 improved from Fair in 1998 to Good in 2002.

Due to the removal of the toxic discharge and resulting improvement in bioclassification, DWQ recommends Mackey Creek be removed from the state 303(d) list. However, steady declines in bioclassification in the upper reaches of this stream were noted above SR 1453. Recent land-disturbing activities were identified as a source of sediment and lead to enforcement actions.

1.3.3 North Fork Catawba River [AU# 11-24-(2.5)b]

Current Status and 2004 Recommendations
The North Fork Catawba River just below the Baxter Healthcare Corporation discharge declined from Excellent to Good between 1997 and 2002; but there was a dramatic decline from Good to Fair further downstream, where the river was wider with slower flow. A 3.47-mile segment of the North Fork Catawba River from Stillhouse Branch to Armstrong Creek is Impaired because of the Fair bioclassification at site B-11. The drought conditions provided minimal dilution, and a conductivity value of 576 µmhos/cm was observed at the time of the benthic sampling in August 2002.

Baxter Healthcare experienced problems with oil and grease discharges during the assessment period but has taken steps to remedy the problem. There are several other concerns in the river that may be contributing to the conditions noted. Those include sediment from road construction, silviculture, mining, and naturally high pH conditions caused by limestone. DWQ will continue to monitor the river and work with local resource agencies and landowners to improve these conditions.

1.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

1.4.1 Lake James [AU# 11-(23)]

Current Status and 2004 Recommendations
Three dams that impound waters of the Catawba River and the Linville River create Lake James, now operated by Duke Power. The Catawba, the North Fork of the Catawba, and the Linville Rivers are its major tributaries. The lake is used to generate electricity at the Bridgewater Hydroelectric Plant; public recreation is a secondary use.

The most upstream of the impoundments in the Catawba River Chain Lakes system, Lake James, is divided into two hydrologic units: the Catawba River section and the Linville River section. A man-made canal located at the Highway 126 Bridge connects these units. As a result, the lake is a hydrologically complex system.

The reservoir is currently meeting all designated uses. However, increasing residential growth along the shoreline and upstream along the Catawba River poses a threat to water quality. An increase in the number of lakefront homes with septic tanks and greater recreational boating activities is viewed as potentially damaging to the lake's water quality.

The Lake James Environmental Association joined the Volunteer Water Information Network (see Section C, Chapter 1, Part 1.6.1) and began sampling Lake James in 2001. Their sampling results support concerns about sediment and nutrient loads entering the lake from the Catawba River and the North Fork Catawba River (Mass et al., 2002).

Duke Power discovered the nuisance aquatic plant, *Hydrilla*, in the Catawba River arm in 1999. This plant has the potential of spreading rapidly throughout the lake, reducing available boating and swimming areas, and decreasing the lake's aesthetic appearance. In 2002, 21,500 grass carp were stocked by the NC Wildlife Resources Commission to control the spread of *Hydrilla*.

The Western Piedmont Council of Governments (WPCOG) in cooperation with the Isothermal Planning and Development Commission completed a modeling effort to estimate sediment and nutrient loadings to Lake James under current and future conditions using EUTROMOD, a watershed and lake modeling tool developed for southeastern reservoirs. The objectives of this effort were to estimate nutrient and sediment loads to the lake from individual subbasins and compare future loadings from three hypothetical management scenarios. Those scenarios included a Growth Scenario with new lakefront development, a Conservation Scenario with reduced shoreline development and a 30-meter buffer along streams within the watershed, and a Point Source Control Scenario featuring nutrient reductions from a major point source discharger.

Analysis of the modeling results along with data on land cover, point source dischargers, soils, agricultural practices, and septic tanks revealed several notable points and suggestions for future management. Perhaps most importantly, the model estimated 71 percent of the annual phosphorus load to the lake currently comes from nonpoint sources. Of the nonpoint source phosphorus load, the model estimates 63 percent originates from agricultural practices even though agriculture only makes up 7 percent of the watershed's land cover. Additionally, 91 percent of the watershed remains forested. These facts lead to two management suggestions: first, a variety of BMPs should be implemented to reduce phosphorus laden sediment runoff from agriculture activities; and secondly, emphasis should be placed on protecting those forested lands that currently exist along streams through landowner education and incentive programs offered by existing agencies and organizations. The report goes on to suggest that local governments use their authority to establish land use regulations to limit development in floodplains and on steep slopes and to partner with other agencies and organizations with land management interests to provide incentive based sediment reduction plans (WPCOG, June 2003).

DWQ fully supports the recommendations stated in the WPCOG modeling report. In addition, DWQ will work to foster mutually beneficial relationships between local governments and those agencies and organizations that have an interest in environmentally sound land management in the hope that cost-effective solutions to sediment control will develop.

1.4.2 Linville River [AU# 11-29-(1)]

Current Status and 2004 Recommendations

This 7.1-mile headwater portion of the Linville River near Linville and Grandfather Village drains a highly developed area, including three golf courses, one of which has an impoundment less than a mile upstream of DWQ's benthic monitoring site B-13. The river harbors good instream habitat, though very slippery rocks indicate nutrient enrichment may be a problem in this portion of the Linville River. Residential and agricultural land use near this site affect the stream habitat, resulting in a narrow riparian zone, unstable banks and infrequent pools.

The areas upstream of the Linville Gorge Wilderness Area face increasing development pressure as tourism and second home purchases increase. DWQ recommends that local municipalities and county governments carefully and sensibly manage the coming growth to protect the natural resources that drive this growth. They can accomplish that end by adopting and enforcing land use and zoning ordinances that reduce stormwater runoff from lawns, streets and golf courses. Examples and advice on implementing these types of ordinances can be found at the Low Impact Development Center webpage at http://www.lowimpactdevelopment.org/publications.htm.

1.4.3 Left Prong Catawba River [AU# 11-6]

Current Status and 2004 Recommendations

The Left Prong Catawba River drains the northern slope of Allison Ridge before its confluence with the mainstem Catawba River upstream of Old Fort. This river is currently being threatened by sediment-laden runoff from two large home construction projects in its headwaters. The mainstem Catawba River, to which it drains, is demonstrating impacts from poor land use practices (NCDENR-DWQ, June 2003). If this problem is not addressed, impacts from sediment originating in the Left Prong Catawba River could impair the stream itself and impact the mainstem Catawba River and Lake James.

In the short-term, DWQ is working together with the Division of Land Resources to ensure that all construction activities are in compliance with the NC Sedimentation and Pollution Control Act. In the long-term, DWQ recommends that local municipalities and county governments carefully and sensibly manage growth in order to protect the natural resources that attract new development. They can accomplish that end by adopting and enforcing land use and zoning ordinances that reduce stormwater runoff from lawns, streets and new development.

1.4.4 Muddy Creek [AU# 11-32]

Current Status and 2004 Recommendations
The 98-square mile watershed of Muddy Creek is in Burke and McDowell counties. Muddy Creek is formed by the confluence of North Muddy Creek and South Muddy Creek just upstream of the confluence of Muddy Creek and the Catawba River. This watershed shows evidence of significant sediment loads. Duke Power has been collecting sediment load data in the watershed and estimates that up to 23,000 tons per year of sediment enter the Catawba River from the Muddy Creek watershed under typical streamflow conditions. DWQ did not monitor Muddy Creek during this assessment cycle but did conduct benthic and fish community assessments on both its major tributaries, the North and South Fork Muddy Creeks. The benthic communities in each of these streams showed significant impacts, and habitat assessments showed signs of nutrient enrichment and sedimentation problems. Data compiled by the Muddy Creek Watershed Restoration Initiative (discussed later) confirms heavy suspended solids loads and fecal coliform contamination.

The City of Morganton uses the Catawba River as its primary drinking water source. Reductions in the sediment load from the Muddy Creek watershed will likely result in lower treatment costs for the city and significantly reduce the sediment loading to Lake Rhodhiss. Although Muddy Creek is not currently impaired, the impacts of nonpoint source pollution are clearly evident. Funding programs aimed at reducing nonpoint source pollution impacts should consider the Muddy Creek watershed a primary candidate for awards.

The NC Wildlife Resources Commission, Duke Power, Natural Resources Conservation Service, Trout Unlimited, Clean Water Management Trust Fund, National Fish and Wildlife Foundation, Western Piedmont Council of Governments, DWQ, McDowell County Soil and Water Conservation District, Burke County Department of Community Development, City of Morganton, and the Foothills Conservancy of NC are working together to reduce sediment loads in Muddy Creek. This initiative is forming partnerships among industry, resource and conservation agencies, local governments, and landowners to pursue sedimentation and water quality improvements in the Muddy Creek watershed. The ultimate goal is to improve fish habitat and water quality in the Catawba River and demonstrate the effectiveness of BMPs.

In 1999, the project partners began to implement a stream improvement project, conduct a Muddy Creek watershed assessment to determine the feasibility and cost of significant sediment improvement, and outreach and education through a newsletter and a brochure. Since 1999, the partners have restored over 8,000 feet of barren banks through natural channel design stream restoration and have reforested an additional 6,000 feet of riparian land that were devoid of riparian forest buffer. In addition, the partners have developed the Muddy Creek Watershed Restoration Plan, outlining the steps necessary to fully restore the watershed. All projects undertaken by the partnership are done collaboratively with willing landowners on a voluntary basis.

The Muddy Creek Watershed Restoration Plan outlines four areas of investment needed to complete the restoration and estimates that it will take an additional $17.5 million and a minimum of ten years to achieve that goal. DWQ endorses the Muddy Creek Watershed Restoration Plan and will assist the partners in any way possible to secure the resources necessary to implement their four-point strategy. The four areas of investment are as follows:

1. *Natural Channel Design Stream Restoration*
   The plan identifies six high priority stream reaches in the watershed totaling approximately 12,000 linear feet that would benefit from natural channel design stream restoration. These reaches contain 18 of the 26 highest priority barren bank sites identified during field inventories that were responsible for the highest sediment delivery estimates. Natural channel design stream restoration will likely consume $1.5-2.0 million of the benchmark cost estimate given above.

2. *Riparian Reforestation*
   The plan reveals approximately 32,000 feet of creek side land without riparian forest vegetation as first priorities for riparian reforestation projects. Three additional subwatersheds lack adequate riparian forest coverage on over 50 percent of their stream lengths. Riparian forest enhancement should extend to these drainage areas as well. Riparian reforestation of these inadequate buffer areas would likely consume $224,000 of the benchmark estimate.

3. *Livestock Exclusion*
   The plan prioritizes 15 livestock exclusion projects, which should eliminate an estimated 50-75 percent of the cattle access issues in the watershed. The partners would like to do more, but the variable livestock market makes prioritization unpredictable because grazing activities change year to year. These projects would likely consume $124,000 of the benchmark estimate.

4. *Riparian Forest Preservation*
   The plan also recognizes that gains made in these restoration strategies above will be nullified if intact upstream areas become degraded. Therefore, approximately 15,200 acres have been prioritized for riparian forest preservation. Most of this acreage is in large tract holdings and occurs at headwater areas and in subwatersheds whose riparian zones are currently forested and intact. The $15 million preservation estimate is a ballpark figure and would require purchase of conservation easements and donations of conservation easements to cover anticipated costs. Fee simple purchase agreements would likely increase that figure.

1.4.5 Canoe Creek [AU# 11-33-(1) and 11-33-(2)]

Current Status and 2004 Recommendations
Both the benthic macroinvertebrate and fish community in Canoe Creek at site B-19 were rated Good in 2002. However, DWQ biologists noted problems from siltation and nonpoint source pollution. These findings corroborate similar observations by local resource professionals and citizens. Further study should be conducted to determine water quality conditions and potential pollution sources. This creek would be a good candidate for assessment by local agencies or volunteer groups.

1.5 Additional Water Quality Issues within Subbasin 03-08-30

Although most streams in this subbasin are not Impaired by urban stormwater runoff, they are threatened in many areas (Linville River, Left Prong Catawba River, Corpening Creek) by development pressure from residential development. This is especially true with high value vacation and retirement properties such as those around Lake James. In order to prevent aquatic habitat degradation and Impaired biological communities, protection measures should be put in place immediately. Refer to Section A, Chapter 4, Part 4.11 for a description of stream water quality problems in developing areas and recommendations for reducing impacts and restoring water quality.

Section B - Chapter 2
Catawba River Subbasin 03-08-31
Lower Creek, Wilson Creek, Johns River and Lake Rhodhiss

2.1 Subbasin Overview

Subbasin 03-08-31 at a Glance

Land and Water Area

Total area:	581 mi^2
Land area:	578 mi^2
Water area:	3 mi^2

Population Statistics

2000 Est. Pop.:	90,041 people
Pop. Density:	160 persons/mi^2

Land Cover (percent)

Forest/Wetland:	85%
Surface Water:	1%
Urban:	3%
Agriculture:	11%

Counties

Avery, Burke, Caldwell and Watauga

Municipalities

Blowing Rock, Cajah Mountain, Cedar Rock, Connelly Springs, Drexel, Gamewell, Glen Alpine, Granite Falls, Lenoir, Morganton, Rhodhiss, Rutherford College, Sawmills and Valdese

This subbasin contains many headwater tributaries designated as HQW because they are native trout waters. Portions of this catchment, including Wilson Creek, are within the Pisgah National Forest and have received ORW designation. Wilson Creek itself recently received designation from the National Park Service as a Wild and Scenic River. The Johns River catchment contains high quality areas, but also has widespread agricultural land use and is threatened by residential development.

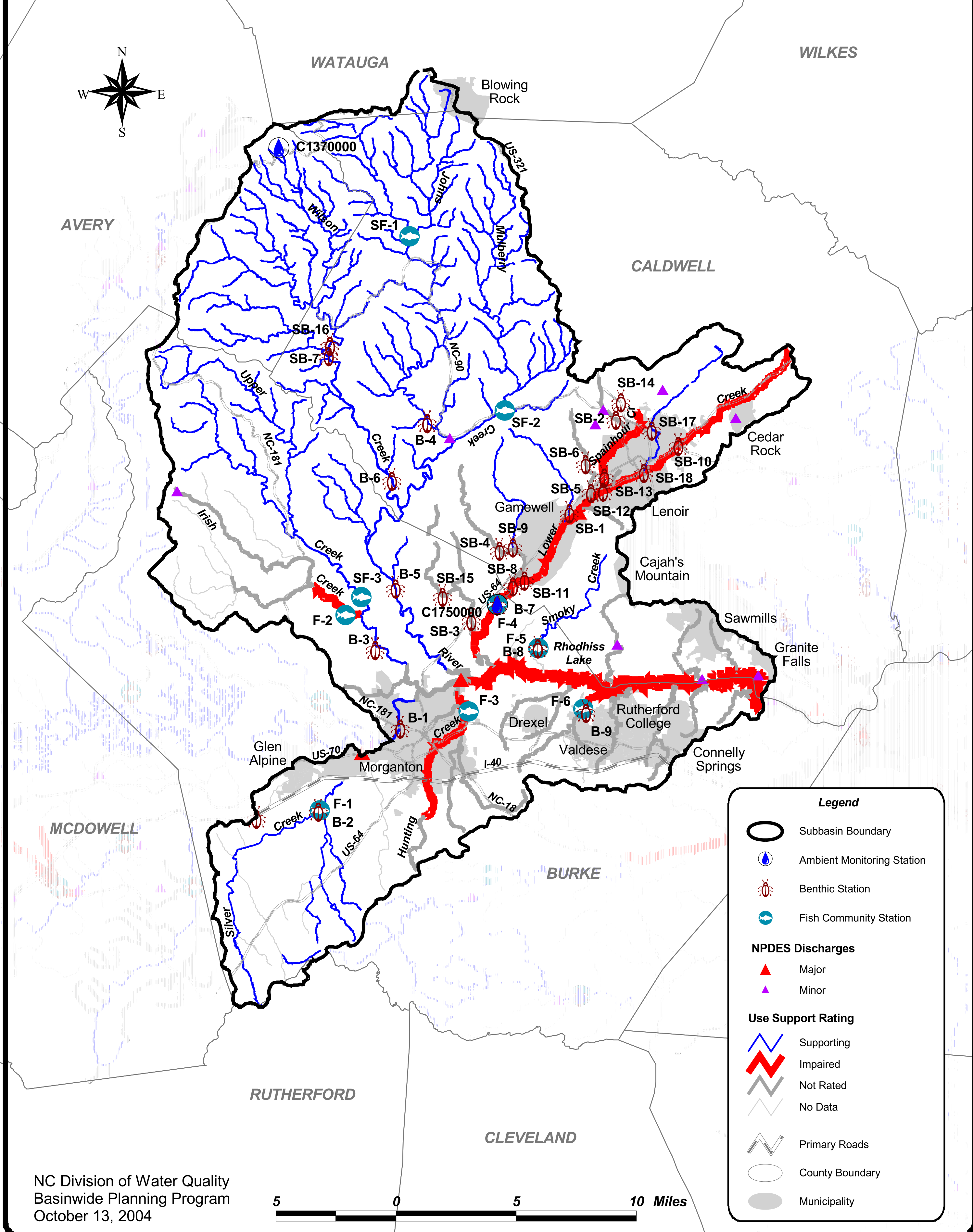
There were 32 benthic macroinvertebrate community samples and 15 fish community samples (Figure B-2 and Table B-3) collected during this assessment period. One site improved; five sites remained the same; two sites had a lower bioclassification, and 23 sites were sampled for the first time during this assessment period. Data were also collected from three ambient monitoring stations as well. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

The Burke County population is expected to increase by over 20 percent by the year 2020 (Table A-6). Urban development and runoff from Lenoir and Morganton have impacted several tributaries to the Catawba River in the southeastern portion of the subbasin.

There are three ambient monitoring sites in this subbasin: Lower Creek near Morganton, Wilson Creek near Gragg (a high elevation, headwater site), and Lake Rhodhiss. None of these sites represents typical water quality for this subbasin. Wilson Creek had many low pH measurements. This pattern had not been observed at this site since the early 1990s, and it suggested that similar low pH values may be occurring in other high elevation streams that drain forested catchments. Such areas have low buffering capacity and are most susceptible to acid precipitation.

Five facilities in this subbasin monitor effluent toxicity. The two largest municipal dischargers (Lenoir's WWTP, 6 MGD; and Morganton's WWTP, 8 MGD) have experienced occasional failures over the last ten years. Lenoir's facility failed about 25 percent of its self-monitoring

Figure B-2 Catawba River Subbasin 03-08-31



NC Division of Water Quality
Basinwide Planning Program
October 13, 2004

Table B-3 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-31

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area		Category	Data Type with Map Number and Data Results			Use Support Rating	
						Biological	Ambient	Other	2004	1998
Abingdon Creek	11-39-6	C	5.6	mi.	AL	SB-1 NI-02			S	-
Blair Fork	11-39-3-1	C	2.6	mi.	AL	SB-2 NR--02			NR	-
Bristol Creek	11-39-8	WS-IV	5.6	mi.	AL	SB-3 NR--02			NR	PS
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(32.7)	WS-IV	3.9	mi.	AL	B-1 GF--97 B-1 GF--02			S	FS
CATAWBA RIVER (Rhodhiss Lake below elevation 995)	11-(37)	WS-IV & B CA	1,848.5	ac.	AL		C2030000 ce	L-1 ce & Special Algal Studies ce	I	FS
Celia Creek	11-39-7-1-(2)	WS-IV	1.3	mi.	AL	SB-4 NR--02			NR	-
Gragg Prong	11-38-10	C Tr	4.0	mi.	AL	SF-1 E--98 SF-1 E--99			S	-
Greasy Creek	11-39-4	C	4.6	mi.	AL	SB-6 NR--02 SB-5 NR--02			NR	PS
Harper Creek	11-38-34-14	C Tr ORW	9.1	mi.	AL	SB-7 E--02			S	-
Hunting Creek	11-36-(0.7)	WS-IV	7.4	mi.	AL	F-3 F--02			I	-
Husband Creek	11-39-7-(1)	C	6.0	mi.	AL	SB-9 NI--02			S	ST
Irish Creek	11-35-3-(2)b	WS-III	3.0	mi.	AL	F-2 F--02			I	-
Johns River	11-38-(35.5)	WS-IV HQW	6.9	mi.	AL	B-5 G--02			S	-
Lower Creek	11-39-(0.5)a	C	8.8	mi.	AL	SB-10 P--02			I	ST
Lower Creek	11-39-(0.5)b	C	5.1	mi.	AL	SB-12 F--02			I	PS
Lower Creek	11-39-(6.5)	WS-IV	6.8	mi.	AL	B-7 F--02 F-4 GF--97 F4 GF--02 SB-11 F--02	C1750000 nce		I	PS
McGalliard Creek	11-44-(3)	WS-IV CA	3.9	mi.	AL	B-9 GF--97 B-9 G--02 F-6 G--97 F-6 F--03			I	ST
Mulberry Creek	11-38-32-(15)	C	5.4	mi.	AL	SF-2 E--99			S	FS

Table B-3 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-31

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results: Biological	Ambient	Other	Use Support Rating: 2004	1998
Silver Creek	11-34-(0.5)	C	15.4 mi.	AL	F-1 GF--97 F-1 GF--02 B-2 E--02			S	ST
Smoky Creek	11-41-(1)	WS-IV	7.5 mi.	AL	B-8 G--97 B-8 GF--02 F-5 E--02			S	FS
Spainhour Creek	11-39-3	C	4.7 mi.	AL	SB-12 F--02 SB-13 F--02			I	PS
Upper Creek	11-35-2-(13)	WS-III Tr HQW	4.3 mi.	AL	SF-3 E--99			S	FS
Warrior Fork	11-35-(1)	WS-III	4.9 mi.	AL	B-3 E--97 B-3 G--02			S	FS
White Mill Creek	11-39-8-1-(2)	WS-IV	3.4 mi.	AL	SB-15 NR--02			NR	-
Wilson Creek	11-38-34	B Tr ORW	23.3 mi.	AL	B-6 E--02	C1370000 nce		S	FS
Zacks Fork Creek	11-39-1	C	8.0 mi.	AL	SB-17 NI--02			S	PS
Lower Creek	11-39-(6.5)	WS-IV	6.8 mi.	REC		C1750000 ce		NR	-
Wilson Creek	11-38-34	B Tr ORW	23.3 mi.	REC		C1370000 nce		S	FS

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SF - Special Fish Community Study
SB - Special Benthic Community Study
A - Ambient Monitoring Site
L - Lakes Assessment

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
NR - Not Rated

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting, ST - supporting but threatened
PS - partially supporting, NS - not supporting
NR - not rated, N/A - not applicable

toxicity tests between 1992 and 1999, but has passed all tests since 2000. The last documented problem at Morganton's facility was in January 2002.

The site on Lower Creek reflected the influence of various point and nonpoint source problems with high turbidity, high fecal coliform bacteria concentrations, and elevated conductivity near the City of Lenoir. Samples from the site on Lake Rhodhiss often reflected algal bloom problems with elevated dissolved oxygen concentrations and pH values.

The Catawba River near the City of Morganton was rated Good-Fair in 1997 and 2002, based on benthic macroinvertebrate samplings. Some intolerant organisms were abundant at this site, but daily variations in flow, due to power generation at the upstream Lake James dam, affected the quality of the instream habitats. Many of the recently monitored streams that originate in the Pisgah National Forest had Good or Excellent water quality ratings based on either fish or macroinvertebrate data.

The middle portion of this subbasin has extensive areas used for the cultivation of ornamental shrubs and trees. While streams in this area usually still have good water quality, two sites have recently (2002) shown a decline from an Excellent to a Good bioclassification based on macroinvertebrate data: Warrior Fork and the lower section of the Johns River. It is not known if drought conditions contributed to this decline. A fish community sample from Irish Creek (a tributary of Warrior Fork) showed severe habitat problems and was rated Fair.

Where watersheds have become more developed around the cities of Morganton, Lenoir and Valdese, the stream bioclassifications were lower (Good-Fair or Fair). The physical characteristics of these streams have also changed. Lower, Silver, Hunting and McGalliard Creeks had lower gradients and were much sandier than streams in the northern part of the subbasin. McGalliard Creek showed a decline in bioclassification between 1997 and 2002, based on fish and macroinvertebrates. An intensive survey of the Lower Creek catchment in 2002 documented problems for many streams around Lenoir.

Waters in Parts 2.3 and 2.4 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 2.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 2.3 below. Supporting waters with noted water quality impacts are discussed in Part 2.4 below. Refer to Appendix III for use support methods and more information on all monitored waters.

2.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-31 were assigned for aquatic life, fish consumption, recreation and water supply. There is no fish consumption advice for waters in this subbasin;

therefore, all waters are rated No Data for Fish Consumption. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-4 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-4 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-31

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	119.6 mi	0	23.3 mi	0
Impaired	39.7 mi 1,848.5 ac	0	0	0
Not Rated	25.5 mi	0	6.8 mi	0
Total	**184.8 mi 1,848.5 ac**	**0**	**30.1 mi**	**0**
Unmonitored Waters				
Supporting	333.7 mi	0	0	241.9 mi 1,848.5 ac
Impaired	0.0 mi	0	0	0
Not Rated	102.1 mi	0	0	0
No Data	61.3 mi	682.0 mi 1,848.5 ac	651.9 mi. 1,848.5 ac.	0
Total	**497.1 mi**	**682.0 mi 1,848.5 ac**	**651.9 mi 1,848.5 ac**	**241.9 mi 1,848.5 ac**
Totals				
All Waters	**682.0 mi 1,848.5 ac**	**682.0 mi 1,848.5 ac**	**682.0 mi 1,848.5 ac**	**241.9 mi 1,848.5 ac**

Note: All waters includes monitored, evaluated and waters that were not assessed.

2.3 Status and Recommendations of Newly and Previously Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

2.3.1 Lower Creek Watershed Including:
Lower Creek [AU# 11-39-(0.5)a, 11-39-(0.5)b, 11-39-(6.5), and 11-39-(9)]
Zacks Fork Creek [AU#11-39-1]
Spainhour Creek [AU#11-39-3]
Greasy Creek [AU#11-39-4]
Bristol Creek [AU#11-39-8]
Husband Creek [AU#11-39-7-(1)]

The watershed of Lower Creek includes the City of Lenoir and drains the southwest portion of Caldwell County into the upper reaches of Lake Rhodhiss. 35.5 stream miles in the Lower Creek Watershed appear on the 2004 303(d) list.

1999 Recommendations
DWQ recommended that suggestions for improving water quality found in WPCOG Study (WPCOG, October 1998) be implemented in the Lower Creek watershed. The recommendations were grouped into two general areas: watershed protection and urban stormwater planning. DWQ noted that the key implementers of these recommendations, and others that may be developed in the future, are the local governments and citizens of the Lower Creek watershed.

WPCOG Study recommendations for watershed protection include:

1. Establish 50-foot buffers along streams in the Lower Creek watershed.
2. Within targeted subbasins, identify property owners interested in participating in nonpoint source demonstration projects.
3. Develop a strategy to raise awareness and educate the public about major pollution sources to Lower Creek.
4. Encourage bioengineered solutions for future projects to stabilize streambanks.
5. Establish a Lower Creek Nonpoint Source Team to assist in implementing recommendations and evaluate progress.

WPCOG Study recommendations for consideration by the local governments for urban stormwater include:

1. Adopt strategies and regulations to minimize new impervious surfaces.
2. Encourage use of curb cuts and reduce street curb and gutter systems.
3. Encourage cluster development or open space zoning near perennial streams.
4. Encourage treatment of "hot spots" including gas stations and trash storage and handling areas.
5. Label stormwater drains.
6. Participate in regional stormwater discussions.

Current Status and 2004 Recommendations
Based on data collected in this assessment period, approximately 20.7 miles of Lower Creek are now Impaired for aquatic life because of Fair and Poor bioclassifications all along the stream. This watershed also includes the entire length of Zacks Fork Creek (8.0 mi.), Spainhour Creek (4.7 mi.), Greasy Creek (4.6 mi.), Bristol Creek (5.6 mi.), and Husband Creek, (5.96 mi) all of which appear on the state’s 303(d) list. Current data indicate Husband Creek is not impaired and will be removed from the 303(d) list during the 2006 revision.

DWQ is in the process of developing a TMDL to address turbidity violations in Lower Creek. In 2002, DWQ conducted an intensive study of the Lower Creek watershed to provide data and information for future TMDL development. The study clearly demonstrated the effects of poor land use practices, showing negative impacts to the biological community at all of the 17 sample sites included in the study. The study also indicated the absence of severe nutrient or organic enrichment, or toxic conditions. The study did note severe streambank erosion and nonexistent or inadequate riparian buffers at many sites. Zacks Fork Creek, Greasy Creek and Bristol Creek were too small to rate using standard evaluation techniques, and thus, were rated either Not Impaired (Upper Zacks Fork Creek) or Not Rated (Lower Zacks Fork, Greasy and Bristol Creeks). For a description of Use Support Methodology, refer to Appendix III. Despite methodology restrictions, the variability in stream integrity seen within the watershed points to the conclusion that overall, streams draining urban areas seem to be the most severely impacted.

In 2003, the EEP initiated a Local Watershed Plan for the Lower Creek watershed in Burke and Caldwell counties. The EEP will use the watershed plan to identify and prioritize wetland and stream restoration projects as well as best management practices to provide water quality and aquatic habitat improvements to the watershed. The watershed characterization, or compilation of existing data about watershed conditions, was completed in December 2003. The detailed watershed assessment including water quality monitoring, field assessment and a restoration plan is scheduled for completion by June 2005. The EEP will coordinate with local community groups, local governments and others to develop and implement the restoration plan. For more information about the Lower Creek Local Watershed Plan, contact Kristin Cozza of EEP at (704) 572-0955.

Until actions are taken to reduce urban stormwater runoff, it is reasonable to assume that stream integrity in the Lower Creek watershed will continue to remain fair at best, or decline. Stream restoration and watershed protection efforts should be coordinated with management strategies developed for Lake Rhodhiss. Please refer to Section A, Chapter 4, Part 4.11 for information on Low Impact Development and other techniques to minimize the impacts of stormwater runoff. More information on Lake Rhodhiss can be found below and Section A, Chapter 4, Part 4.7.2.

2.3.2 Lake Rhodhiss [AU# 11-(37)]

Current Status and 2004 Recommendations

Lake Rhodhiss is operated by Duke Power and is formed by the discharge of Lake James into the Catawba River, the Mud and Lower Creek watersheds, and by the Johns River. The lake was filled when the construction of the Rhodhiss Hydroelectric Station was completed in 1925. Lake Rhodhiss is a relatively small and narrow lake located between Lake James and Lake Hickory on the Catawba River. Three-fourths of the land in the watershed is forested, but the watershed is under increasing pressure from development. The waters of the lake are used for water supply by several municipalities, recreational purposes and hydropower generation. Algal blooms, taste and odor problems, violation of the pH standard, and percent dissolved oxygen saturation values above 120 percent indicate the reservoir (1,848.5 acres) suffers from eutrophication and is Impaired in its support of aquatic life.

Rhodhiss Lake has been sampled by DWQ since 1981. This lake is usually eutrophic although it was evaluated as mesotrophic in 1989 and 1997. Although there were high nutrient concentrations, algal blooms were often limited by the reservoir's short retention time. Drought conditions increased retention times, and blooms of nuisance algae (especially blue-greens) were recorded in 2001 and 2002. The presence of algae, which creates taste and odor problems in treated drinking water, made it necessary for water treatment plants to use activated charcoal to make the water drinkable. Nutrient reductions may help to alleviate these problems.

In 1999, after reviewing the results of a water quality modeling effort by the WPCOG (Jaynes, 1994; and Giorgino et al., 1997), DWQ committed to developing a watershed management strategy for controlling nutrient inputs to the reservoir.

The water quality in Lake Rhodhiss has a dramatic impact on downstream conditions in Lake Hickory. The intimate link between these two reservoirs was made more evident by the continuance of taste and odor issues in Lake Hickory during the summer of 2002 until the algal populations died back in Lake Rhodhiss. This close relationship supports DWQ's conclusion that a regional watershed management plan, encompassing the drainages of both Lake Hickory and Lake Rhodhiss, must be developed to address the water quality concerns in each reservoir. Because such a strategy would be applied across multiple subbasins, please refer to Section A, Chapter 4, Part 4.7.2 for a detailed discussion.

2.3.3 McGalliard Creek [AU# 11-44-(3)]

Current Status and 2004 Recommendations
The watershed of McGalliard Creek drains an area dissected by Interstate 40, US 64/70, and includes the Town of Valdese. The stream is also a tributary to Lake Rhodhiss and hosts a dramatic waterfall approximately 40 feet high. The Town of Valdese maintains a popular city park at the waterfall and hosts an annual family fishing tournament each June. About 1,200 trout are stocked in the waters above the falls for each tournament, but due to poor habitat conditions the fish do not survive long enough to reproduce. There are no NPDES dischargers in this watershed, but elevated conductivity measurements indicate impacts from urban runoff. A windshield survey conducted by DWQ in 2003 revealed most of the land in the watershed is established residential neighborhoods. Many lots lack sufficient riparian vegetation to restrict sediment and nutrient runoff during construction and from lawns. Declining fish bioclassifications at site F-6 have led to aquatic life Impairment in the 3.9-mile stream segment from McGalliard Falls to Lake Rhodhiss. The headwaters of McGalliard Creek are Not Rated.

The potential for McGalliard Creek to support a diverse aquatic population is high, but physical barriers to natural recolonization, like the waterfall and Lake Rhodhiss, make it unlikely without human intervention. Given the stable nature of land use in the watershed, DWQ encourages private property owners to install landscaping that reduces the amount of sediment and nutrient runoff entering the creek. Additionally, the Town of Valdese, through its Recreation Department, should consider implementing a habitat restoration project in the creek above the falls to increase the potential for stocked trout survival and enhance the visual appeal of the park. Finally, McGalliard Creek should be evaluated in any nutrient/sediment management plan developed for Lake Rhodhiss.

2.3.4 Irish Creek [AU# 11-35-3-(2)b]

Current Status and 2004 Recommendations
The fish community in Irish Creek was sampled for the first time in 2002. Draining central Burke County, Irish and Upper Creeks join to form Warrior Fork, a tributary to the Catawba River north of the City of Morganton. The valleys in this area of Burke County are used extensively for nursery tree propagation. Consequently, the stream's instream and riparian habitats suffer. The fish community was rated Fair at site F-2. Resampling in 2003 also resulted in a Fair bioclassification, confirming the 2002 results. Thus, aquatic life is Impaired in this 3.0-mile segment from Roses Creek to Warrior Fork.

Given that a significant portion of land in this subbasin is dedicated to nursery tree propagation, there are excellent opportunities for the implementation of agriculture BMPs. DWQ will assist local groups with project development in cooperation with local landowners and the regional Soil and Water Conservation District to install and maintain BMPs. Additionally, Irish Creek should be evaluated in any nutrient/sediment management plan developed for Lake Rhodhiss.

2.3.5 Harper Creek [AU# 11-38-34-14]

Current Status and 2004 Recommendations
Harper Creek lies within Pisgah National Forest, northeast of Gamewell. All nine miles of Harper Creek appear on the state's 303(d) list because of a historical listing for sediment.

DWQ sampled Harper Creek in 2002 (site SB-7) and determined that the benthic community was in Excellent condition. This suggests that either the stream was incorrectly listed as Impaired or the circumstances causing the reported sediment loads have since been abated. In either case, the Excellent bioclassification indicates Harper Creek is not Impaired and will be removed from the 303(d) list in 2006.

2.3.6 Hunting Creek [AU# 11-36-(0.7)]

Current Status and 2004 Recommendations
The fish community in Hunting Creek was sampled for the first time in 2002 and received a Fair bioclassification at site F-3. It is therefore Impaired. Resampling in 2003 also resulted in a Fair bioclassification, confirming the 2002 results. This 7.4-mile segment (1 mile upstream of SR 1940 to 0.4 mile downstream of Pee Dee Branch) of urban stream drains the southern and southeastern areas of the City of Morganton in central Burke County. There are no NPDES facilities in the watershed. Much like Irish Creek, the instream and riparian habitats suffer due to the urbanization of the watershed. The stream is a tributary to the Catawba River just above Lake Rhodhiss.

As the Town of Morganton implements Phase II stormwater regulations, DWQ suggests it take measures to reduce urban stormwater impacts to the stream and advocates the use of LID and stormwater BMPs as outlined in Section A, Chapter 4, Part 4.11. Additionally, Hunting Creek should be evaluated in any nutrient/sediment management plan developed for Lake Rhodhiss (see Section A, Chapter 4, Part 4.7.2).

2.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

2.4.1 Johns River [AU# 11-38-(1), 11-38-(9), 11-38-(28), 11-38-(34.5), 11-38-(35.5), and 11- 38-(36.5)]

Current Status and 2004 Recommendations
The Johns River originates in the Pisgah National Forest on the south side of the Grandfather Mountain drainage basin and flows southward to Collettsville. Just north of the Caldwell-Burke county line, Wilson Creek joins the Johns River, significantly increasing the flow. The Johns River then flows southward to the Catawba River at essentially the beginning of Lake Rhodhiss, just northeast of Morganton. The entire reach is 23.8 miles long.

The Johns River has historically received an Excellent bioclassification; but in 2002, the lower reach had declined by one bioclassification to Good at site B-5 and showed signs of nutrient enrichment, including excessive growth of filamentous algae and aquatic macrophytes. It is DWQ's recommendation that immediate action be taken to protect the remaining intact riparian forests in the upper reaches of the Johns River watershed and to implement agriculture BMPs in the areas where intensive agriculture is currently underway or likely to expand. Such actions could arrest the declining water quality in the lower Johns River watershed and insure good quality water well into the future.

Crescent Resources, a major landholder in the Johns River watershed, proposed just such a plan in 1997 (Crescent Resources, Inc., 1997). The plan would have protected over 2,000 acres by restoring, enhancing and preserving former and existing riparian and wetland habitats. Although this particular plan proved ultimately unsuccessful, it outlined a basic strategy that could still result in effective protection for the Johns River. It is DWQ's intent to pursue negotiations with multiple stakeholders (Crescent Resources, WRC, FWS, etc.) during the next basinwide cycle that would permanently protect natural habitat in the Johns River watershed. WRC is actively pursuing funding opportunities that would be used to protect riparian habitat in the watershed. DWQ supports that pursuit and will assist where possible.

2.4.2 Silver Creek [AU# 11-34-(0.5)]

Current Status and 2004 Recommendations
There are two sample sites on Silver Creek that are used to evaluate fish and benthic macroinvertebrate populations. The benthic site (B-2) has consistently produced Good-Fair results since 1992. The fish site (F-1), new this assessment period, produced an Excellent rating. These apparently contradictory results and concerns about pollution in this creek by local citizens suggest the need for further investigation into water quality conditions and potential

pollution sources is necessary. This creek would be a good candidate for assessment by local agencies or volunteer groups.

2.4.3 Catawba River [AU# 11-(32.7)]

Current Status and 2004 Recommendations

This reach of the Catawba River passes near the center of Morganton and is heavily influenced by the releases from Bridgewater Dam at Lake James. DWQ biologists noted a decline in the biological community between site B-15 at Glen Alpine and site B-1 at NC 181. This may be the result of urban runoff entering through Silver Creek, Canoe Creek and along the banks of the mainstem. Negotiations during the FERC relicensing process (Section A, Chapter 4, Part 4.7.1) should result in more consistent flows that may help establish more robust benthic communities. Additionally, this segment should be evaluated in any nutrient/sediment management plan developed for Lake Rhodhiss (see Section A, Chapter 4, Part 4.7.2).

Section B - Chapter 3
Catawba River Subbasin 03-08-32
Lower, Middle and Upper Little Rivers, Lake Hickory, Lookout Shoals Lake and Lake Norman

3.1 Subbasin Overview

Subbasin 03-08-32 at a Glance

Land and Water Area

Total area:	706 mi²
Land area:	647 mi²
Water area:	59 mi²

Population Statistics

2000 Est. Pop.: 180,804 people
Pop. Density: 257 persons/mi²

Land Cover (percent)

Forest/Wetland:	57%
Surface Water:	9%
Urban:	3%
Agriculture:	34%

Counties

Alexander, Burke, Caldwell, Catawba, Iredell, Lincoln and Mecklenburg

Municipalities

Cajah Mountain, Catawba, Claremont, Connelly Springs, Conover, Cornelius, Davidson, Granite Falls, Hickory, Hildebran, Hudson, Huntersville, Lenoir, Long View, Mooresville, Newton, Rhodhiss, Sawmills, Taylorsville and Troutman

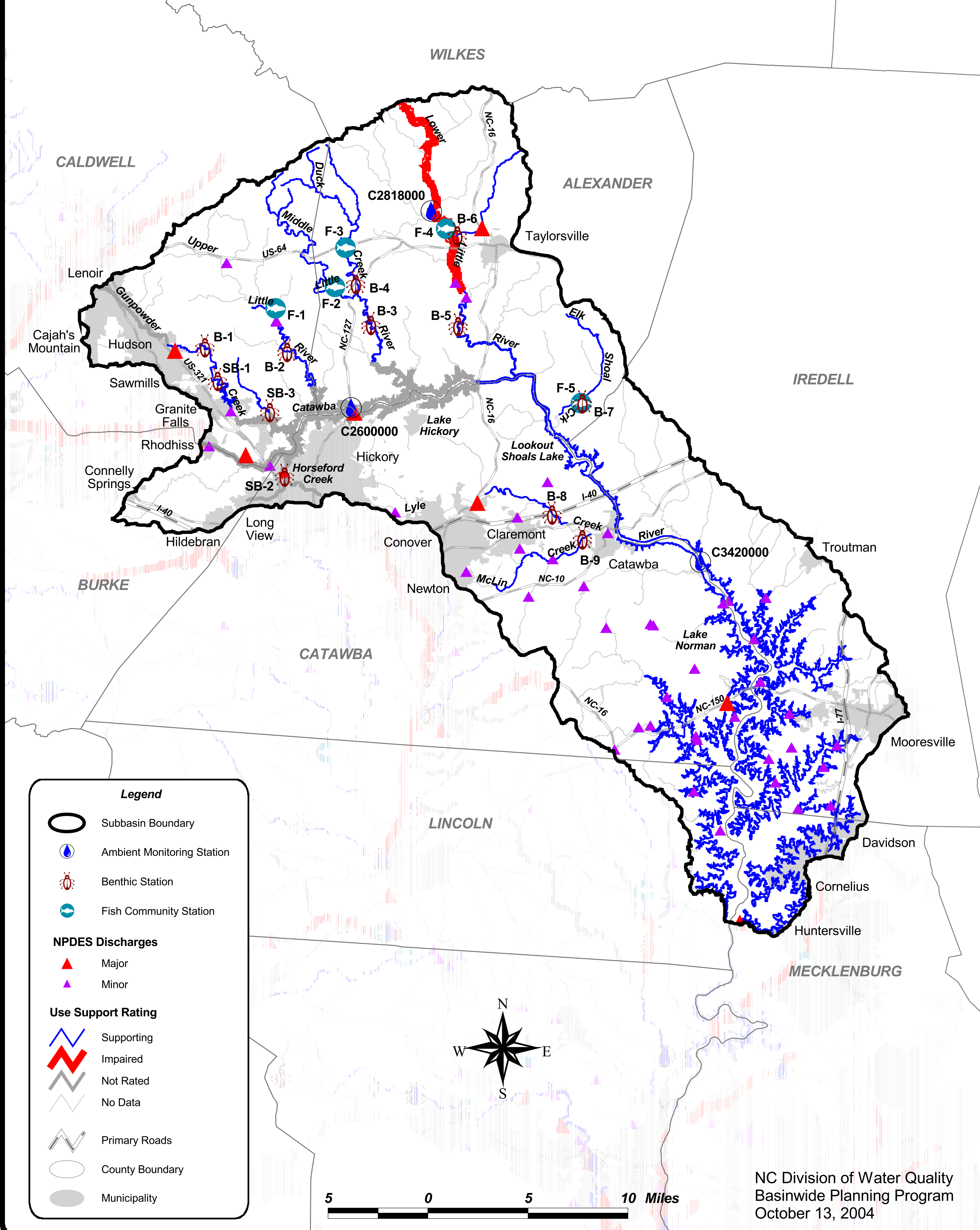
This subbasin is located in the Northern Inner Piedmont and Southern Outer Piedmont ecoregions with the extreme northwestern headwaters of several streams in the Eastern Blue Ridge Foothills ecoregion. The southeastern portion of this subbasin (east of the Lower Little River and south of the Catawba River) is flatter and more characteristic of Piedmont areas than the northern section.

Highly erodible soils and moderate gradients contribute large amounts of sediment in the Little River watershed. However, a majority of the subbasin remains forested. Major reservoirs in this subbasin include Lakes Hickory and Norman and Lookout Shoals Lake. Because of these impoundments, a greater percentage of this subbasin is classified as a water supply watershed than any of the other subbasins, highlighting the increased pressure placed on the resource by ever expanding populations. In fact, the populations of Alexander, Catawba, Iredell, Lincoln and Mecklenburg counties are all expected to increase by over 20 percent by the year 2020 (Table A-6).

There were 24 benthic macroinvertebrate community samples and 13 fish community samples (Figure B-3 and Table B-5) collected during this assessment period. Two sites improved; 12 sites remained the same; two sites had a lower bioclassification, and three sites were sampled for the first time during this assessment period. Data were also collected from three ambient monitoring stations as well. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

Sixteen facilities monitor effluent toxicity, some having multiple discharges. Four dischargers had problems with toxicity, although three were very small dischargers with a permitted flow less than 0.02 MGD. This group of discharges was associated with either groundwater remediation or contact cooling water.

Figure B-3 Catawba River Subbasin 03-08-32



NC Division of Water Quality
Basinwide Planning Program
October 13, 2004

Table B-5 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-32

Waterbody	Assessment	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(51)	WS-IV & B CA	263.1 ac.	AL		C2600000 nce	L-1 ce	NR	FS
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(53)	WS-IV & B CA	1,232.8 ac.	AL		C2600000 nce	L-1 ce	NR	FS
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(59.5)	WS-V & B	2,093.6 ac.	AL		C2600000 nce	L-1 ce	NR	FS
CATAWBA RIVER (Lake Norman below elevation 760)	11-(74)	WS-IV CA	265.3 ac.	AL		C3420000 nce	L-3 nce	S	FS
CATAWBA RIVER (Lake Norman below elevation 760)	11-(75)	WS-IV & B CA	31,331.6 ac.	AL		C3420000 nce	L-3 nce	S	FS
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(67)	WS-IV	182.7 ac.	AL			L-2 nce	S	FS
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(68.5)	WS-IV CA	95.4 ac.	AL			L-2 nce	S	FS
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(72)	WS-IV & B CA	577.8 ac.	AL			L-2 nce	S	FS
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(73.5)	WS-IV & B CA	175.4 ac.	AL			L-2 nce	S	FS
Duck Creek	11-62-2-(4)	C	4.4 mi.	AL	B-4 GF--97 B-4 G--02 F-3 G--02			S	ST

Table B-5 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-32

Waterbody	Assessment	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results: Biological	Ambient	Other	Use Support Rating: 2004	1998
Elk Shoal Creek (East Side)	11-73-(0.5)	WS-IV	7.8 mi.	AL	B-7 GF--97 B-7 GF--02 F--5 E--97 F-5 G--02			S	ST
Gunpowder Creek (Old Mill Pond)	11-55-(1.5)	WS-IV	13.4 mi.	AL	B-1 GF--97 B-1 GF--02			S	ST
Horseford Creek	11-54-(0.5)	WS-IV	0.4 mi.	AL	SB-2 P--02			I	-
Lower Little River	11-69-(0.5)	C	14.0 mi.	AL	F-4 G--97 F-4 F--02	C2818000 nce		I	FS
Lower Little River	11-69-(5.5)	WS-IV	8.6 mi.	AL	B-5 G--97 B-5 GF--02			S	FS
Lyle Creek	11-76-(3.5)	WS-IV	6.3 mi.	AL	B-8 GF--97 B-8 GF--02			S	FS
McLin Creek	11-76-5-(3)	WS-IV CA	0.7 mi.	AL	B-9 GF--97 B-9 GF--02			S	FS
Middle Little River	11-62	C	21.5 mi.	AL	B-3 GF--97 B-3 F--02 B-3 GF--03 F-2 G--97 F-2 E--02			S	ST
Muddy Fork	11-69-4	C	6.8 mi.	AL	B-6 GF--97 B-6 F--02 B-6 GF--03			S	ST
Silver Creek	11-56-(2)	WS-IV CA	0.8 mi.	AL	SB-3 GF--02			S	-
Upper Little River (Cedar Creek)	11-58-(5.5)	WS-IV	9.8 mi.	AL	B-2 G--97 B-2 G--02 F-1 GF--97 F-1 GF--02			S	FS
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(53)	WS-V & B	1,232.8 ac.	REC		C2600000 nce		S	-

Table B-5 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-32

Waterbody	Assessment	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(59.5)	WS-V & B	2,093.6 ac.	REC		C2600000 nce		S	-
CATAWBA RIVER (Lake Norman below elevation 760)	11-(74)	WS-IV CA	265.3 ac.	REC		C3420000 nce		S	-
CATAWBA RIVER (Lake Norman below elevation 760)	11-(75)	WS-IV & B CA	31,331.6 ac.	REC		C3420000 nce		S	-
Lower Little River	11-69-(0.5)	C	14.0 mi.	REC		C2818000 ce		NR	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SB - Special Benthic Community Study
L - Lakes Assessment

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting, ST - supporting but threatened
PS - partially supporting, NS - not supporting
NR - not rated, N/A - not applicable

There are three ambient monitoring sites in this subbasin: two on Lakes Hickory and Norman, and one on the Lower Little River. There were few unusual measurements at the two lake sites, although high algal production sometimes produced high dissolved oxygen concentrations and pH readings. Elevated fecal coliform bacteria concentrations and high turbidity levels were noted on the Lower Little River after rainfall events.

Recent biological data produced Good or Good-Fair bioclassifications for most monitored streams in this subbasin. However, a Fair bioclassification was recorded for a section of Middle Little River and for Muddy Fork. Fish data also produced a Fair bioclassification for a section of the Lower Little River. The Fair bioclassification for the Middle Little River seemed to be due to low flow in 2002 and did not indicate a significant water quality problem. This finding was reinforced by the Excellent fish community bioclassification given to the river. Muddy Fork, however, showed signs of organic loading from nearby animal operations. The cause of the Fair bioclassification for the headwaters of the Lower Little River (above the Town of Taylorsville WWTP) was unknown, although a sand-dipping operation was noted just above the sampling reach.

Based upon benthic macroinvertebrate data, water quality was fairly stable in this subbasin. The majority of the between-year changes in bioclassification were associated with between-year changes in flow. These changes fell into three categories:

1. Streams where drought conditions resulted in loss of flow. These streams showed a decline during the extreme drought. Example: Middle Little River.
2. Streams which maintained flow under drought conditions and were influenced mainly by nonpoint source pollution. These streams improved under drought conditions due to a reduction in nonpoint source runoff. Example: Duck Creek.
3. Streams influenced by point source dischargers. These streams declined under drought conditions due to higher instream waste concentrations. Example: the downstream segment of the Lower Little River below the Town of Taylorsville.

Lake Hickory has been sampled by DWQ since 1981. This reservoir was consistently evaluated as eutrophic based on summer samples from 1981 to 1992. Since then, however, the reservoir has been most frequently evaluated as mesotrophic. High productivity was indicated in August 2002, but no visible algal blooms were observed.

Lookout Shoals Lake is a small run-of-the-river lake with a retention time of only nine days. It has been sampled by DWQ since 1981, and the trophic state has fluctuated from oligotrophic to eutrophic depending on the nutrient loading and flow conditions. The reservoir's water quality is thought to be more reflective of releases from upstream impoundments than conditions in the immediate, surrounding watershed.

Lake Norman is the largest of the Catawba River reservoirs. It has been monitored by Duke Power since the 1970s, and DWQ has sampled the reservoir since 1981. This reservoir has consistently been evaluated as oligotrophic with low nutrient values and low algal production.

A nuisance aquatic plant, *Myriophyllum aquaticum*, infested the upper ends of Lake Hickory and Lookout Shoals Lake. This plant can interfere with recreational and industrial uses of the lakes.

Lookout Shoals Lake was drawn down in the fall of 2002 in an attempt to control the spread of this plant.

Hydrilla, another nuisance aquatic plant, was found in Lake Norman. This macrophyte is invasive, can decrease fish habitat, and can impact recreational activities such as swimming and boating. It also has the potential of clogging intakes of water treatment plants. In an effort to manage its growth, Duke Power is treating the infestation with herbicide.

Waters in Parts 3.3 and 3.4 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 3.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 3.3 below. Supporting waters with noted water quality impacts are discussed in Part 3.4 below. Refer to Appendix III for use support methods and more information on all monitored waters.

3.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-32 were assigned for aquatic life, fish consumption, recreation and water supply. There is no fish consumption advice for waters in this subbasin; therefore, all waters are rated No Data for Fish Consumption. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-6 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-6 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-32

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	101.4 mi 32,628.1 ac	0	34,923.2 ac	0
Impaired	14.5 mi	0	0	0
Not Rated	0.7 mi 3,589.4 ac	0	14.0 mi	0
Total	**116.6 ac 36,217.5 ac**	**0**	**14.0 mi 34,923.2 ac**	**0**
Unmonitored Waters				
Supporting	10.4 mi	0	0	260.8 mi 36,217.5 ac
Impaired	0	0	0	0
Not Rated	10.6 mi	0	0	0
No Data	315.6 mi	453.2 mi 36,217.5 ac	439.1 mi. 1,294.3 ac.	0
Total	**336.6 mi**	**453.2 mi 36,217.5 ac**	**439.1 mi 1,294.3 ac**	**260.8 mi 36,217.5 ac**
Totals				
All Waters	**453.2 mi 36,217.5 ac**	**453.2 mi 36,217.5 ac**	**453.2 mi 36,217.5 ac**	**260.8 mi 36,217.5 ac**

Note: All waters include monitored, evaluated and waters that were not assessed.

3.3 Status and Recommendations of Newly and Previously Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

3.3.1 Horseford Creek [AU# 11-54-(0.5) and 11-54-(3)]

Current Status and 2004 Recommendations

Horseford Creek is a tributary to Lake Hickory. It is formed from the confluence of Frye and Cripple Creeks, which both originate in the City of Hickory. The drainage area of Horseford Creek is fairly small (4.7 mi^2); the watershed is 100 percent urban, and there are no NPDES dischargers. In response to a citizen complaint, a benthic macroinvertebrate sample (site SB-2) was collected in September 2002 from Horseford Creek in the City of Hickory. This stream had good habitat, but water quality problems associated with urban runoff produced a Poor bioclassification. Therefore, the 1.1 mile segment from Frye Creek to Lake Hickory is Impaired for aquatic life.

This unusual combination of good habitat and poor biological integrity suggests that even favorable instream habitat cannot compensate for the toxic effects of poorly controlled urban runoff. Local citizen groups should cooperate with city officials and local business leaders to develop a plan for reducing the impacts of urban runoff. Please refer to Section A, Chapter 4, Part 4.11 for information on ways to reduce those impacts.

3.3.2 Lower Little River [AU# 11-69-(0.5)]

Current Status and 2004 Recommendations
This stream's watershed drains the northeast portion of the Brushy Mountains and northwestern Alexander County, northwest of the Town of Taylorsville. It is a tributary to Lookout Shoals Reservoir. In 2002, a new sand dipping operation was functional above the sampling reach. Additionally, resource agency staff has noted significant sediment deposits at the mouth of the Lower Little River where it enters the Catawba River/Lookout Shoals Lake headwaters.

A precipitous bioclassification decline from Good to Fair occurred at fish community site F-4. Therefore, aquatic life is Impaired in this 14.0-mile reach from its source to Stirewalt Creek. A less severe decline was also documented downstream in the benthic community at site B-5. This site declined from Good to Good-Fair between 1997 and 2002. Further investigations into the major sources of sediment in this watershed should be conducted in order to find opportunities for sediment control BMP installations. Opportunities for cooperation between local and county planners should also be pursued to expedite the implementation of such BMPs.

3.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

3.4.1 Lake Hickory [AU# 11-(51), 11-(53), and 11-(59.5)]

Current Status and 2004 Recommendations
Lake Hickory is a run-of-river impoundment located between Lake Rhodhiss and Lookout Shoals Lake on the Catawba River. The lake was filled in 1928 and is operated by Duke Power. Approximately one-half of the drainage area is forested and another one-third is agricultural. The major tributaries into Lake Hickory are the Catawba River, Middle Little River and Gunpowder Creek. The waters of the lake are used to generate hydroelectric power, for public water supply, and for recreational purposes. Lake Hickory is classified from the Rhodhiss Dam to the US Highway 321 bridge on the Catawba River as WS-IV B CA, and from the US Highway 321 bridge to Oxford Dam as WS-V and Class B. There are several municipal wastewater dischargers located in the reservoir's immediate watershed. These discharges, as

well as nonpoint source pollution, have contributed to the eutrophic conditions observed over the years. Because of algal blooms, taste and odor problems, and dissolved oxygen percent saturation values greater than 120 percent, aquatic life use support in Lake Hickory (3,589 acres) is Not Rated.

The water quality in Lake Hickory is driven by a variety of stressors including runoff from rural and urban areas, NPDES discharges, and perhaps most notably, the discharge from Lake Rhodhiss. The intimate link between these two reservoirs was made more evident by the continuance of taste and odor issues in Lake Hickory during the summer of 2002 until the algal populations died back in Lake Rhodhiss. This close relationship leads DWQ to the conclusion that a regional watershed management plan, encompassing the drainages of both Lake Hickory and Lake Rhodhiss, must be developed to address the water quality concerns in each reservoir. Because such a strategy would be applied across multiple subbasins, please refer to Section A, Chapter 4, Part 4.7.2 for more information on a regional watershed plan.

3.4.2 Muddy Fork [AU# 11-69-4]

Current Status and 2004 Recommendations
Muddy Fork originates in north central Alexander County and is a tributary to the Lower Little River. Muddy Fork is currently rated as Supporting, but has very poor habitat, generally lacking riffles and pools. The immediate riparian zones are used for cattle grazing and cattle have direct access to this 6.8-mile stream. A major industrial discharger has an outflow several miles above the sample site. The stream received a Good-Fair bioclassification in 1997, a Fair in 2002, and Good-Fair again in 2003 during a resample effort. Problems seem to be caused by organic loading, possibly from cattle wastes. DWQ recommends Muddy Fork be considered for installation of agriculture BMPs, including cattle exclusion fencing.

3.4.3 Middle Little River [AU# 11-62]

Current Status and 2004 Recommendations
The watershed of the Middle Little River drains western Alexander and eastern Caldwell counties, including the southwest portion of the Brushy Mountains. Site B-3 has shown a steady decline in bioclassification over the past 10 years: Good in 1992, Good-Fair in 1997, and Fair in 2002. A resample to verify the Fair rating resulted in a Good-Fair bioclassification. Therefore, this stream continues to be rated Supporting, although it demonstrates significant habitat degradation. It is likely that these impacts are the result of poor land use practices. DWQ will continue to monitor this stream and recommends further work be done to determine the cause of habitat degradation in this stream.

3.4.4 Gunpowder Creek [AU# 11-55-(0.5) and 11-55-(1.5)]

Current Status and 2004 Recommendations
Gunpowder Creek drains the southeastern portion of the City of Lenoir before passing through Granite Falls and emptying into Lake Hickory. The City of Lenoir operates a wastewater treatment plant on this 13.4-mile long creek. The stream is currently Supporting its designated use with a Good-Fair bioclassification at site SB-1 in both 1997 and 2002. However, heavy sedimentation has resulted in habitat degradation. DWQ will continue to monitor this stream and recommends further work be done to determine the cause of habitat degradation in this stream.

3.4.5 Lookout Shoals Lake [AU# 11-(72) and 11-(73.5)]

Current Status and 2004 Recommendations

Lookout Shoals Lake, situated between Lakes Hickory and Norman, is one of the smaller impoundments on the Catawba River. The lake is operated by Duke Power and is used for hydropower generation, public water supply, and public recreation. The lake's water quality is more reflective of releases from upstream impoundments (Lake Hickory and Lake Rhodhiss) than conditions in the immediate watershed. It is, therefore, likely that effective management in the Lake Rhodhiss and Lake Hickory watersheds coupled with tailwater management by Duke Power will help prevent water quality degradation in Lookout Shoals Lake. Please refer to Section A, Chapter 4, Part 4.7.2 for more information on a regional watershed plan.

In 2002, the upper end of the lake was infested with *Myriophyllum aquaticum*, the same species that is thriving in Lake Hickory. To control the spread of Parrot Feather, Duke Power drew down the water level to a target of 20 feet below full pool in November 2002. But due to rainfall in December, the water level rose to 14.3 feet below full pool in early January 2003. The pool level was brought to its normal operation level of three feet below full pool by February 2003 to accommodate annual fish spawning. Thus, the efficacy of the drawdown will probably be minor.

Duke Power, along with stakeholders and DWQ, will continue to develop and implement a Parrot Feather management program for the reservoir (see Section A, Chapter 4, Part 4.7.4).

3.4.6 Lake Norman [AU# 11-(74) and 11-(75)]

Current Status and 2004 Recommendations

Lake Norman, the state's largest man-made reservoir, is located between Lookout Shoals and Mountain Island Lakes on the Catawba River. The lake is operated by Duke Power and is used to generate hydroelectric power at Cowans Ford Dam and for multiple purposes at the Marshall Steam Station and the McGuire Nuclear Plant. The lake is also used for public water supply and recreation.

In 1999, approximately 25 acres of *Hydrilla* were discovered in the reservoir by Duke Power staff. This invasive macrophyte has the potential for rapid growth with the subsequent loss of swimming and boating areas. It also has the potential to clog intakes of water treatment and power generation plants. A survey conducted in October 2002 by Duke Power staff found *Hydrilla* as far upstream as the NC 150 bridge. There is also the potential for Parrot Feather, *Myriophyllum aquaticum*, to become established in Lake Norman via introduction from contaminated boat trailers or from plant fragments floating downstream from Lookout Shoals Lake. The occurrence of *Hydrilla* and the potential for Parrot Feather infestation pose an immediate threat to recreation, water supply use, and power generation uses in the lake.

The area around Lake Norman is also experiencing the inevitable water quality impacts associated with rapid development and increased recreational use. Elevated dissolved oxygen levels, elevated nutrient and metal levels, and boating congestion have all been noted on the lake (NCDENR-DWQ, June 2003). Lake Norman's massive volume has allowed the lake to absorb these human induced impacts and maintain reasonable water quality. But ultimately, the increased demands on the lake's aquatic resources could overwhelm its ability to accommodate them, resulting in declining water quality. Now is the time to implement management strategies that will offset the impacts of development and possibly avoid critical water quality situations as seen on other lakes in the Catawba River Chain Lakes and in other river basins (see Section A, Chapter 4, Part 4.7).

Over the next basinwide planning cycle, DWQ will look for opportunities to develop appropriate and cost-effective management strategies. Please refer to the sections on Urbanization, FERC Relicensing, and Local Involvement (Section A, Chapter 4, Parts 4.7 and 4.8) for more information. Duke Power, along with stakeholders and DWQ, will continue to develop and implement an invasive plant management program for the reservoir (Section A, Chapter 4, Part 4.7.4).

Section B - Chapter 4
Catawba River Subbasin 03-08-33
Dutchmans Creek, McDowell Creek and Mountain Island Lake

4.1 Subbasin Overview

Subbasin 03-08-33 at a Glance

Land and Water Area
Total area: 220 mi^2
Land area: 216 mi^2
Water area: 4 mi^2

Population Statistics
2000 Est. Pop.: 117,621 people
Pop. Density: 546 persons/mi^2

Land Cover (percent)
Forest/Wetland: 69%
Surface Water: 2%
Urban: 2%
Agriculture: 27%

Counties
Catawba, Gaston, Lincoln and Mecklenburg

Municipalities
Cornelius, Huntersville, Mount Holly and Stanley

This subbasin is located in the Southern Outer Piedmont ecoregion. The largest watershed in this subbasin is Dutchmans Creek, formed by the confluence of Leepers and Killian Creeks. Dutchman's Creek flows into the Catawba River just downstream of Mountain Island Lake. Streams in the subbasin are often sandy, low gradient streams. Land use is primarily forested. The largest discharger in this subbasin is the Charlotte/Mecklenburg Utilities District which discharges 3 MGD into McDowell Creek.

Urbanization is a significant threat to water quality in this basin as some of the fastest growing communities in the state are located within it (Table A-7). Recognizing this threat, local governments have begun implementation of innovative management strategies to reduce urbanization's negative impact on water quality.

There are six facilities in this subbasin required to monitor effluent toxicity. Five facilities have passed all required toxicity tests. The CMUD/McDowell Creek WWTP has had three failing tests since 1997. The most recent failings were in 2000 and thought to be due to sample contamination. Otherwise, there have been no toxicity failures since the plant disinfection process was converted from chlorine to ultra-violet (UV) in 1998.

There are three ambient monitoring sites located in this subbasin: Mountain Island Lake above Gar Creek, Dutchmans Creek at SR 1918, and the Catawba River at NC 27. All three sites have exhibited elevated conductivity since the middle and late 1990s.

There were four benthic macroinvertebrate community samples and four fish community samples (Figure B-4 and Table B-7) collected during this assessment period. Three sites had lower bioclassifications, and one site was sampled for the first time during this assessment period. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

Figure B-4 Catawba River Subbasin 03-08-33

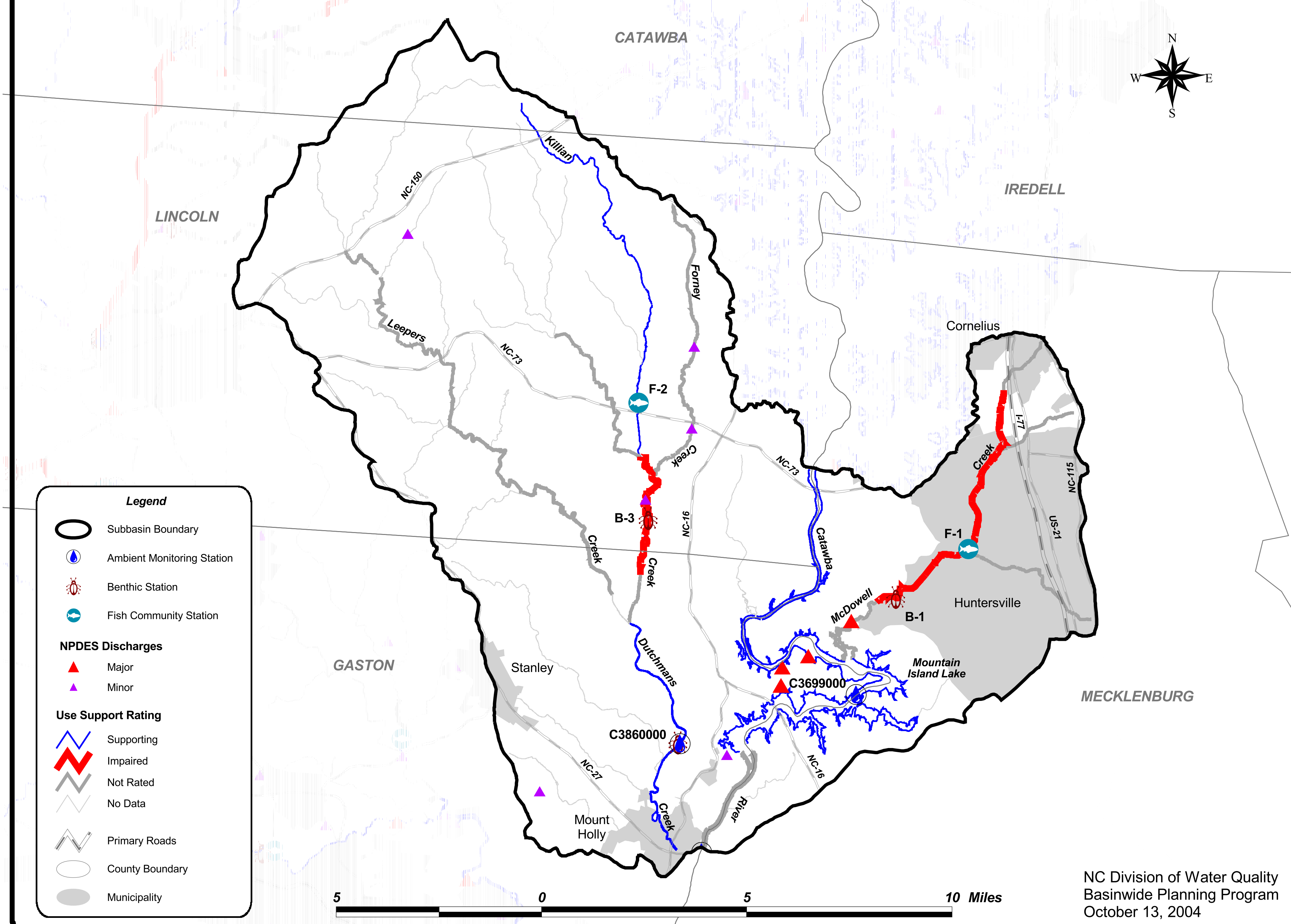


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Table B-7 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-33

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(117)	WS-IV CA	375.3 ac.	AL		C3900000 nce	L-1 nce	NR	FS
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(112)	WS-IV CA	389.4 ac.	AL		C3699000 nce	L-1 nce	S	FS
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(114)	WS-IV & B CA	1,937.1 ac.	AL		C3699000 nce	L-1 nce	S	FS
Dutchmans Creek	11-119-(0.5)	WS-IV	7.4 mi.	AL		C3860000 nce		S	FS
Killian Creek	11-119-2-(0.5)a	C	11.6 mi.	AL	F-2 G--97 F-2 GF--02			S	FS
Killian Creek	11-119-2-(0.5)b	C	3.2 mi.	AL	B-3 G--97 B-3 F--02			I	FS
McDowell Creek	11-115-(1.5)a	WS-IV	4.4 mi.	AL	F-1 F--97 F-1 P--02			I	PS
McDowell Creek	11-115-(1.5)b	WS-IV	2.9 mi.	AL	B-1 F--02			I	PS
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(117)	WS-IV CA	375.3 ac.	REC		C3900000 nce		S	-
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(114)	WS-IV & B CA	1,937.1 ac.	REC		C3699000 nce		S	-
Dutchmans Creek	11-119-(0.5)	WS-IV	7.4 mi.	REC		C3860000 nce		S	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
L - Lakes Assessment

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting
PS - partially supporting, NS - not supporting

Based on past benthic macroinvertebrate data, Dutchmans and Killian Creeks received either Excellent or Good bioclassifications, and McDowell Creek a Good-Fair. In 2002, benthic macroinvertebrate data from Dutchmans Creek declined to Good-Fair, and Killian and McDowell Creeks declined to Fair. Similar trends were observed for the fish community at McDowell Creek, which declined from Fair in 1997 to Poor in 2002; and in Killian Creek, which declined from Good in 1997 to Good-Fair in 2002. The lower benthic macroinvertebrate and fish bioclassifications were likely the result of the prolonged drought in Killian Creek, while the lower bioclassifications in McDowell Creek were likely the result of expanding urbanization surrounding the City of Charlotte. Remaining benthic macroinvertebrate sites which declined in 2002 from previous samples were likely due to extended low flows from the drought.

Mountain Island Lake is located on the Catawba River downstream of Lake Norman. In 2002, it was classified as oligotrophic and received the lowest trophic scores since 1981. Nutrient levels in 2002 were generally lower than measured in the past, and lakewide Secchi depths were correspondingly high. These improved conditions might have been due to decreased runoff as a result of the drought. The noxious exotic macrophyte, *Hydrilla*, is established and covers more than 600 acres. To manage it, grass carp were stocked in 2000 and 2002.

Waters in Parts 4.3 and 4.4 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 4.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 4.3 below. Supporting waters with noted water quality impacts are discussed in Part 4.4 below. Water quality issues related to the entire subbasin are discussed in Part 4.5. Refer to Appendix III for use support methods and more information on all monitored waters.

4.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-33 were assigned for aquatic life, fish consumption, recreation and water supply. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-8 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-8 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-33

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	18.93 mi 2,701.7 ac	0	7.4 mi 2,312.4 ac	0
Impaired	10.4 mi	0	0	0
Not Rated	3.4 mi.	0	0	0
Total	**32.7 mi 2,701.7 ac**	**0**	**7.4 mi 2,312.4 ac**	**0**
Unmonitored Waters				
Supporting	0.0 mi	0	0	53.5 mi 2,701.7 ac
Impaired	0.0 mi	133.88 mi 375.29 ac	0	0
Not Rated	37.2 mi	0	0	0
No Data	92.2 mi	28.2 mi 2,326.41 ac	154.8 mi 389.3 ac	0
Total	**129.4 mi**	**162.1 mi 2,701.7 ac**	**154.8 mi 389.3 ac**	**53.5 mi 2,701.7 ac**
Totals				
All Waters	**162.1 mi 2,701.7 ac**	**162.1 mi 2,701.7 ac**	**162.1 mi 2,701.7 ac**	**53.5 mi 2,701.7 ac**

Note: All waters include monitored, evaluated and waters that were not assessed.

4.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

4.3.1 McDowell Creek [AU# 11-115-(1.5)a and 11-115-(1.5)b]

Current Status and 2004 Recommendations

McDowell Creek is a tributary to the upper reaches of Mountain Island Lake and drains the rapidly growing suburban areas of the towns of Cornelius and Huntersville and the lands between Interstate 77 and Lake Norman.

In 1999, DWQ noted that bank erosion in McDowell Creek was severe and instream habitat was generally poor. The basinwide plan also mentioned that upgrades to the Charlotte-Mecklenburg

Utilities WWTP had resulted in reduced nutrient loads. DWQ suggested that local initiates be pursued to find solutions to habitat degradations.

Site B-1 was added in 2002 by DWQ as a basinwide monitoring site to track this rapidly developing portion of Mecklenburg County. The site was previously monitored in 1990 and was given a Good-Fair bioclassification. In 2002, the bioclassification declined to Fair. Upstream at site F-1, the bioclassification declined from Fair in 1997 to Poor in 2002. The upper 7.2 miles of McDowell Creek (US Hwy 21 to SR 2136) are Impaired for aquatic life because of the bioclassifications at site B-1. The downstream 2.7 miles (SR 2136 to Mountain Island Lake) are Not Rated because there is no sample site on this segment. It should be noted that no visible difference in stream quality exists between the up and downstream segments.

Water quality data colleted by the Mecklenburg County Water Quality Program (MCWQP) since 1988 also indicates a significant decline in water quality conditions in McDowell Creek and the cove in Mountain Island Lake where the creek drains. These declining water quality conditions are being caused by the increased discharge of pollutants carried in stormwater runoff from rapidly increasing impervious cover (parking lots, roads, houses, etc.) and construction activities in the McDowell Creek watershed. Sediment from construction sites, nutrients from lawn fertilizers, and heavy metals (lead, chromium and zinc) from parking lot and road runoff are the primary culprits. Currently, water quality in McDowell Creek Cove is ranked as "POOR" by Mecklenburg County and consistently ranks as one of the lowest water quality sites in the county.

To assess the impacts from future development in this watershed, MCWQP completed a water quality model for the McDowell Creek watershed that indicates a significant increase in pollutant loads as the area approaches build out. If left unchecked, the poor water quality conditions in McDowell Creek and McDowell Creek Cove will persist and could impact the quality of the water at Charlotte-Mecklenburg Utilities (CMUD) drinking water intake located downstream. The quality and usability of McDowell Creek Cove as a recreational area are also threatened by sediment depositions that decrease water depth and impair navigation.

Town of Huntersville Role:
In October 2002, the Huntersville Town Board adopted a "non-degradation" goal for the McDowell Creek watershed to halt the declining water quality trends. The board later expanded this goal to include all the surface waters within its jurisdiction. The board further requested that the MCWQP work with town staff to develop a post-construction ordinance to ensure that this was fulfilled. In response to this request, a Low Impact Development (LID) Ordinance was drafted by staff and approved by the Town Board in February 2003.

Huntersville’s decision to adopt LID standards is based on the fact that a developed site can be designed as an integral part of the environment, and thus, serves to protect existing water quality conditions through the careful use of design principles that seek to mimic natural site hydrology. In some applications, LID designs can also significantly reduce development costs with the reduction of impervious surfaces (roadways), curb and gutters; use of less storm drain piping; and elimination of large stormwater ponds. Reducing site development infrastructure also reduces associated project, bonding and maintenance costs. Refer to Section A, Chapter 4, Part 4.11.

Mecklenburg County's Role:
Mecklenburg County's Water Quality Program is providing support to the Town of Huntersville through plan reviews and inspections to ensure compliance with the new ordinance. In addition, Mecklenburg County has agreed to install BMPs in critical areas of the McDowell Creek watershed to remove nonpoint source pollutants from development activities that occurred prior to the adoption of the Huntersville ordinance. The combination of the implementation of Huntersville's new water quality ordinance and the installation of retrofit BMPs will work toward reversing negative water quality trends in McDowell Creek and result in the ultimate improvement of overall water quality conditions. Mecklenburg County has already purchased properties at several locations in the watershed and is currently working to secure Clean Water Management Trust Fund grants to install BMPs at these sites.

Charlotte-Mecklenburg Utilities Role:
Charlotte-Mecklenburg Utilities (CMUD) received a permit modification to expand the McDowell Creek WWTP (NC0036277) located in the lower reaches of the watershed near Mountain Island Lake. In its plans for stepped plant expansion to 12 MGD (6.6, 9.0, 12.0 MGD), CMUD has included the treatment systems necessary to prevent an increase in existing pollutant loads. In addition, CMUD will be expanding current nutrient removal systems at the plant. The schedule is to complete construction to treat 9.0 MGD in 2005 and finish construction to treat 12.0 MGD in 2007.

North Carolina's Role:
Without state assistance, Huntersville and Mecklenburg County will be unable to fund the efforts necessary to reverse the negative water quality trends in McDowell Creek. Funding from programs such as the Clean Water Management Trust Fund and the Section 319 Program is essential. State support is needed to ensure that this funding is made available.

DWQ applauds the cooperation, foresight and initiative demonstrated by all the parties involved in the effort to reverse water quality impairment in McDowell Creek. The McDowell Creek watershed offers several unique opportunities. MCWQP has over 20 years worth of water quality data for McDowell Creek and Cove and continues to maintain a very extensive monitoring network to measure the effectiveness of efforts to restore water quality. This provides an opportunity to test the effectiveness of LID on a watershed scale and also to test the effectiveness of regional BMPs as a retrofit in a developing watershed. This also creates a unique opportunity to evaluate modeling as a tool for ordinance development and implementation.

Over the next basin cycle, DWQ will work to provide Huntersville and Mecklenburg County with the necessary support to continue their BMP implementation program. Additionally, DWQ will seek guidance from Huntersville and Mecklenburg County as it encourages the development of similar programs across the Catawba River basin.

4.3.2 Killian Creek [AU# 11-119-2-(0.5)b

<u>Current Status and 2004 Recommendations</u>
Killian Creek is a tributary to upper Dutchmans Creek in southeastern Lincoln County. In 1992 and 1994, the stream received an Excellent bioclassification, Good in 1997, and Fair in 2002. Because of the Fair bioclassification at site B-3 in 2002, 3.2 miles (from Anderson Creek to a

point 1.2 miles upstream of mouth) are Impaired. Flows were less than 20 percent of historical median flow during the 2002 sampling and likely influenced the water quality decline. The decrease in bioclassification may also be due to reduced dilution of instream wastes from the Forney Creek and Fa Be Enterprises WWTPs. These facilities discharge to Forney Creek, a tributary to Killian Creek. There is no evidence to suggest these facilities are operating improperly or violating their current permits. DWQ will continue to monitor this creek in the next basin cycle.

4.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

4.4.1 Mountain Island Lake [AU# 11-(112) and 11-(114)]

Current Status and 2004 Recommendations
Mountain Island Lake is operated by Duke Power and is located on the Catawba River downstream from Lake Norman. The reservoir is used as a water supply for the City of Charlotte and to generate electricity at the Riverbend Steam and Mountain Island Stations.

The reservoir was most recently monitored by DWQ in 2002. The lake was classified as oligotrophic; nutrient concentrations were generally lower than those observed in the past, and lake-wide Secchi depths indicated good water clarity. Decreased nutrient concentrations and greater water clarity may have been due to the drought conditions, which decreased nonpoint source runoff throughout the basin. Prior to 2002, the most recent monitoring was conducted in 1997.

Hydrilla is established in the reservoir and covers approximately 625 acres (Bonham, 2001). The exotic macrophyte was observed in the upper end of the reservoir in 2002. Grass carp were first stocked in 2000 as a possible biological control agent for this plant. In 2002, an additional 20,000 fish were stocked. Duke Power, along with stakeholders and DWQ, will continue to develop and implement an invasive plant management program for the reservoir.

Extensive management efforts are underway in the McDowell Creek Cove area of Mountain Island Lake. Please refer to the discussion of McDowell Creek (Section B, Chapter 4, Part 4.3.1) for a detailed description of those activities.

4.5 Additional Water Quality Issues within Subbasin 03-08-33

4.5.1 Water Quality Threats to Streams in Urbanizing Watersheds

Subbasins in and around the Greater Charlotte Metropolitan Area are experiencing rapid growth as new homes and businesses sprout up on old farms and forests. This development places intense pressure on the sensitive stream communities within those basins. In order to prevent aquatic habitat degradation and Impaired biological communities, protection measures should be put in place immediately. Refer to Section A, Chapter 4, Parts 4.11 and 4.13 for a description of urban stream water quality problems and recommendations for reducing impacts and restoring water quality.

Section B - Chapter 5
Catawba River Subbasin 03-08-34
Irwin Creek, Long Creek, McAlpine Creek and Sugar Creek

5.1 Subbasin Overview

Subbasin 03-08-34 at a Glance

Land and Water Area
Total area: 324 mi^2
Land area: 317 mi^2
Water area: 7 mi^2

Population Statistics
2000 Est. Pop.: 408,821 people
Pop. Density: 1,231 persons/mi^2

Land Cover (percent)
Forest/Wetland: 52%
Surface Water: 2%
Urban: 32%
Agriculture: 13%

Counties
Gaston and Mecklenburg

Municipalities
Belmont, Charlotte, Huntersville, Matthews, Mint Hill, Mount Holly and Pineville

This subbasin is in the Southern Outer Piedmont ecoregion and contains the Sugar Creek watershed, a portion of Lake Wylie, and much of the City of Charlotte metropolitan area. This is the most heavily urbanized region of the basin and the state, and its population is expected to increase over 30 percent by 2020 (Table A-6). Only 52 percent of the subbasin is forested – the smallest percentage of any of the subbasins.

There are currently over 50 NPDES permitted dischargers in this subbasin. The largest one is the Charlotte/Mecklenburg Utilities District, which discharges to Irwin Creek (15 MGD), McAlpine Creek (64 MGD), and Little Sugar Creek (20 MGD).

There are 30 facilities in this subbasin required to monitor effluent toxicity. Of these, six facilities have had more than one failing toxicity test since 1997: American Truetzschler, Inc. (12), Cousins Real Estate/Gateway Village (12), Duke Power/Allen 002 (3), First Union Commons (4), Hoechst Celanese/Dreyfus (2), and Unocal/Rhom and Haas Facility (5). Four other facilities had one failing test since 1997: (AquAir WWTP, Belmont WWTP, CMUD/Irwin Creek WWTP, and CMUD/McAlpine Creek WWTP).

There were eight benthic macroinvertebrate community samples and four fish community samples (Figure B-5 and Table B-9) collected during this assessment period. One site improved; three sites remained the same; two sites had a lower bioclassification, and two sites were sampled for the first time during this assessment period. There are ten ambient monitoring stations located in this subbasin, both in North and South Carolina.

Based upon benthic macroinvertebrate data, McAlpine Creek and Sugar Creek (at SC 160) were given Fair bioclassifications in 1997 and 2002, while Sugar Creek at SR 1156 and Little Sugar Creek were given Poor bioclassifications. Both streams had been given Fair bioclassifications in 1997. These low bioclassifications are due to urban runoff, poor habitat, and may be influenced by wastewater discharges. The declines were attributed to the drought rather than significant declines in water quality.

Figure B-5 Catawba River Subbasin 03-08-34

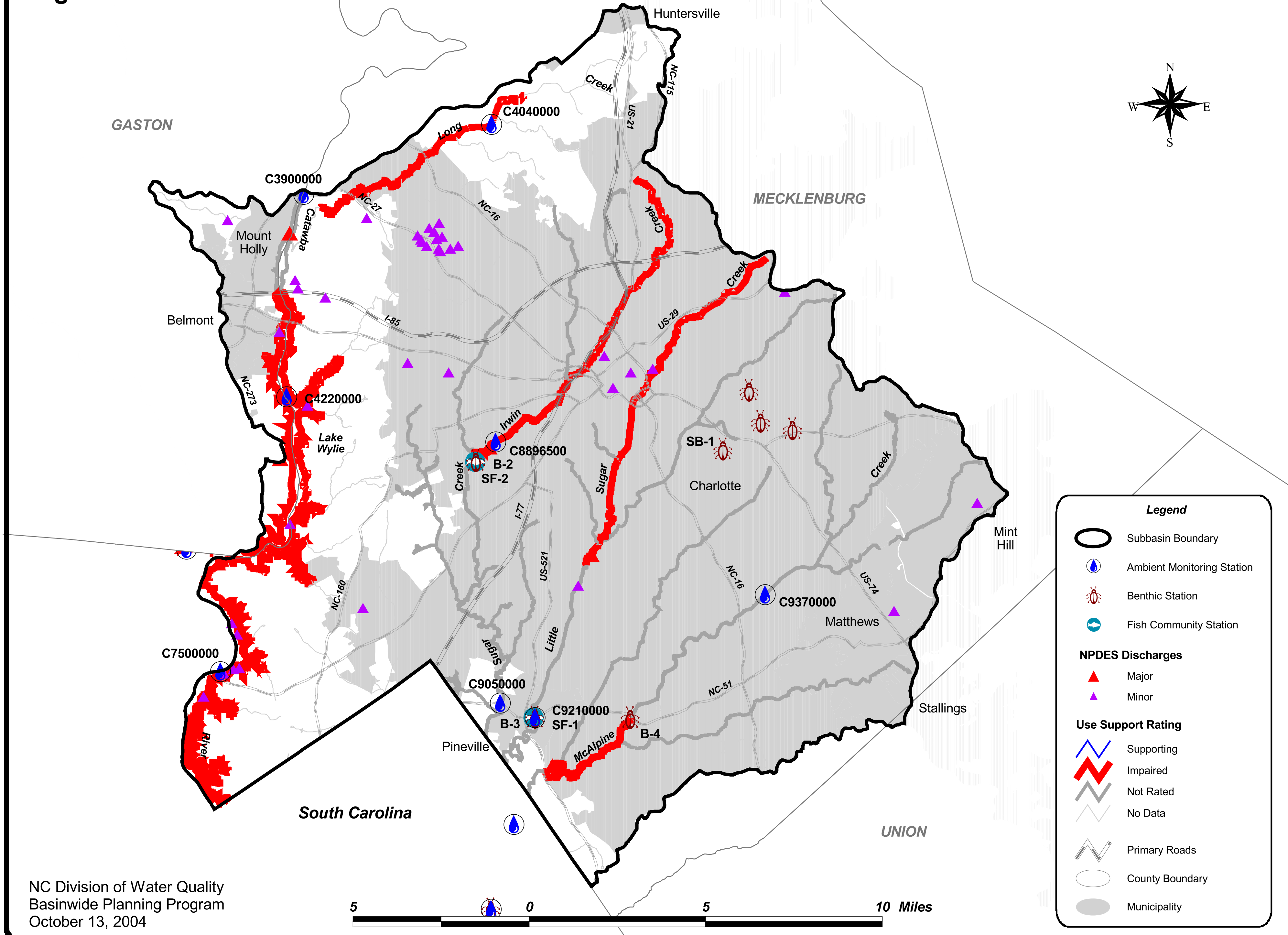

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Table B-9 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-34

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results: Biological	Ambient	Other	Use Support Rating: 2004	1998
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	WS-IV & B CA	601.1 ac.	AL		C3900000 nce C4220000 nce	L-1 ce	I	FS
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	WS-V & B	3,418.5 ac.	AL		C7000000 nce C7400000 nce C7500000 nce	L-1 ce	I	FS
Irwin Creek	11-137-1	C	11.8 mi.	AL	B-2 F--97 B-2 P--02 SF-2 P--97 SF-2 P--02	C8896500 nce		I	PS
Little Sugar Creek	11-137-8b	C	5.5 mi.	AL	B-3 F--97 B-3 P--02 SF-1 F--97 SF-1 GF--02	C9210000 nce		I	PS
Long Creek	11-120-(2.5)	WS-IV	11.3 mi.	AL		C4040000 ce		I	PS
McAlpine Creek (Waverly Lake)	11-137-9a	C	8.5 mi.	AL		C9370000 nce		NR	PS
McAlpine Creek (Waverly Lake)	11-137-9c		4.6 mi.	AL	B-4 F--97 B-4 F--02			I	PS
Sugar Creek	11-137a	C	0.3 mi.	AL	B-1 F--97 B-1 F--02	C8896500 nce		I	PS
Sugar Creek	11-137b		10.9 mi.	AL		C9050000 nce		NR	PS
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	WS-IV & B CA	601.1 ac.	REC		C4220000 nce		S	
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	WS-V & B	3,418.5 ac.	REC		C3900000 nce		S	-
Irwin Creek	11-137-1	C	11.8 mi.	REC		C8896500 ce		NR	-
Little Sugar Creek	11-137-8b	C	5.5 mi.	REC		C9210000 ce		NR	-
Long Creek	11-120-(2.5)	WS-IV	11.3 mi.	REC		C4040000 ce		NR	-

Table B-9 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-34

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
McAlpine Creek (Waverly Lake)	11-137-9a	C	8.5 mi.	REC		C9370000 ce		NR	-
Sugar Creek	11-137a	C	0.3 mi.	REC		C8896500 ce		NR	-
Sugar Creek	11-137b	C	10.9 mi.	REC		C9050000 ce		NR	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SF - Special Fish Community Study
L - Lakes Assessment

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting
PS - partially supporting, NS - not supporting

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

ambient monitoring stations as well. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

Waters in Part 5.3 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 5.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 5.3 below. Water quality issues related to the entire subbasin are discussed in Part 5.4. Refer to Appendix III for use support methods and more information on all monitored waters.

5.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-34 were assigned for aquatic life, fish consumption, recreation and water supply. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-10 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-10 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-34

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	0	0	4,019.6 ac	0
Impaired	39.5 mi 4,019.6 ac.	0	0	0
Not Rated	35.2 mi	0	48.3 mi	0
Total	**74.8 mi 4,019.6 ac**	**0**	**48.3 mi 4,019.6 ac**	**0**
Unmonitored Waters				
Supporting	0	0	0	30.4 mi 4,019.6 ac
Impaired	0	246.8 mi 4,019.6 ac	0	0
Not Rated	93.2 mi	1.0 mi	0	0
No Data	79.8 mi	0	199.5 mi.	0
Total	**173.0 mi**	**247.8 mi 4,019.6 ac**	**199.5 mi 4,019.6 ac**	**30.4 mi 4,019.6 ac**
Totals				
All Waters	**247.8 mi 4,019.6 ac**	**247.8 mi 4,019.6 ac**	**247.8 mi 4,019.6 ac**	**30.4 mi 4,019.6 ac**

Note: All waters include monitored, evaluated and waters that were not assessed.

5.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

5.3.1 The Sugar Creek Watershed Including: Irwin Creek [AU# 11-137-1] Little Sugar Creek [AU# 11-137-8] McAlpine Creek [AU# 11-137-9a and 11-137-9c] Sugar Creek [AU# 11-137a and 11-137b]

1999 Recommendations

These four streams and their smaller tributaries collectively drain the metropolitan center of Charlotte in Mecklenburg County. The watershed receives large amounts of both point and nonpoint pollution from the urban areas, severely impacting stream health in each of the streams. Similar habitat conditions are found at all sample sites within this watershed, sand/silt substrate, severe bank erosion, and disturbed or nonexistent riparian vegetation. Elevated levels of both fecal coliform bacteria and turbidity indicate impairment by urban runoff and wastewater discharges in all four streams. In the 1999 plan, DWQ noted they would work closely with Mecklenburg County and the City of Charlotte during the development of a TMDL and implementation plan for this watershed.

Current Status and 2004 Recommendations
Impairment for Sugar Creek = 11.2 mi.; Irwin Creek = 11.8 mi.; Little Sugar Creek = 5.5 mi.; and McAlpine Creek = 4.6 mi.

Water quality in general has remained low but stable over the last planning cycle. In 2002, declines were noted on Sugar Creek (B-2) and Little Sugar Creek (B-3), but this decline was most likely due to the severe drought. The Irwin Creek site is showing a slight trend of lowered conductivity since the middle 1990s. Conversely, McAlpine Creek at SR 3356 showed slightly elevated conductivity trends since the middle 1990s. In addition, McAlpine Creek at SR 3356 had slightly elevated levels of $NO_2 + NO_3$-N and ammonia since the early 1990s. Sugar Creek at NC 51 has had slightly elevated levels in $NO_2 + NO_3$-N, while other nutrients have decreased notably since the early 1980s. Dissolved oxygen concentrations have steadily increased since the late 1960s at this site. Sugar Creek at SC 160 has shown elevated trends in $NO_2 + NO_3$-N and dissolved oxygen since the late 1980s, while ammonia and total Kjeldahl nitrogen have dramatically decreased since the late 1970s.

Many streams in this watershed are also Impaired within South Carolina. Recreational or aquatic life uses on Steele, Sugar and McAlpine Creeks are Impaired because of fecal coliform bacteria or copper violations and appear on South Carolina's Draft 2003 303(d) List (SCDEHC, 2002). North Carolina is subject to an interstate TMDL developed by South Carolina and will therefore cooperate on its development.

Fecal Coliform Bacteria TMDL
In response to a high level of government and citizen interest in a fecal coliform TMDL, a stakeholder group was formed in 1999. The stakeholder group, lead by the Mecklenburg County Department of Environmental Protection (MCDEP) and the DWQ, took a very active role in every stage of the TMDL development process. MCDEP has a well-developed and respected water quality management program and was able to take the lead role in both the source assessment and model development.

The end result of this stakeholder effort was a comprehensive fecal coliform TMDL that received approval in March 2002. The TMDL addresses all identifiable sources of fecal coliform pollution including, but not limited to, wastewater treatment plants, sanitary sewer overflows, stormwater runoff, failing septic systems, and background wildlife contributions. The TMDL study indicated that excluding stormwater runoff, the primary contributors of fecal coliform pollution in this watershed are point sources (WWTP, etc.) and direct input nonpoint sources (failing septic systems). Table B-11 presents a summary of the TMDL and describes the necessary reductions in fecal coliform contamination in the Sugar Creek watershed. Loading reductions are defined for both point and nonpoint sources.

Table B-11 Summary of Sugar Creek Watershed Fecal Coliform TMDL

Critical Conditions	Site-specific critical conditions occurred during periods of low streamflow coinciding with high fecal coliform loads from both the SSOs and the WWTPs.
Seasonality	All seasons addressed.
Development Tools	Watershed model, BASINS Versions
Supporting Documents	*Fecal Coliform Total Maximum Daily Load for the Irwin, McAlpine, Little Sugar and Sugar Creek Watersheds, Mecklenburg County*, and references listed in report.
TMDL(s)	**Waterbody** — **TMDL (cfu/100ml)**
	Sugar Creek — $8.4x10^{12}$ Irwin Creek — $7.7x10^{12}$ Little Sugar Creek — $9.4x10^{12}$ McAlpine Creek downstream of Sardis Road — $1.1x10^{13}$ McAlpine Creek upstream of Sardis Road — $6.8x10^{12}$
Loadings	*Sugar Creek watershed:* Point sources $7.4x10^{12}$ col/100ml (63% reduction) Nonpoint sources $8.9x10^{11}$ col/100ml (58% reduction) *Irwin Creek watershed:* Point sources $7.0x10^{12}$ col/100ml (60% reduction) Nonpoint sources $7.3x10^{11}$ col/100ml (62% reduction) *Little Sugar Creek watershed:* Point sources $6.7x10^{12}$ col/100ml (43% reduction) Nonpoint sources $2.6x10^{12}$ col/100ml (19% reduction) *McAlpine Creek watershed (downstream):* Point sources $7.8x10^{12}$ col/100ml (70% reduction) **Nonpoint Sources $3.2x10^{12}$ col/100ml (28% reduction)** *McAlpine Creek watershed (upstream):* Point sources $7.8x10^{12}$ col/100ml (32% reduction) Nonpoint sources $5.9x10^{11}$ col/100ml (68% reduction)

The MCDEP, Charlotte Mecklenburg Utilities, and Charlotte Mecklenburg Storm Water Services can accomplish implementation of the TMDL cooperatively. Local coordination, oversight and reporting for the TMDL should be the responsibility of the MCDEP. Each of the three programs has currently funded efforts dedicated to reducing fecal coliform levels in Charlotte's streams, and these efforts can be augmented to fulfill the requirements of the TMDL Implementation Strategy.

Phosphorus Load Reduction Strategy

In the summer of 2001, the South Carolina Department of Health and Environmental Control (SCDHEC) filed a Petition for a Contested Case in the North Carolina Office of Administrative Hearings regarding the renewal of the Charlotte Mecklenburg Utilities Department (CMUD) McAlpine Creek wastewater treatment plant. The primary complaint on the part of SCDHEC was that the permit was renewed without a phosphorus limit. Nearly all of South Carolina's municipal dischargers to the mainstem Catawba River (upstream of Lake Wateree) have been given phosphorus limits, generally equivalent to 1 mg/l. The McAlpine Creek WWTP permit had a phosphorus optimization study special condition that stipulated preparatory requirements for the facility to ready itself for the upcoming phosphorus TMDL.

In January 2002, SCDHEC, DWQ and CMUD reached an agreement on the terms of the phosphorus limits at the McAlpine treatment plant and expanded the permitting strategy to include the WWTPs on Sugar, Irwin and Twelvemile Creeks (in Union County). The final settlement agreement includes four main points: phosphorus limits at all three CMUD facilities, a bubble limit, a mass cap, and a TMDL. The phosphorus limit corresponds to 1 mg/l at the permitted flows calculated on a 12-month rolling average. The bubble limit refers to a mass limit for total phosphorus that applies to the combined discharge of all three CMUD plants. This type of limit allows CMUD operational flexibility with regard to phosphorus removal. In order to be protective of water quality in the downstream lakes, SCDHEC requested a maximum combined limit to ensure optimized plant operation at all times. The maximum limit corresponds to a concentration limit of 2 mg/l at maximum permitted flow. In addition, the agreement includes a provision that will include DWQ and all affected NC entities in the TMDL process.

5.3.2 Long Creek [AU# 11-120-(2.5)]

Current Status and 2004 Recommendations

The Long Creek watershed drains north central Mecklenburg County between Charlotte and Huntersville. Approximately 11.3 miles of Long Creek (from a point 0.6 mile downstream of Mecklenburg County SR 2074 to a point 0.4 mile upstream of Mecklenburg County SR 1606) are rated Impaired due to turbidity and exceedances of the manganese water quality standard. Ambient data from the current assessment period indicate that the turbidity readings remain in violation of the state standard. Fecal coliform concentrations are also above the state standard, but Long Creek is not used for primary recreation. There are no NPDES discharges to this stream, suggesting that impairment is likely a result of urban runoff, construction and agriculture in the watershed. This evaluation is based on chemical monitoring data because DWQ does not have biological monitoring locations on Long Creek at this time.

In 2002, Mecklenburg County entered into a partnership with the NCDOT and the NC Division of Land Quality regarding the I-485 construction project through the Long Creek watershed. NCDOT funded staff and resources for the development, monitoring and maintenance of 15 continuous automated monitoring sites located throughout the watershed, which automatically download water quality data to a website every 15 minutes and alert staff regarding elevated turbidity levels. In 2003 and 2004, the network detected several sedimentation problems that were quickly corrected thus preventing significant downstream water quality impacts. The program has been extremely successful and NCDWQ encourages similar programs and partnerships when the opportunity arises in other watersheds.

Long Creek suffers from the impacts of rapid urbanization. Please refer to Section A, Chapter 4, Part 4.13 for a detailed discussion on DWQ's approach to and recommendations for this issue.

5.3.3 Lake Wylie [AU# 11-(122) and 11-(123.5)]

The area covered by Lake Wylie overlaps the boundaries of subbasins 03-08-34, 03-08-36 and 03-08-37. Therefore, a detailed discussion on Lake Wylie can be found in Section A, Chapter 4, Part 4.7.3. Because of chlorophyll *a* standard violations, algal blooms, and dissolved oxygen percent saturation values greater than 120 percent, Lake Wylie (4,019.6 acres, NC portion) is Impaired by eutrophication. Data collected by the Mecklenburg County Water Quality Program support these findings.

5.4 Additional Water Quality Issues within Subbasin 03-08-34

Water Quality Threats to Streams in Urbanizing Watersheds

Subbasins in and around the Greater Charlotte Metropolitan Area are experiencing rapid growth as new homes and businesses replace old farms and forests. This development places intense pressure on the sensitive stream communities within those basins. In order to prevent aquatic habitat degradation and Impaired biological communities, protection measures should be put in place immediately. Refer to Section A, Chapter 4, Part 4.13 for a description of urban stream water quality problems and recommendations for reducing impacts and restoring water quality.

Section B - Chapter 6
Catawba River Subbasin 03-08-35
Clark Creek, Mauney Creek, South Fork Catawba River, Henry Fork and Jacob Fork

6.1 Subbasin Overview

Subbasin 03-08-35 at a Glance

Land and Water Area
Total area: 559mi^2
Land area: 558mi^2
Water area: 1mi^2

Population Statistics
2000 Est. Pop.: 163,865 people
Pop. Density: 292 persons/mi^2

Land Cover (percent)
Forest/Wetland: 57%
Surface Water: 0%
Urban: 3%
Agriculture: 39%

Counties
Burke, Catawba, Gaston and Lincoln

Municipalities
Brookford, Cherryville, Conover, Hickory, High Shoals, Hildebran, Lincolnton, Long View, Maiden, Newton, Spencer Mountain and Stanley

There are three ecoregions in this subbasin: the Eastern Blue Ridge Foothills (including the South Mountains), the Northern Inner Piedmont, and the Southern Outer Piedmont. The subbasin forms most of the watershed of the South Fork Catawba River. This river has its origin at the confluence of Henry and Jacob Forks. The other major tributaries in this subbasin include Clark and Indian Creeks.

Land use is primarily forested, but there is also a large percentage of the subbasin in pasture. A greater percentage of this subbasin is in pasture than in any other subbasin. However, pasture is rapidly being converted to residential land uses as the local population expands. Most communities in this region are expected to increase in population by more than 20 percent by 2020 (Table A-6 and A-7).

There are seven facilities in this subbasin which are required to monitor effluent toxicity. Five municipal and one industrial facilities had one or more failing tests since 1997: Cherryville (3), Delta Mills (1), Lincolnton (3), Maiden Creek (1), and Stanley WWTP (9).

The largest dischargers in this subbasin are those of Hickory, 15 MGD to Henry Fork; Lincolnton, 6 MGD to South Fork Catawba River; and Newton, 5.0 MGD to Clark Creek. Smaller dischargers include the Town of Cherryville's WWTP (2 MGD to Indian Creek), Delta Mills, Inc. (1 MGD to Clark Creek), and the Town of Stanly's WWTP (1 MGD to Mauney Creek).

There were 24 benthic macroinvertebrate community samples and six fish community samples (Figure B-6 and Table B-12) collected during this assessment period. Two sites remained the same; four sites had lower bioclassifications, and 16 sites were sampled for the first time during this assessment period. Data were also collected from six ambient monitoring stations as well. Benthic macroinvertebrate data showed that every site, except for Henry Fork declined in bioclassification. Henry Fork may have maintained its Good rating despite the drought and the City of Hickory's discharge because of its large drainage area. Benthic data suggest the wastewater treatments plants for the towns of Newton and Cherryville and Delta Mills may be having negative effects, likely exacerbated by the drought, on Clark and Indian Creeks. Both

Figure B-6 Catawba River Subbasin 03-08-35

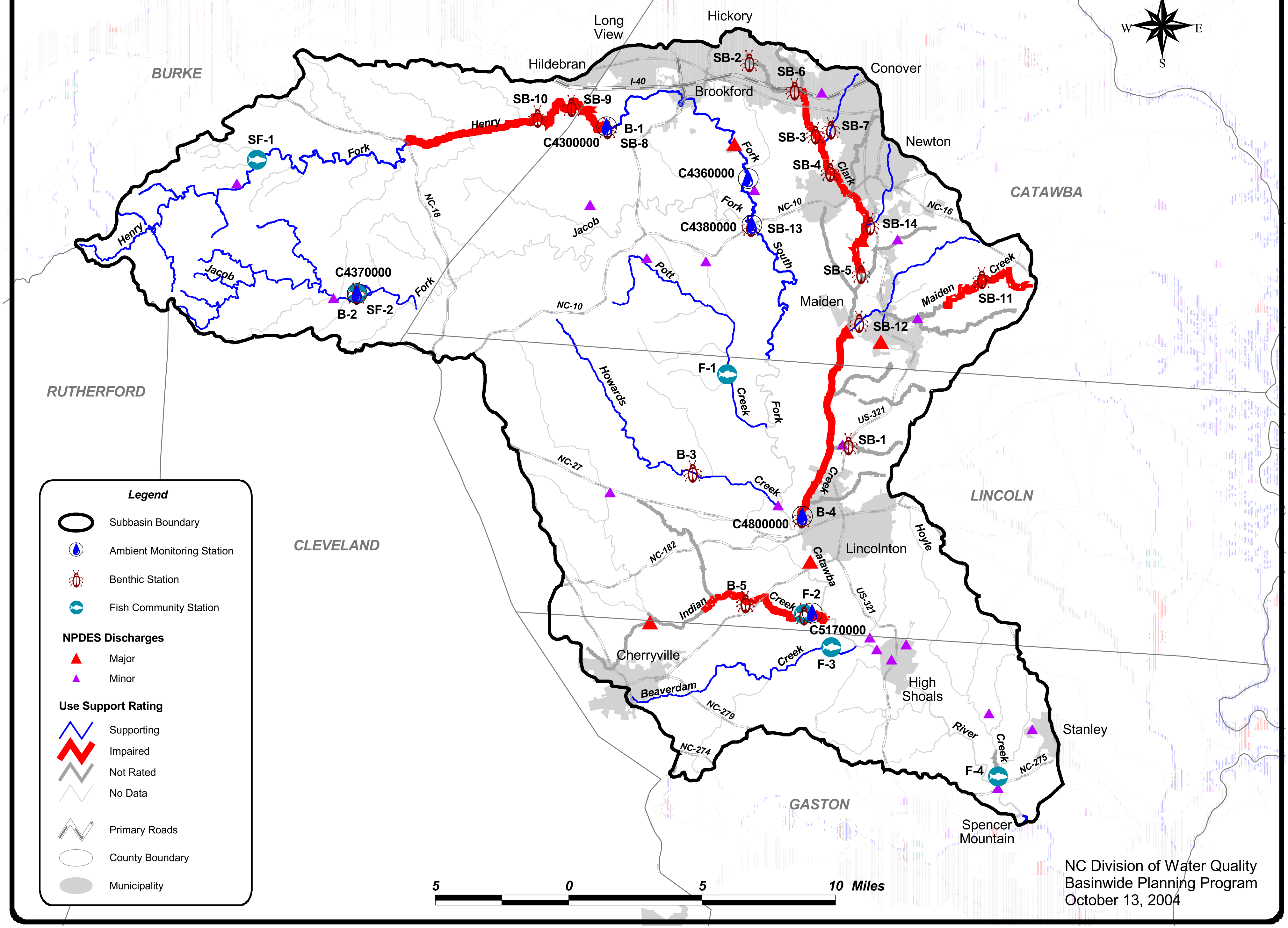

Table B-12 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-35

Waterbody	Assessment Unit Number	DWQ Classification	Length/ Area	Category	Data Type with Map Number and Data Results: Biological	Ambient	Other	Use Support Rating: 2004	1998
Beaverdam Creek	11-129-9-(0.7)	WS-IV	8.3 mi.	AL	F-3 G--02			S	-
Carpenter Creek (Horseshoe Lake)	11-129-5-9	C	3.6 mi.	AL	SB-1 NR--01			NR	FS
Clark Creek	11-129-5-(9.5)	WS-IV	1.8 mi.	AL	B-4 GF--97 B-4 F--02	C4800000 nce		I	PS
Clark Creek (Shooks Lake)	11-129-5-(0.3)a	C	3.3 mi.	AL	SB-2 NR--01 SB-6 NR--00 SB-6 NR--01			NR	PS
Clark Creek (Shooks Lake)	11-129-5-(0.3)b	C	14.3 mi.	AL	SB-3 F--00 SB-4 GF--01 SB-4 F--02			I	PS
Cline Creek	11-129-5-2	C	3.1 mi.	AL	SB-7 NI--01			S	-
Henry Fork	11-129-1-(12.5)a	C	10.3 mi.	AL	SB-9 F--01 SB-10 GF--01			I	FS
Henry Fork	11-129-1-(12.5)b	C	4.8 mi.	AL	B-1 G--02	C4300000 nce		S	FS
Henry Fork	11-129-1-(12.5)c	C	8.6 mi.	AL		C4360000 nce		S	
Henry Fork	11-129-1-(2)	C ORW	19.5 mi.	AL	SF-1 G--98			S	FS
Howards Creek	11-129-4	C	13.8 mi.	AL	B-3 G--97 B-3 GF--02			S	FS
Hoyle Creek	11-129-15-(6)	WS-IV CA	0.5 mi.	AL	F-4 GF--02			S	-
Indian Creek	11-129-8-(6.5)	WS-IV	6.0 mi.	AL	B-5 G--97 B-5 F--02 B-5 F--03 F-2 F--02	C5170000 nce		I	ST
Jacob Fork	11-129-2-(4)	WS-III ORW	6.8 mi.	AL		C4370000 nce		S	FS
Maiden Creek	11-129-5-7-2-(1)	WS-II	4.9 mi.	AL	SB-11 F--02			I	FS
Pinch Gut Creek	11-129-5-7	C	7.2 mi.	AL	SB-12 G--01			S	-
Pott Creek	11-129-3-(0.7)	WS-IV	3.2 mi.	AL	F-1 G--02			S	-
South Fork Catawba River	11-129-(0.5)	WS-V	8.4 mi.	AL		C4380000 nce		S	FS
Town Creek	11-129-5-4	C	3.8 mi.	AL	SB-14 GF--00			S	-

Table B-12 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-35

Waterbody	Assessment Unit Number	DWQ Classification	Length/ Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Clark Creek	11-129-5-(9.5)	WS-IV	1.8 mi.	REC		C4800000 ce		NR	-
Henry Fork	11-129-1-(12.5)b	C	4.8 mi.	REC		C4300000 nce		S	-
Henry Fork	11-129-1-(12.5)c	C	8.6 mi.	REC		C4360000 nce		S	-
Indian Creek	11-129-8-(5)	C	2.6 mi.	REC		C5170000 nce		S	-
South Fork Catawba River	11-129-(0.5)	WS-V	8.4 mi.	REC		C4380000 nce		S	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SF - Special Fish Community Study
SB - Special Benthic Community Study
A - Ambient Monitoring Site
L - Lakes Assessment
FT - Fish Tissue Site

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting, ST - supporting but threatened
PS - partially supporting, NS - not supporting

streams declined from Good-Fair in 1997 to Fair in 2002. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

Waters in Parts 6.3 and 6.4 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 6.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 6.3 below. Supporting waters with noted water quality impacts are discussed in Part 6.4 below. Refer to Appendix III for use support methods and more information on all monitored waters.

6.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-35 were assigned for aquatic life, fish consumption, recreation and water supply. All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-13 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-13 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-35

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	119.0 mi	0	42.4 mi	0
Impaired	37.2 mi	0	0	0
Not Rated	15.0 mi	0	1.8 mi	0
Total	**171.2 mi**	**0**	**44.2 mi**	**0**
Unmonitored Waters				
Supporting	36.2 mi	0	0	297.2 mi
Impaired	0	18.1 mi.	0	0
Not Rated	42.6 mi	520.9 mi.	494.8 mi	0
No Data	289.0 mi	0	0	0
Total	**367.8 mi**	**539.0 mi**	**494.8 mi**	**297.2 mi**
Totals				
All Waters	**539.0 mi**	**539.0 mi**	**539.0 mi**	**297.2 mi**

Note: All waters include monitored, evaluated and waters that were not assessed.

6.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

6.3.1 Clark Creek [AU# 11-129-5-(0.3)a, 11-129-5-(0.3)b, and 11-129-5-(9.5)]

Clark Creek drains a 91-square mile watershed, flowing from its headwaters in the City of Hickory southward through Newton and Maiden before joining the South Fork Catawba River in Lincolnton. Aquatic life is Impaired on the 16.7-mile segment of Clark Creek from Miller Branch to the South Fork Catawba River because of Fair bioclassifications at sites B-4, SB-4, SB-5 and SB-7. Additionally, 1.8 miles are Not Rated for recreation because of high fecal coliform readings at ambient site C4800000.

1999 Recommendations
TMDL: In 1999, DWQ recommended further study be conducted to determine the sources of copper, cadmium and silver. The 1999 basinwide plan noted that the TMDL process would be implemented to address fecal coliform, copper and turbidity problems in the Clark Creek watershed.

CWMTF Grant: DWQ conducted an intensive study of the upper Clark Creek watershed, funded by the Clean Water Management Trust Fund. This study was intended to reveal causes of biological impairment. Its results are discussed below.

Color Reduction Strategy: DWQ recommended that Clark Creek be included in the development of a Color Reduction Strategy for the South Fork Catawba River. Because the color issue extends beyond the boundaries of this subbasin, it is discussed further in Section A, Chapter 4, Part 4.4.

Current Status and 2004 Recommendations
Land use is a mixture of industrial, commercial and residential uses in the areas in and near municipalities, with widespread agricultural use in the more rural areas. Two towns, Newton and Maiden, operate major wastewater treatment plants with discharges into the creek. Additional discharges are made by multiple industrial permit holders including textile, furniture and food processors. In the early 20th century, almost the entire length of Clark Creek was channelized (dredged and straightened) to improve drainage of agricultural lands. Benthic macroinvertebrate communities are Impaired throughout the mainstem of Clark Creek. Aquatic habitat is generally poor. The streambed is comprised largely of unstable sand deposits, and bank erosion is widespread.

Intensive Watershed Assessment Study
Much progress has been made towards understanding the impacts to Clark Creek during the last assessment period. After extensive study in the Clark Creek watershed (funded by the CWMTF), DWQ published an assessment report for the upper Clark Creek watershed in

Catawba County. The study analyzed a broad range of data about the watershed to determine the most probable stressors and sources of impairment. The analysis noted the following three primary stressors:

- Widespread habitat degradation, manifested by extensive sedimentation and instability.
- Toxicity from nonpoint sources (industrial and commercial areas), together with scour (high velocity stormwater flows) and limited recolonization potential in the Clark Creek headwaters.
- Toxicity due to chlorine discharge from the Newton WWTP is a likely cause of impairment for at least one mile below the outfall.

DWQ's report recommends the following actions to address current sources of impairment and prevent future degradation. Actions one through six are all essential to the restoration of aquatic communities throughout Clark Creek. Action seven is essential to improvement in the lower portion of the study area below the Newton WWTP. The remaining actions should also be implemented, but will result in limited improvement unless the first seven are also accomplished.

1. Extensive stream channel restoration activities and stormwater retrofit BMPs should be implemented throughout the watershed. This will involve a substantial effort, likely to take several decades to fully implement.
2. These activities should be implemented deliberately and incrementally over time:
    - Work should be carried out first in tributary and headwater subwatersheds. Restoration of the mainstem of Clark Creek should be approached later when upstream sediment sources have been reduced and upstream hydrologic conditions have been mitigated to the extent practical.
    - Channel restoration and stormwater BMPs should be implemented in an integrated fashion so that both channel morphology and watershed hydrology problems are addressed using a coordinated approach in each subwatershed.
    - Local governments and other stakeholders should develop the cooperative organizational framework necessary to carry out the watershed planning, project design, implementation and monitoring activities that will be necessary to sustain the effort over time.
3. The five-square mile Cline Creek subwatershed should serve as the focus for initial planning and project activities.
4. Post-construction stormwater management should be required for all new development in the study area in order to prevent further channel erosion and continued habitat degradation.
5. Existing riparian buffers must be protected.
6. In order to prevent future water quality deterioration related to new construction activities, sediment and erosion control practices should be improved.
7. DWQ should ensure that chlorine concentrations in the Newton WWTP effluent are reduced to nontoxic levels and plans to add a chlorine limit when the permit is renewed in 2005.

8. The headcut in Clark Creek near the Martin Marietta quarry above I-40, of unknown origin, should be stabilized to prevent further erosion and sediment loading to the stream.
9. A watershed education program should be developed and implemented with the goal of targeting homeowners and managers of commercial and industrial facilities in order to reduce current stream damage and prevent future degradation.
10. Additional data should be obtained to more narrowly define the nature and source of toxicants impacting the headwater of Clark Creek.

TMDLs
DWQ made significant progress regarding TMDL development during the last basinwide planning cycle. In 2002, DWQ published a fecal coliform TMDL for Clark Creek.

Fecal Coliform Bacteria TMDL
The model outputs indicate that the sources of fecal coliform bacteria in the Clark Creek watershed include primarily urban development, animal grazing and septic systems. These sources accounted for about 53, 22 and 15 percent of the loading, respectively. In order for the water quality target to be met, the final allocation of the fecal coliform bacteria requires a nonpoint source load reduction of 77 percent/day for the various nonpoint sources of the fecal coliform bacteria.

The sewer system lines connecting the Newton Clark Creek WWTP and the sewage collection system in the watershed run along the mainstem of Clark Creek. The City of Newton should check the system to verify there are no leaks. Connection failures between the sewer pipelines or any leak from the pipe could result in fecal coliform contamination in the creek.

The model estimated that the point sources contributed about 5 percent of the total fecal coliform loading in the watershed. The wasteload allocation, based on DWQ permits, was estimated to be considerably lower than the actual discharged load. Therefore, reduction of fecal coliform loading from point sources is not necessary at this time.

Copper TMDL
DWQ placed a Draft Copper TMDL on public notice in December 2003 and received many comments. During the public comment period, questions were raised regarding the methodology used to determine copper concentrations in the stream. The method used by DWQ looked at the total level of copper in a sample. However, only a portion of the total copper in a sample is environmentally active, or capable of harming aquatic ecosystems. Therefore, a "Hardness Adjusted" analysis was performed to determine if the environmentally active copper exceeded state standards. The results of this analysis revealed that environmentally active copper does not exceed state standards in Clark Creek. For this reason, a copper TMDL will not be published and copper impairment on Clark Creek will be removed from the next revision of the 303(d) list.

Planning Considerations
As indicated by the conclusions of the watershed assessment and TMDL efforts, the most important factors leading to impairment in the Clark Creek watershed are broad in nature, originating from a wide variety of sources. Addressing these problems will require actions that are similarly broad in scope. Mitigating the potential impacts of future watershed development on watershed hydrology is also critical, or improvements resulting from efforts to control current

sources of impairment may be short lived. The work described above provides the basic information and framework necessary to develop a successful management strategy for the Clark Creek watershed. It is now up to local governments, along with local citizen and business input, to develop their own management techniques with assistance from DWQ. Please refer to Section A, Chapter 4, Part 4.8.

6.3.2 Maiden Creek [AU# 11-129-5-7-2-(1)]

Current Status and 2004 Recommendations
Maiden Creek begins its journey to Clark Creek just west of NC 16 in southern Catawba County. The stream is impounded just above its confluence with Allen Creek to Maiden Reservoir. The Town of Maiden uses Maiden Reservoir for its public drinking water supply. The 4.9-mile segment from its source to a point 0.7 mile upstream from backwaters of Maiden Reservoir is Impaired because of a Fair bioclassification at site SB-11.

This site at SR 1810 (Catawba County) was sampled at the request of the NC Division of Water Resources (DWR). DWR sought benthic data to determine minimum flow requirements for the Town of Maiden's water supply reservoir. The resulting Fair bioclassification indicates the stream is in a state of severe stress. DWQ suggests further study be conducted to determine stressors and sources of impairment in this relatively small watershed. Identification and effective management of those stressors may reduce operating costs and efficiency at the Town of Maiden water treatment plant. Being part of the larger Clark Creek watershed, DWQ recommends Maiden Creek be considered in any management plan developed for Clark Creek (Section B, Chapter 6, Part 6.3.1).

6.3.3 Indian Creek [AU# 11-129-8-(6.5)]

Current Status and 2004 Recommendations
The watershed of Indian Creek includes western Lincoln County and the extreme northwestern corner of Gaston County encompassing the north side of the Town of Cherryville. The fish sample site (F-2) is eight miles below the Town of Cherryville's WWTP (2 MGD) and a smaller WWTP associated with the West Lincoln High School (0.01 MGD). Aquatic life is Impaired in the 6.0-mile segment from a point 0.3 mile upstream of Lincoln County SR 1169 to South Fork Catawba River as indicated by Fair bioclassifications at sites F-2 and B-5.

The overall stream and riparian habitats are of moderately high quality, but fish sampling resulted in a Fair bioclassification in 1997 and 2002. Further study should be conducted to determine the stressors causing impairment. DWQ will continue to monitor this stream.

6.3.4 Mauney Creek [AU# 11-129-15-5]

Current Status and 2004 Recommendations
About 4.3 miles of Mauney Creek was listed Impaired due to both nonpoint and point sources (Stanley WWTP) of pollution.

In the 1999 basin plan, DWQ pledged to continue working with the Stanley WWTP facility to assure permit limits are met and noted that additional resources will be necessary to conduct a watershed survey to determine the potential actions needed to address nonpoint sources of pollution in this creek. This remains true.

The Stanley WWTP conducts whole effluent toxicity tests on the discharge and has been in compliance with permit limits recently. Recent compliance is due to improvements made at the facility, including dechlorination and implementation of an industrial pretreatment program. In addition, some flow from Stanley WWTP has been diverted to Mount Holly. This cooperation reduces the number of sewer overflows for the Stanley system.

DWQ will resample this stream in the next assessment cycle.

6.3.5 Henry Fork [AU# 11-129-1-(12.5)a]

Current Status and 2004 Recommendations
Henry Fork drains central Burke County south of Morganton. It flows along the south side of Hickory before joining with Jacob Fork to form the South Fork Catawba River in Catawba County. Water quality in the upper segments of the river have been rated Good since 1989.

Two sites on Henry Fork (Burke County) were sampled as part of a study to examine the effects of a breached milldam. This breaching released large amounts of sediment into portions of the stream. Site SB-10, upstream of the breached milldam, had good riffle habitat with a mix of boulder, rubble, gravel, and sand and silt substrates. The sampling resulted in a Good-Fair bioclassification.

The stream below the dam (SB-9) was noticeably impacted by the sediment release as evidenced by the sand dominated substrate (~70 percent). The sand was several feet thick and was sufficient to eliminate all bank and most riffle habitats. The site was given a Fair bioclassification.

The impacts of sediment from the breached dam have Impaired aquatic life in the 10.3 mile segment from Laurel Creek to SR1124, but the effects may be temporary. The presence of good habitat directly above and below the impairment will aid in the recolonization of the segment, as sediment is washed downstream. DWQ will continue to monitor this segment.

The lower reach of Henry Fork [11-129-1-(12.5)c] appears on the *2002 Integrated 304(b) and 303(d) Report* because of turbidity levels. Data from this assessment period indicate that the turbidity standard was not exceeded. However, there were periods where turbidity was elevated above natural conditions. DWQ will continue to monitor this segment and again determine the conditions of Henry Fork the next assessment period.

6.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

6.4.1 South Fork Catawba River [AU# 11-129-(0.5), 11-129-(3.5), 11-129-(3.7)a, 11-129-(3.7)b, 11-129-(9.5), 11-129-(10.5), 11-129-(14.5), 11-129-(15.5)]

The South Fork Catawba River is formed by the confluence of Jacob and Henry Forks in Catawba County. It flows southerly through Lincoln and Gaston counties before joining the mainstem Catawba River at Lake Wylie. The river is used extensively as both a drinking water supply and for the assimilation of municipal and industrial wastewater. Because the South Fork Catawba River flows through two subbasins, further discussion of issues and watersheds related to the South Fork Catawba River is presented in Section A, Chapter 4.

6.4.2 Howards Creek [AU# 11-129-4]

Howards Creek is only six meters wide and has predominately sand and silt substrates, poor riffles, and an intact riparian zone. In 1997, banks were considered stable, but there were many erosion areas detected in 2002. The stream was rated Good in 1992 and 1997, but declined to Good-Fair in 2002. The decline most likely resulted from the low flow due to drought and not declining water quality.

6.4.3 Hoyle Creek [AU# 11-129-15-(6)]

From 1997 to 2002, the bioclassification at site F-4 declined from Good to Good-Fair. The decline did not appear to be drought related. This stream is entrenched with easily eroded banks. There are three NPDES facilities with a combined discharge of 0.6 MGD above the site: Lincoln County's WWTP; the Town of Stanley's Lola Street WWTP; and a small, mobile home park's WWTP. Further investigation should be conducted on this stream to determine the cause of decline in the fish community.

6.4.4 Town Creek [AU# 11-129-5-4]

Town Creek drains a portion of the Town of Newton. This stream was sampled for the first time in 2000 and received a Good-Fair bioclassification. This borderline classification likely reflects impacts from urban stormwater runoff and residential nonpoint source pollution. Refer to Section A, Chapter 4, Parts 4.11 and 4.13 for information on urban runoff and habitat degradation.

Section B - Chapter 7
Catawba River Subbasin 03-08-36
Long Creek, Dallas Branch and South Fork Catawba River

7.1 Subbasin Overview

Subbasin 03-08-36 at a Glance

Land and Water Area
Total area: 104mi²
Land area: 101mi²
Water area: 3mi²

Population Statistics
2000 Est. Pop.: 57,125 people
Pop. Density: 522 persons/mi²

Land Cover (percent)
Forest/Wetland: 54%
Surface Water: 3%
Urban: 14%
Agriculture: 29%

Counties
Gaston

Municipalities
Belmont, Bessemer City, Cramerton, Dallas, Gastonia, Kings Mountain, Lowell, McAdenville, Ranlo and Spencer Mountain

Subbasin 03-08-36 is located entirely in Lincoln County in the Southern Outer Piedmont ecoregion. The small subbasin consists of the Long Creek watershed and a portion of the South Fork Catawba River between the Town of Stanly and Lake Wylie. Major metropolitan areas include the cities of Gastonia and Belmont, the Interstate 85 corridor, and parts of Bessemer City. These areas are not growing as quickly as other subbasins (Tables A-6 and A-7), yet urban stormwater remains a concern. Most of the streams are very sandy due to erosion problems throughout the area. Land use remains primarily forested.

Major dischargers in this watershed include Collins and Aikman Products (4 MGD) and the City of Gastonia's Long Creek WWTP (16 MGD), both discharging to the South Fork Catawba River.

There are six facilities in this subbasin required to monitor effluent toxicity. Five of these facilities had one or more failing tests since 1997: Cramerton WWTP (2), Dallas WWTP (6), Lowell WWTP (2), Pharr Yarns (1), and Yorkshire Americas (3).

There were six benthic macroinvertebrate community samples and two fish community samples (Figure B-7 and Table B-14) collected during this assessment period. Two sites improved and four sites were sampled for the first time during this assessment period. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

There are four ambient monitoring sites located in this subbasin: Long Creek at SR 1456, Long Creek at SR 2042, South Fork Catawba River at NC 7, and South Fork Catawba River at SR 2524. The Long Creek at SR 1456 site has exhibited elevated conductivity levels since the early 1990s and has also shown elevated levels in pH since the middle 1980s. Long Creek at SR 2042 has shown declining levels of nutrients since the middle 1980s.

Benthic macroinvertebrate sampling could not be conducted in 2002 at the South Fork Catawba River and Long Creek sites due to flow problems. However, a fish community assessment was conducted on Long Creek in 2002 and resulted in a Good-Fair rating.

Figure B-7 Catawba River Subbasin 03-08-36

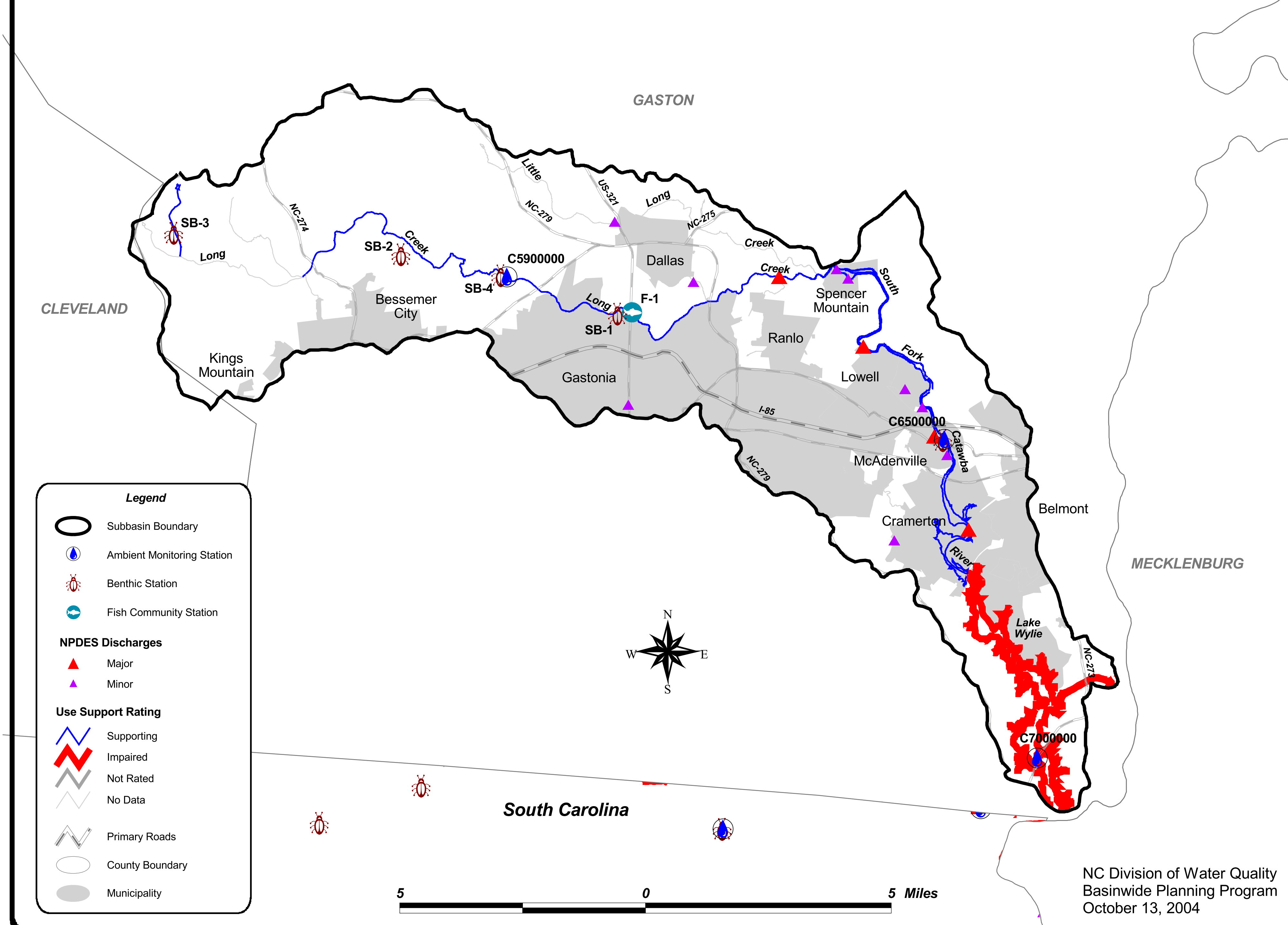

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Table B-14 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-36

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Limekiln Creek	11-129-16-2	WS-II	1.9 mi.	AL	SB-3 G--98 SB-3 E--01			S	FS
Long Creek	11-129-16-(4)	C	15.3 mi.	AL	F-1 F--97 F-1 GF--02 SB-1 NR--98 SB-2 F--98 SB-2 NR--01 SB-4 GF--97	C5900000 nce		S	FS/ST
South Fork Catawba River	11-129-(15.5)	WS-V	18.1 mi.	AL		C6500000 nce		S	ST
South Fork Catawba River	11-129-(15.5)	WS-V	18.1 mi.	REC		C6500000 nce		S	-
Long Creek	11-129-16-(4)	C	15.3 mi.	REC		C5900000 ce		NR	

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SB - Special Benthic Community Study

Bioclassifcations:
E - Excellent
NR - Not Rated
G - Good
GF - Good-Fair
F - Fair
P - Poor

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting, ST - supporting but threatened
PS - partially supporting, NS - not supporting

Bessemer City Lake, a small water supply reservoir for Bessemer City, was classified as oligotrophic in 2002. Nutrient concentrations were low with the exception of elevated ammonia levels in June.

Waters in Parts 7.3 and 7.4 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 7.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 7.3 below. Supporting waters with noted water quality impacts are discussed in Part 7.4 below. Refer to Appendix III for use support methods and more information on all monitored waters.

7.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-36 were assigned for aquatic life, fish consumption, recreation and water supply. All waters in the subbasin are considered Impaired on an Evaluated basis because of a fish consumption advice (Section A, Chapter 4, Part 4.10). All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-15 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-15 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-36

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	17.2 mi	0	0	0
Impaired	0	0	0	0
Not Rated	0	0	15.3 mi	0
Total	**17.2 mi**	**0**	**15.3 mi**	**0**
Unmonitored Waters				
Supporting	0	0	0	19.5 mi
Impaired	0	55.9 mi	0	0
Not Rated	0	0	0	0
No Data	38.7 mi	0	40.6 mi	0
Total	**38.7 mi.**	**55.9 mi**	**40.6 mi**	**19.5 mi**
Totals				
All Waters	**55.9 mi**	**55.9 mi**	**55.9 mi**	**19.5 mi**

Note: All waters include monitored, evaluated and waters that were not assessed.

7.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

7.3.1 Dallas Branch [AU# 11-129-16-7b]

Current Status and 2004 Recommendations
Dallas Branch is a tributary to Long Creek and the 0.8-mile segment from the Dallas WWTP (NC0068888) to Long Creek was listed as Impaired in the *2002 Integrated 305(b) and 303(d) Report* due to municipal point source discharges. The Dallas WWTP has had compliance issues with quarterly chronic toxicity and weekly fecal coliform limits. Effluent chlorine values are elevated at times. In response, the facility has recently added a dechlorination system. Upon permit renewal in 2005, a total residual chlorine limit will be added. Upon inspection in October 2003, the plant was meeting its permit requirements and appeared to be well maintained. DWQ will resample this stream once the chlorine limit is in place.

7.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

7.4.1 South Fork Catawba River [AU# 11-129-(0.5), 11-129-(3.5), 11-129-(3.7)a, 11-129-(3.7)b, 11-129-(9.5), 11-129-(10.5), 11-129-(14.5), 11-129-(15.5)]

The South Fork Catawba River is formed by the confluence of Jacob and Henry Forks in Catawba County. It flows southerly through Lincoln and Gaston counties before joining the mainstem Catawba River at Lake Wylie. The river is used extensively as both a drinking water supply and for the assimilation of municipal and industrial wastewater. Because the South Fork Catawba River flows through two subbasins, further discussion of issues and watersheds related to the South Fork Catawba River is presented in Section A, Chapter 4.

7.4.2 Long Creek [AU# 11-129-16-(4)]

<u>*Current Status and 2004 Recommendations*</u>

The Long Creek watershed includes the north side of Gastonia and Bessemer City and central Gaston County. Due to a variety of restoration efforts and verification by scientific investigations, Long Creek was removed from the state's 303(d) list in 2000.

An eight-year study and restoration plan concluded in 2002 with the implementation of nonpoint source controls in the upper two-thirds of the watershed. Best management practices, land use changes, closure of mining operations, construction of livestock exclusion fencing, and riparian buffer establishments all led to significant decreases in nutrients, sediment and bacterial concentrations in the stream (Line and Jennings, 2002). The following is a summary of the study's major findings and achievements:

- More than 350 BMPs to treat runoff from 9,000 acres of pasture and cropland were implemented in the watershed. Animal waste management systems were installed to properly handle and apply 5,000,000 gallons of animal waste from four dairy operations.
- The implementation of primarily erosion control practices and the conversion of some land from row crop to tree production in the headwaters of Long Creek resulted in a decrease in the frequency of dredging around the water supply intake for Bessemer City. Prior to 1996, the stream channel required dredging of deposited sediment three to four times per year, but after, the need for dredging decreased to less than once per year.
- The implementation of BMPs and changes in land use in the watershed resulted in 75 and 70 percent decreases in median annual total phosphorus and fecal coliform levels at three downstream monitoring sites on Long Creek.

- The closure of a surface mining operation and subsequent draining of several large tailings ponds in 1997 coincided with decreases in suspended sediment and fecal coliform levels at three monitoring sites on Long Creek.
- The installation of livestock exclusion fencing and riparian buffer establishment in the pasture of a large dairy operation resulted in major reductions in weekly nitrogen, phosphorus and suspended sediment loads to the creek. Fecal coliform bacteria levels decrease following livestock exclusion.
- Monthly sampling of 10 monitoring wells in a dairy pasture documented elevated levels of nitrogen and phosphorus in groundwater beneath heavily use areas of the pasture. Data from monitoring wells in the riparian buffer indicated that the buffer was effective at nitrogen removal from groundwater, but was not effective at phosphorus removal.
- Annual sampling has documented that the abundance and diversity of the macroinvertebrate community at several sites in Long Creek has been increasing, indicating an improving trend in water quality.
- Monitoring of a small wetland, constructed along an urban stream, documented decreases in the concentrations of petroleum-related polycyclic aromatic hydrocarbons (PAHs) as water from the stream passed through the wetland. However, the wetland had little effect on combustion-related PAHs.
- Sampling of cropland soil, streambanks and streambeds indicated that cropland had considerably higher total phosphorus levels than streambank or bed material. Storm sampling of two tributaries and Long Creek showed the phosphorus load in suspended sediment was an order of magnitude greater than for bedload sediment.

At least 1.5 years of background or pretreatment water quality monitoring are required to document the effectiveness of nonpoint source controls; however, the start of a project and the initiation of monitoring often prompt landowners to implement improved management practices. Therefore, a concerted effort to explain the timeline of the study must be made prior to the start of monitoring.

Section B - Chapter 8
Catawba River Subbasin 03-08-37
Catawba Creek and Crowders Creek

8.1 Subbasin Overview

Subbasin 03-08-37 at a Glance

Land and Water Area

Total area:	106mi²
Land area:	105mi²
Water area:	1mi²

Population Statistics

2000 Est. Pop.:	55,232 people
Pop. Density:	516 persons/mi²

Land Cover (percent)

Forest/Wetland:	63%
Surface Water:	1%
Urban:	15%
Agriculture:	21%

Counties

Cleveland and Gaston

Municipalities

Bessemer City, Gastonia and Kings Mountain

This subbasin contains the Catawba and Crowders Creek watersheds which flow through Kings Mountain and the Southern Outer Piedmont ecoregions. Much of the subbasin is forested, but there are also substantial urban areas. The population in this area is not expected to grow as rapidly as in other areas of the Catawba River basin (Table A-6), but urban stormwater remains a significant concern.

There are six facilities in this subbasin required to monitor effluent toxicity. Five of these facilities have had one or more failing tests since 1997: Gastonia/Catawba Creek WWTP (3 failures), FMC Corp. (formerly Lithium Corp. (3)), Rhodia Inc. (4), CR Industries (3), and Textron, Inc. (7).

There were 11 benthic macroinvertebrate community samples and two fish community samples (Figure B-8 and Table B-16) collected during this assessment period. Two sites remained the same and 11 sites were sampled for the first time during this assessment period. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

There are two ambient monitoring sites located in this subbasin: Lake Wylie at NC 49 and Crowders Creek at SC 564. Catawba Creek has shown a steady decrease in conductivity since the middle 1980s; whereas, Crowders Creek has shown elevated conductivity and nitrogen levels since the early 1990s. Catawba Creek has shown slightly decreased total phosphorus concentrations since the late 1970s, while dissolved oxygen concentrations have decreased since the late 1970s. Point source dischargers have historically contributed to severe problems in Crowders Creek.

Waters in Part 8.3 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Figure B-8 Catawba River Subbasin 03-08-37

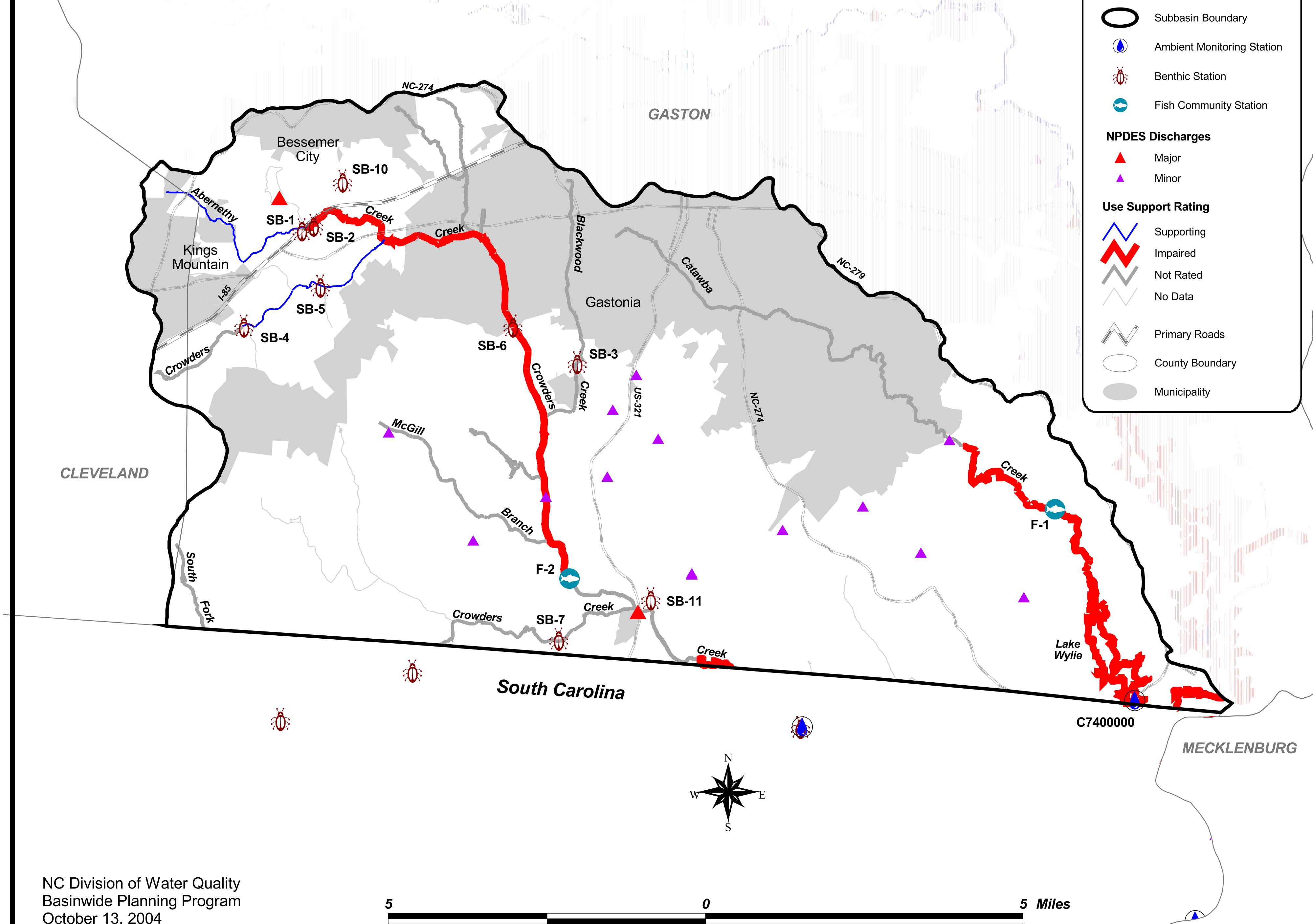

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Table B-16 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-37

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Abernethy Creek	11-135-4a	C	3.2 mi.	AL	SB-1 NI--02			S	ST
Abernethy Creek	11-135-4b	C	1.8 mi.	AL	SB-2 F--02			I	ST
Blackwood Creek	11-135-7	C	4.4 mi.	AL	SB-3 NR--02			NR	-
Catawba Creek	11-130c	C	4.9 mi.	AL	F-1 F--02			I	NS
Crowders Creek	11-135a	C	1.9 mi.	AL	SB-4 NR--02			NR	PS
Crowders Creek	11-135b	C	3.1 mi.	AL	SB-5 GF--02			S	PS
Crowders Creek	11-135c	C	3.3 mi.	AL	SB-6 F--02			I	PS
Crowders Creek	11-135d	C	7.3 mi.	AL	F-2 F--02			I	PS
Crowders Creek	11-135g	C	1.5 mi.	AL	B-1 F--02	C8660000 nce		I	PS
South Fork Crowders Creek	11-135-10	C	5.7 mi.	AL	SB-7 GF--02 SB-8 F--02 SB-9 GF--02			NR	PS
Blackwood Creek	11-135-7	C	4.4 mi.	REC			Special Fecal Coliform TMDL Study	I	-
Crowders Creek	11-135a	C	1.9 mi.	REC			Special Fecal Coliform TMDL Study	I	-
Crowders Creek	11-135b	C	3.1 mi.	REC			Special Fecal Coliform TMDL Study	I	-
Crowders Creek	11-135c	C	3.3 mi.	REC			Special Fecal Coliform TMDL Study	I	-
Crowders Creek	11-135d	C	7.3 mi.	REC			Special Fecal Coliform TMDL Study	I	-
Crowders Creek	11-135e	C	1.5 mi.	REC			Special Fecal Coliform TMDL Study	I	-

Table B-16 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-37

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Crowders Creek	11-135f	C	1.4 mi.	REC			Special Fecal Coliform TMDL Study	I	-
Crowders Creek	11-135g	C	1.5 mi.	REC		C8660000 ce	Special Fecal Coliform TMDL Study	I	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey
B - Benthic Community Survey
SB - Special Benthic Community Study

Bioclassifcations:
E - Excellent
NI - Not Impaired
G - Good
GF - Good-Fair
F - Fair
P - Poor

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Use Support Ratings 1998:
FS - fully supporting, ST - supporting but threatened
PS - partially supporting, NS - not supporting

Use support ratings are summarized in Part 8.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 8.3 below. Waters with notable impacts and water quality issues related to the entire subbasin are discussed in Parts 8.4 and 8.5. Refer to Appendix III for use support methods and more information on all monitored waters.

8.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-37 were assigned for aquatic life, fish consumption, recreation and water supply. All waters in the subbasin are considered Impaired on an Evaluated basis because of a fish consumption advice (Section A, Chapter 4, Part 4.10). Refer to Table B-17 for a summary of use support ratings by use support category for waters in the subbasin. Table B-17 does not include freshwater acreage associated with Lake Wylie to avoid duplication between subbasins. Lake Wylie's entire acreage is included in Table B-10.

Table B-17 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-37

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	6.3 mi	0	0	0
Impaired	18.8 mi	0	24.4 mi.	0
Not Rated	23.6 mi	0	0	0
Total	**48.7 mi**	**0**	**24.4 mi**	**0**
Unmonitored Waters				
Supporting	0	0	0	0.
Impaired	0	84.4 mi	0	0
Not Rated	11.4 mi	0	0	0
No Data	24.2 mi	0	59.9 mi	0
Total	**35.6 mi**	**84.4 mi**	**59.9 mi**	**0**
Totals				
All Waters	**84.4 mi**	**84.4 mi**	**84.4 mi**	**0**

Note: All waters include monitored, evaluated and waters that were not assessed.

8.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

8.3.1 Catawba Creek [AU# 11-130a, 11-130b, and 11-130c]

Current Status and 2004 Recommendations
Catawba Creek, a tributary to Lake Wylie, drains the south and southeast area of the City of Gastonia and southeastern Gaston County. The 13.5 miles from its source to Lake Wylie appear on the state's 303(d) list as Impaired because of urban runoff, storm sewers and municipal point source discharges.

The City of Gastonia's 9 MGD WWTP, which previously discharged to Catawba Creek, no longer discharges into this watershed. Eliminating this discharge decreased the conductivity in the stream from 293 µmhos/cm in 1997 to 148 µmhos/cm in 2002. Four smaller NPDES permitted dischargers continue to operate, but there are no longer any major (>1 MGD) dischargers in the watershed. At site F-1, the stream and riparian zones are degraded by poor land use and livestock have access to the stream.

Catawba Creek is in a very similar condition to Long Creek (subbasin 03-08-36) prior to the restoration activities described in Section B, Chapter 7. Poor land use activities, livestock access, and an urbanizing watershed all suggest that Catawba Creek would benefit from a restoration program modeled after the Long Creek project. DWQ will work with interested parties to provide guidance and secure funding for such a project.

8.3.2 Crowders Creek [AU# 11-135a, 11-135b, 11-135c, 11-135d, 11-135e, 11-135f, and 11-135g]

Current Status and 2004 Recommendations
Crowders Creek, also a tributary to Lake Wylie, drains the south and western region of the City of Gastonia, the Interstate 85 corridor, and the eastern area of the Town of Kings Mountain. The entire 15.8-mile creek is listed as Impaired in the state's 303(d) list due to high fecal coliform concentrations from urban runoff, storm sewers and point source discharges. Data also indicate the biological community is Impaired. The South Carolina portions of the creek are Impaired because of poor biological communities and high fecal coliform concentrations. SCDHEC is providing information to assist DWQ in this TMDL development. As a by-product of this project, SCDHEC will receive an updated version of the Catawba WARMF model.

DWQ met with representatives of the City of Gastonia and the Gaston County Cooperative Extension Services in 2001 to discuss the development of a Crowders Creek TMDL. As a result of that meeting, the organizations agreed to conduct two intensive surveys of fecal coliform in the Crowders Creek watershed. The studies concluded that widespread water quality problems exist in the watershed and fecal coliform concentrations exceed the state standard in many locations. However, because of upgrades to a lithium ore processing plant and the removal of the Kings Mountain WWTP, Bessemer City WWTP and a chicken rendering plant, the studies did not note the severe water quality problems documented in the late 1980s.

A benthic macroinvertebrate sample at the SC 564 site in 1988 was rated Poor. Although the rating improved to Fair in 1989 and Good-Fair in 1992, site B-1 has been rated Fair since 1997.

One facility implicated in the degraded water quality was the Carolina and Southern Processing plant. Approximately three years ago, this facility tied onto the City of Gastonia's WWTP and has ceased its direct discharge to Crowders Creek. Additionally, in the spring of 2002, the Bessemer City WWTP ceased its 1.5 MGD discharge to Abernethy Creek (a tributary to Crowders Creek) and now sends waste to Gastonia's recently upgraded WWTP. These changes may have been responsible for the slight improvement in the biological community in Crowders Creek.

The final product of these studies is a fecal coliform TMDL scheduled for public notice in the first quarter of 2004. The TMDL evaluates the contribution of both point and nonpoint sources and attempts to determine the percentage by which various types of sources (urban, agriculture, WWTP, etc.) contribute to the degradation of Crowders Creek. Initial results show that urban runoff contributes nearly two-thirds of the total fecal coliform load, versus one-third by agriculture and WWTPs combined. This finding indicates that Crowders Creek would likely benefit from a management plan that reduces the detrimental effects of urbanization. For more information on management suggestions for urbanizing watersheds, please refer to Section A, Chapter 4, Part 4.11. Additionally, DWQ encourages implementation of agriculture BMPs wherever possible. Even though agriculture does not constitute the largest source of fecal coliform bacteria in this watershed, eliminating cattle access to streams will provide substantial protection to stream habitat and assist in the reduction of overall fecal coliform concentrations (see Section C, Chapter 1 for funding assistance sources).

8.3.3 Unnamed Tributary to Crowders Creek [AU# 11-135-8.5]

Current Status and 2004 Recommendations

The entire 0.4-mile segment of this stream from its source to Crowders Creek is listed as Impaired for unknown causes. The biological sampling strategy for the Crowders Creek TMDL described above included a site on this stream. DWQ biologists noted poor instream habitat, possible toxicity, and evidence of nutrient enrichment. Given its direct connection to Crowders Creek, DWQ feels improvements to this stream will be best addressed through implementation plans developed for the Crowders Creek TMDL.

8.3.4 McGill Creek [AU#11-135-2]

Current Status and 2004 Recommendations

McGill Creek, a tributary to Crowders Creek, is listed on the state's 303(d) list as Impaired for unknown causes (2.4 miles). Kings Mountain has ceased operation of a wastewater treatment plant that once discharged into this creek and had an instream waste concentration limit of 100 percent. This means that, at times, the discharge from the WWTP could have comprised the entire flow in the stream. Biologists attempting to sample McGill Creek for inclusion in the Crowders Creek TMDL study were unable to locate any water in the stream, instead finding only a dry ditch. McGill Creek was therefore not sampled. Because the WWTP no longer operates and the stream appears to be intermittent, DWQ has no plans to sample this creek again and will recommend it be removed from the 303(d) list.

8.3.5 Abernethy Creek [AU# 11-135-4b]

Current Status and 2004 Recommendations

Abernethy Creek receives runoff from I-85 and discharges from a lithium ore processing plant. The stream was originally rated Fair in 1987, but improved to Good-Fair as upgrades to the plant were completed. Site SB-2 may have been rated Fair in 2002 because of the drought and consequent reduction in dilution of the plant discharge. Therefore, 1.75 miles from First Creek to Crowders Creek are currently Impaired in support of aquatic life. DWQ should continue to monitor the impacts of the discharge on the biological community in Abernethy Creek and work with the discharger to determine if any additional upgrades are necessary. Installation of BMPs to reduce the impact of land use activities along the upper section may also help restore this stream.

8.3.6 Lake Wylie [AU# 11-(117), 11-(122), and 11-(123.5)]

The area covered by Lake Wylie overlaps the boundaries of subbasins 03-08-34, 03-08-36 and 03-08-37. Therefore, a detailed discussion on Lake Wylie can be found in Section A, Chapter 4, Part 4.7.3. This reservoir was most recently monitored in 2001 and 2002 and was classified as eutrophic. Percent oxygen saturation at the surface exceeded 120 percent in approximately 50 percent of the measurements lake wide. Nutrient concentrations ranged from moderate to elevated with particularly high levels of total phosphorus and total Kjeldahl nitrogen in the Crowders Creek arm. This arm also had elevated total phosphorus concentrations in 1997. However, as a result of the City of Gastonia decommissioning its Catawba Creek WWTP and redirecting this effluent to the improved Long Creek WWTP, the Crowders Creek arm has shown an overall decrease in total phosphorus and total nitrogen. Despite these improvements, there are still severe nutrient and dissolved oxygen concerns in the reservoir. Because chlorophyll *a* concentrations violate the state standards, Lake Wylie is considered Impaired for aquatic life.

8.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

8.4.1 South Fork Crowders Creek [AU# 11-135-10]

Current Status and 2004 Recommendations

South Fork Crowders Creek was sampled as part of an intensive sampling effort to support TMDL development for Crowders Creek. Sites SB-7, SB-8 and SB-9 received Good-Fair, Fair and Good-Fair bioclassifications, respectively. The use support rating for this stream is Not Rated because of the inconclusive bioclassifications. However, the habitat at all these sites showed significant impact from non point source runoff. The riparian buffer is narrow and the stream substrate is heavily embedded by sand and silt. The conditions in this stream will not improve and may further decline is nonpoint sources of pollution in the watershed are not reduced. This stream should be included in any management strategy developed for Crowders Creek. See section 8.3.2 above.

8.5 Additional Water Quality Issues within Subbasin 03-08-37

Subbasins in and around the Greater Charlotte Metropolitan Area are experiencing rapid growth as new homes and businesses sprout up on old farms and forests. This development places intense pressure on the sensitive stream communities within those watersheds. In order to prevent aquatic habitat degradation and Impaired biological communities, protection measures should be put in place immediately. Refer to Section A, Chapter 4, Part 4.11 for a description of urban stream water quality problems and recommendations for reducing impacts and restoring water quality.

Section B - Chapter 9
Catawba River Subbasin 03-08-38
Sixmile Creek, Twelvemile Creek and Waxhaw Creek

9.1 Subbasin Overview

Subbasin 03-08-38 at a Glance

Land and Water Area

Total area:	179mi^2
Land area:	178mi^2
Water area:	1mi^2

Population Statistics

2000 Est. Pop.:	48,660 people
Pop. Density:	277 persons/mi^2

Land Cover (percent)

Forest/Wetland:	61%
Surface Water:	1%
Urban:	4%
Agriculture:	35%

Counties

Mecklenburg and Union

Municipalities

Charlotte, Indian Trail, Marvin, Mineral Springs, Monroe, Stallings, Waxhaw, Weddington and Wesley Chapel

This small subbasin includes portions of two ecoregions – the Southern Outer Piedmont and the Carolina Slate Belt. These tributaries to the Catawba River in South Carolina have very low flows during the summer and may stop flowing during drought periods. Much of the subbasin is forested, but a greater percentage of the land is classified as cultivated than in any other subbasin. This is changing rapidly, however, as residential communities expand into the area. Union County has the highest expected population growth rate of any in the basin. The county population is expected to increase by more than 40 percent in the next 20 years (Table A-6 and A-7).

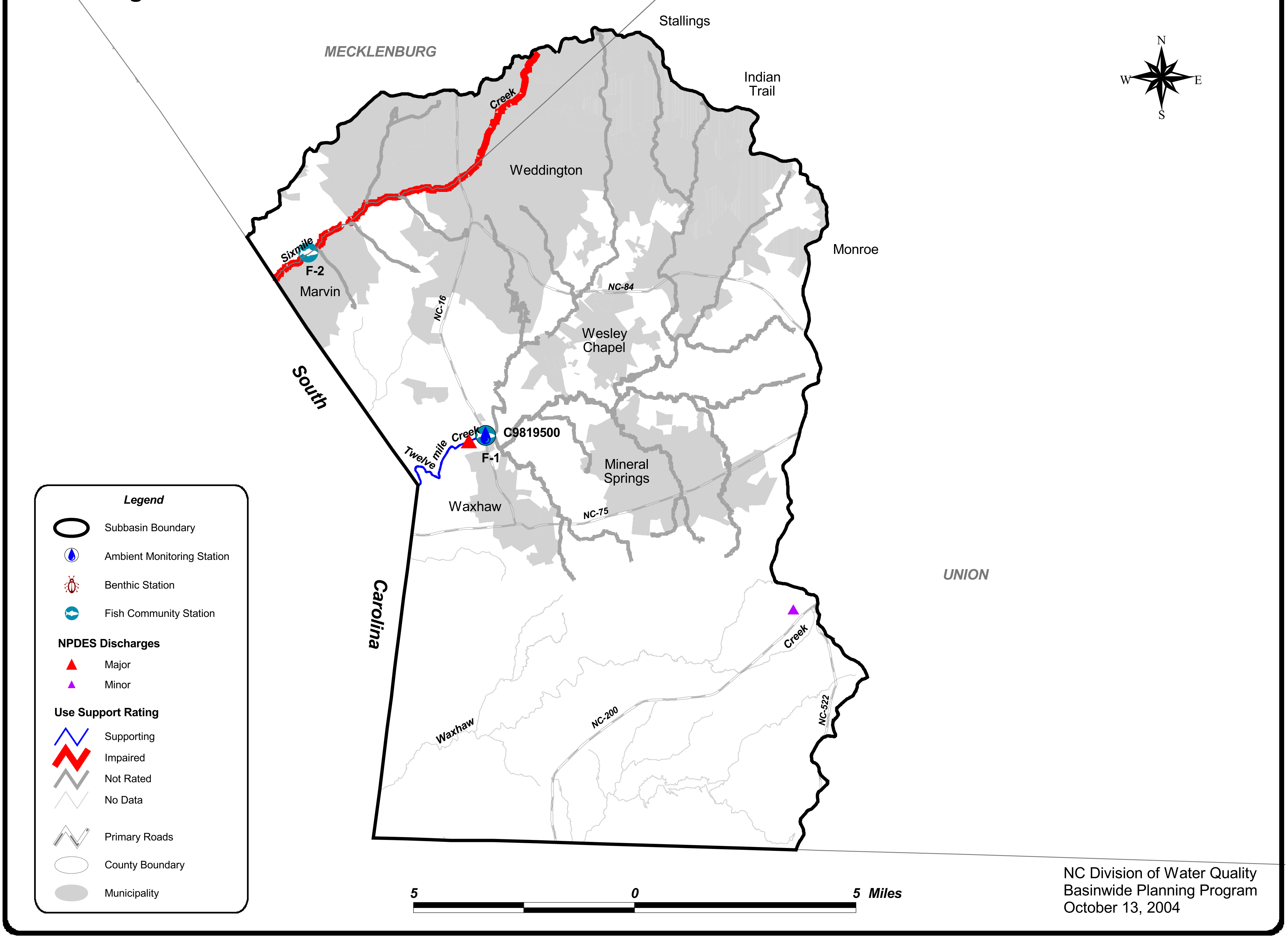
Major dischargers in this subbasin include the Union County/Sixmile Creek (1.0 MGD) and Twelvemile Creek WWTPs (2.5 MGD). There are two facilities in this subbasin which are required to monitor effluent toxicity. Since 1997, the Union County/Sixmile Creek WWTP failed two tests and the Union County/Twelvemile Creek WWTP failed three tests.

No benthic macroinvertebrate community samples and two fish community samples (Figure B-9 and Table B-18) collected during this assessment period. Both sites were sampled for the first time during this assessment period. Refer to *2003 Catawba River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Section A, Chapter 3 for more information on monitoring.

There is only one ambient monitoring site in this subbasin: Twelvemile Creek at NC 16. This site has exhibited elevated conductivity since the early 1990s; other parameters have remained stable since monitoring began in the early 1980s.

Nonpoint source runoff is a major source of water quality degradation in this subbasin. However, acute and prolonged lack of flows during the summer intrinsically limits the diversity of the aquatic life. No benthic macroinvertebrate samples have been collected from this subbasin since 1992. Benthic macroinvertebrates have been collected only six times from three locations since 1983. Four of the collections were made in the winter and early spring when flows were the highest. Twelvemile and Waxhaw Creeks were last rated Good-Fair in the early 1990s. The fish community in Twelvemile Creek declined from Good in 1997 to Good-Fair in 2002, while Sixmile Creek maintained its Fair rating in 2002.

Figure B-9 Catawba River Subbasin 03-08-38



NC Division of Water Quality
Basinwide Planning Program
October 13, 2004

Table B-18 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-38

Waterbody	Assessment Unit Number	DWQ Classification	Length / Area	Category	Data Type with Map Number and Data Results			Use Support Rating	
					Biological	Ambient	Other	2004	1998
Sixmile Creek	11-138-3	C	8.8 mi.	AL	F-2 F--02			I	-
Twelvemile Creek	11-138	C	3.0 mi.	AL	F-1 GF-02	C9819500		S	-
Twelvemile Creek	11-138	C	3.0 mi.	REC		C9819500		NR	-

Assessment Unit Number - Portion of DWQ Classified Index where monitoring is applied to assign a use support rating.

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
F - Fish Community Survey

Bioclassifcations:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor

Ambient Data
nce - no criteria exceeded
ce - criteria exceeded

Use Support Ratings 2004:
S - Supporting, I - Impaired, NR - Not Rated

Waters in Parts 9.3, 9.4 and 9.5 are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Use support ratings are summarized in Part 9.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 9.3 below. Supporting waters with noted water quality impacts are discussed in Part 9.4 below. Other water quality issues are discussed in Part 9.5. Refer to Appendix III for use support methods and more information on all monitored waters.

9.2 Use Support Assessment Summary

Use support ratings in subbasin 03-08-38 were assigned for aquatic life, fish consumption, recreation and water supply. All waters in the subbasin are considered Impaired on an Evaluated basis because of a fish consumption advice (Section A, Chapter 4, Part 4.10). All water supply waters are Supporting on an Evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-19 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-19 Summary of Use Support Ratings by Use Support Category in Subbasin 03-08-38

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	3.0 mi	0	0	0
Impaired	8.8 mi	0	0	0
Not Rated	13.6 mi	0	3.0 mi	0
Total	**25.4 mi**	**0**	**3.0 mi**	**0**
Unmonitored Waters				
Supporting	0	0	0	0
Impaired	0	166.4 mi	0	0
Not Rated	74.0 mi	0		0
No Data	67.0 mi	0	163.4 mi	0
Total	**141.0 mi**	**166.4 mi**	**163.4 mi**	**0**
Totals				
All Waters	**166.4 mi**	**166.4 mi**	**166.4 mi**	**0**

Note: All waters include monitored, evaluated and waters that were not assessed.

9.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were identified in the 1999 basin plan as Impaired or are newly Impaired based on recent data. The current status and recommendations for addressing these waters are presented below. These waters are identified by assessment unit number (AU#). Refer to the overview above for more information on AUs.

9.3.1 Sixmile Creek [AU# 11-138-3]

Sixmile Creek flows along the border between Mecklenburg and Union counties and drains the southeast and southwest portions of each county, respectively. The 8.8-mile segment from its source to the NC/SC border is Impaired for aquatic life because of a Fair bioclassification at site F-2. The South Carolina portion is Impaired because of elevated fecal coliform levels.

1999 Recommendations
DWQ recommended that the two remaining dischargers not connected to Charlotte Mecklenburg Utilities sewer lines perform an Engineering Alternative Analysis (EAA). DWQ stated that the stream was too small to rate and would not be sampled during the next assessment period.

Current Status and 2004 Recommendations
Since the 1999 plan, all NPDES point sources have been removed from Sixmile Creek. Charlotte-Mecklenburg Utilities Department constructed the collection system in the watershed and purchased the private wastewater collection systems. Therefore, EAAs are no longer applicable. DWQ biologists also determined that while the creek was too small in late summer to rate using benthic methodologies, a fish community analyses performed in the wetter spring season is appropriate. DWQ, therefore, again sampled this creek in 2002.

Despite the removal of all NPDES discharges, Sixmile Creek received the highest conductivity rating of any stream in the basin during the 2002 sampling effort. It was also noted that cattle had access to the stream. These two points and the natural low flow state of this stream indicate its sensitivity to nonpoint source runoff. DWQ encourages Union County to develop management strategies that address runoff in this developing watershed. Please refer to Section A, Chapter 4, Part 4.11 for more suggestions on land use planning. DWQ will work with local resource agencies to implement agricultural BMPs for cattle exclusion.

9.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not Impaired, attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement. Waters in the following section are identified by assessment unit number (AU#). See overview for more information on AUs.

9.4.1 Twelvemile Creek [AU# 11-138]

<u>Current Status and 2004 Recommendations</u>
The watershed of Twelvemile Creek abuts the Crooked Creek watershed in the Yadkin-Pee Dee River basin. There are no NPDES facilities within the watershed. The South Carolina portion of the stream is Impaired because of copper, turbidity and fecal coliform concentrations.

From 1997 to 2002, the bioclassification at site F-1 declined from Good to Good-Fair, and no pollution intolerant species were found. Additionally, suspended sediment from the West Fork Twelvemile Creek colored the entire Twelvemile Creek channel. A study should be conducted to compare fish populations and habitat in the East and West Forks of Twelvemile Creek to the mainstem in hopes of determining the primary stressors in this watershed. In the meantime, DWQ encourages Union County to develop management strategies that address runoff in this developing watershed. Please refer to Section A, Chapter 4, Part 4.11 for more suggestions on land use planning.

9.5 Additional Water Quality Issues within Subbasin 03-08-38

9.5.1 Waxhaw Creek [AU# 11-139]

<u>Current Status and 2004 Recommendations</u>
The Catawba Lands Conservancy (CLC) identified Waxhaw Creek in Southwest Union County as a priority for land protection efforts because it is the only stream in the Catawba River basin that supports populations of the federally endangered Carolina heelsplitter mussel. A total of only six populations of this mussel occur in the entire world, including one other North Carolina population in Goose Creek, in the Yadkin-Pee Dee River basin. Perhaps the single most important factor in the conservation of the Carolina heelsplitter is protecting the water quality of their creek habitats, including the use of forested buffers and prevention of siltation and other sources of pollution.

Funded by a grant from the NC Clean Water Management Trust Fund and the Conservation Trust for North Carolina, the Conservancy conducted a study of the integrity of the stream corridor and identified areas most important for conservation and restoration activities. DWQ supports the work being conducted by CLC and will assist in any way possible to protect this unique resource. DWQ also encourages Union County to develop management strategies that address runoff in this developing watershed. Please refer to Section A, Chapter 4, Part 4.11 for more suggestions on land use planning.

The downstream portion of Waxhaw Creek in South Carolina is Impaired because of elevated copper and fecal coliform concentrations. Consequently, in the future, North Carolina will be subject to an interstate TMDL. DWQ will work cooperatively with South Carolina as they develop a TMDL for Waxhaw Creek.

Section C

Current and Future Water Quality Initiatives

1.1 Workshop Summaries

In September 2003, there were three workshops held by DWQ in the Catawba River basin in the towns of Dallas, Hickory and Newton. There were 112 people in attendance representing a variety of interests. Figure C-1 gives an estimation of groups/interests represented based on information recorded on attendance sheets.

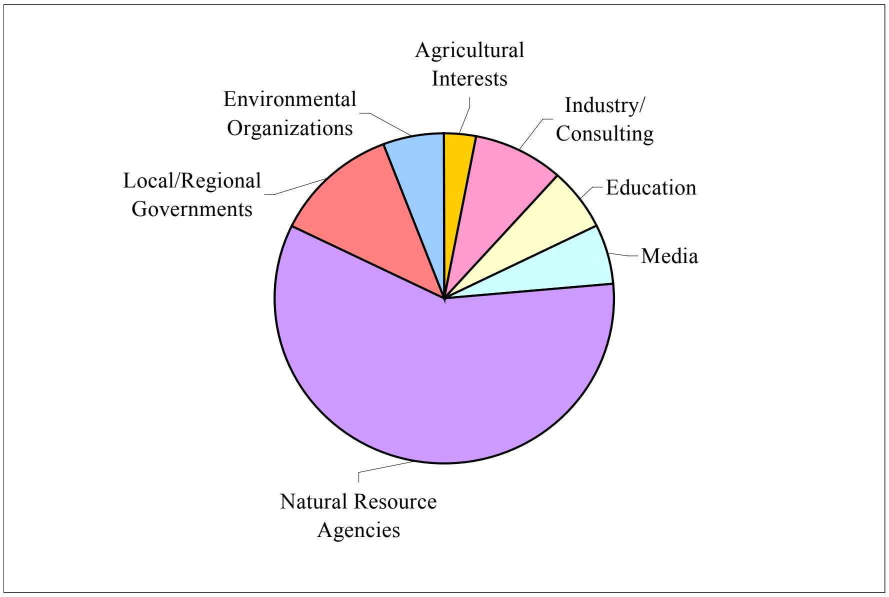


Figure C-1 Total Attendance by Various Interests at DWQ Water Quality Workshops in the Catawba River Basin (2002)

DWQ staff gave presentations about general water quality in the Catawba River basin, basinwide planning and the Wetlands Restoration Program (since reorganized as Ecosystem Enhancement Program, or EEP). Participants at each workshop also gave brief presentations about local water quality initiatives. Workshop attendees were asked to discuss the following questions in small groups:

1. What are the main threats to water quality in the Catawba River basin?
2. Where are the problem areas or waters?
3. What recommendations do you have for addressing these problems/waters?
4. What local agencies or organizations should be involved in addressing the problems?

A detailed outline of each small group's discussion of these questions is available upon request. Good discussion was generated at each workshop, and all of the information was considered and, in some cases, incorporated into this draft plan. The most frequently cited threats to water quality identified by workshop participants are discussed below.

Important Issues Basinwide

The most important issues identified by workshop participants were related to development and nonpoint sources of pollution. Increasing urbanization was a concern identified throughout the basin. Losses of forestland and wetlands, increases in nutrient loading from many sources, and stormwater runoff were identified as threats to water quality at the workshops. Issues related to enforcement of existing rules and monitoring, lack of BMP maintenance, mercury contamination, and better drought planning were also of concern. Refer to Appendix V for summary tables from the workshops.

1.2 Federal Initiatives

1.2.1 Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration projects. USEPA, the granting agency, allocates approximately $4.6 million for Section 319 in North Carolina; three quarters of which the state designates to competitively selected projects. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution. Information on the North Carolina Section 319 Grant Program, including application deadlines and requests for proposals, is available online at http://h2o.enr.state.nc.us/nps/.

From 1992-2004, approximately $1,427,000 was allocated by the Section 319 Program to initiate or complete projects in the Catawba River basin. These projects include land acquisition, stream restoration and education. The projects vary greatly in scope and scale, many having basinwide applications. Descriptions of the projects listed below and other Section 319 Program information are available at http://h2o.enr.state.nc.us/nps/319.htm.

Table C-1 Projects Funded Through Clean Water Act Section 319

FY	Project Name	Agency	Project Area	Total Amount Funded
1992	Long Creek Monitoring	Gaston County	Agriculture	190,000
1994	Long Creek-Agriculture BMP Evaluation	NCSU	Agriculture	157,500
1995	Catawba River Land Acquisition	City of Morganton	Watershed Protection	250,000
1995	Long Creek Watershed Project	NCCES	Agriculture	354,298
1997	Catawba River Basin Buffers	NCSU-NRLI	General	25,282
1998	South Fork Catawba River	NCSU	Urban Stormwater	88,392
1998	Caldwell County Rain Garden and Streambank Stabilization	NCSU CES, BAE	Urban Stormwater	10,800
2000	Stream Restoration Project in Gaston County (New Hope Branch)	Gaston County NRCD	Wetlands and Hydrologic Modification	68,137
2000	Demonstration of Low Impact Development (LID) Strategies for NPS Pollution Prevention and Stream Restoration in the Catawba River Basin	UNC-Charlotte	Urban Stormwater	180,000
2001	Mountain Island Reservoir (MIR) BMPs Education State Forest	DFR	Forestry	103,108

1.2.2 USDA EQIP

The Environmental Quality Incentives Program (EQIP) was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants to install or implement structural and management practices on eligible agricultural land.

EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices to a maximum term of ten years. These contracts provide incentive payments and cost shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to an environmental quality incentives program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions. The local conservation district approves the plan.

EQIP may cost share up to 75 percent of the costs of certain conservation practices. Incentive payments may be provided for up to three years to encourage producers to carry out management practices they may not otherwise use without the incentive. However, limited resource producers and beginning farmers and ranchers may be eligible for cost shares up to 90 percent. Farmers and ranchers may elect to use a certified third-party provider for technical assistance. For application information, refer to any county extension office or visit the website at http://www.nc.nrcs.usda.gov/programs/EQIP/.

1.3 State Initiatives

1.3.1 NC Agriculture Cost Share Program

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

Soil and Water Conservation District contacts for the Catawba River basin are included in Appendix VI or visit the website at http://www.enr.state.nc.us/DSWC/pages/agcostshareprogram.html for more information.

1.3.2 Ecosystem Enhancement Program (Formerly Wetlands Restoration Program)

In July 2003, the NC Wetlands Restoration Program (WRP) was officially merged with compensatory mitigation resources of the NCDOT to become the Ecosystem Enhancement Program (EEP). EEP is administered as a new program area within NCDENR and has essentially replaced the WRP. EEP's central mission includes the same goals of the former WRP. The Memorandum of Agreement of July 2003 between NCDENR, NCDOT and the Army Corps of Engineers further stipulates that EEP mitigation projects will be: 1) provided in advance of the permitted NCDOT impacts; 2) designed to address functional replacement of stream, buffer and wetlands impacts; and 3) identified and implemented within the context of a watershed approach based on multiple scales of planning.

The EEP planning approach will continue to include the development of *Watershed Restoration Plans* on a basinwide scale, GIS-based screening analyses of 8-digit cataloguing units (CUs), and local watershed planning (LWP) initiatives applied at the scale of 14-digit hydrologic units (HUs) and component subwatersheds. A new *Planning Guide* will be prepared in 2004 to describe the updated EEP approach to watershed restoration planning at these various scales, including the selection of *Targeted Local Watersheds*, which will continue to play a key role in our program's watershed restoration strategies.

EEP is a nonregulatory program responsible for implementing wetland and stream restoration projects throughout the state. The focus of the program is to improve watershed functions in the 17 river basins across the state by restoring wetlands, streams and riparian buffers within selected local watersheds. These vital watershed functions include water quality protection, floodwater retention, fisheries and wildlife habitat, and recreational opportunities. The EEP is not a grant program. Instead, the program funds local restoration projects directly through the Wetlands Restoration Fund.

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

The selection of Targeted Local Watersheds (at the scale of NRCS 14-digit Hydrologic Units, or HUs) does not necessarily restrict the location of EEP restoration project sites. However, these targeted HUs are given higher priority than nontargeted HUs in considering the selection of EEP candidate restoration project sites. Targeted Local Watersheds are simply local watersheds where stream, wetland and riparian buffer restoration projects will make the most sense in the context of overall watershed and wetlands protection.

The EEP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example, the EEP's efforts can complement projects funded through the Section 319 Program. Integrating wetlands or riparian area restoration components with

Section 319-funded or proposed projects will often improve the overall water quality and habitat benefits of the project. The EEP actively seeks landowners within the Catawba River basin that have restorable wetland, riparian and stream sites.

Table C-3 below lists the EEP's Targeted Local Watersheds [stream names and 14-digit HU codes] in the Catawba River basin. This table also indicates the pertinent factors that led to the selection of each Targeted Local Watershed. The Targeted Local Watersheds are selected on the basis of available data indicating the need and opportunity for local stream and wetlands restoration projects. Factors such as water quality problems, degraded aquatic habitat, cleared riparian buffers, significant natural areas or species, and increasing development pressures in the watershed are weighted heavily in determining these priority watersheds. Also, the presence of existing or planned water quality or habitat restoration projects in the same local watershed can be a significant factor in the choice of these watersheds. In some cases, EEP has used the water quality information alone (e.g., use impairment, potential increases in nonpoint source pollution) to support the selection of a specific Targeted Local Watershed. Targeted local watersheds are presented in Figure C-2.

The EEP is also working to develop comprehensive Local Watershed Plans within certain Targeted Local Watersheds identified in the Watershed Restoration Plans. These locally-based plans develop comprehensive watershed assessments to identify causes and sources of nonpoint source impairment. They also identify and prioritize wetland areas, stream reaches, riparian buffer areas, and best management practices that will provide significant water quality and habitat improvements and other environmental benefits to local watersheds. The EEP will coordinate with local community groups, local governments and others to develop and implement these plans.

Selection of a watershed as a Targeted Local Watershed does not mean that a Local Watershed Plan will be initiated in that area. Local Watershed Plans are developed in areas that have extensive future mitigation needs, while Targeted Local Watersheds are selected as part of the EEP planning process for the Basinwide Watershed Restoration Plans.

The plans also identify and prioritize wetland areas, stream reaches, riparian buffer areas, and best management practices that will provide significant water quality improvement and other environmental benefits to the local watershed. There are currently two local watershed planning efforts underway in the Catawba River basin and each are described below.

For more information about the EEP and its Watershed Restoration Plans, please call (919) 715-0476 or visit the EEP website at http://www.nceep.net/.

Catawba Local Watershed Plans

Charlotte Area Local Watershed Plan

In 2002, the EEP initiated the Charlotte Area Local Watershed Plan in conjunction with Charlotte Storm Water Services, Mecklenburg Storm Water Services, Charlotte-Mecklenburg Utilities Department, and Mecklenburg Department of Environmental Protection. The 251-square mile planning area included Little Sugar, Long, McDowell, Irwin, Sugar and McAlpine Creeks, all listed on North Carolina's 2002 303(d) Impaired stream list. The primary purpose of this study was to identify stream and wetland restoration opportunities as well as potential stormwater and nonpoint source pollution Best Management Practices that could be implemented in the study area to address water quality problems and habitat degradation. The EEP contracted with CH2MHill to conduct a detailed watershed assessment that involved compiling existing water quality, habitat and land use data and using this information to assess the health of 318 individual catchments (<1 square mile) across the study area. CH2MHill also developed a calibrated water quality model for the study area to predict total suspended solids, phosphorus and zinc concentrations and loadings under alternative management scenarios.

Based on the assessment data, the stakeholders selected five small focus areas or grouping of catchments (0.5 to 7 square miles) for detailed field assessment. The focus areas represented various land use patterns found across the study area from urban built-out areas to suburban areas under development. The field assessments evaluated restoration project opportunities including stream and wetland restoration as well as stormwater and water quality BMPs. The Local Watershed Plan provides detailed information about the recommended projects including cost and pollutant removal at the project and watershed scale. The plan was completed in August 2003. The EEP is currently focusing project implementation in the McDowell Creek and Long Creek watersheds. For more information about this project, contact Kristin Cozza at (704) 572-0955 or to view the technical reports and watershed plan, visit the website at h2o.enr.state.nc.us/wrp/plans/charlotte.htm.

Lower Creek Local Watershed Plan

In 2003, the EEP initiated a Local Watershed Plan for the Lower Creek Watershed in Burke and Caldwell counties. The Lower Creek watershed (90 square miles) drains the municipalities of Lenoir and Gamewell and includes Zacks Fork, Spainhour Creek, Bristol Creek and Greasy Creek, all on North Carolina's 2002 303(d) list of Impaired streams. The EEP will use the plan to identify and prioritize wetland and stream restoration projects, as well as best management practices to provide water quality and aquatic habitat improvements to the watershed. The watershed characterization, or compilation of existing data about watershed conditions, was completed in December 2003. The detailed watershed assessment, including water quality monitoring and field assessment and restoration plan, is scheduled for completion by June 2005. The EEP will coordinate with local community groups, local governments and others to develop and implement the restoration plan. For more information about the Lower Creek Local Watershed Plan, contact Kristin Cozza at (704) 572-0955.

Targeted Local Watersheds

Table C-2 below lists the EEP's Targeted Local Watersheds [stream names and 14-digit HU codes] in the Catawba River basin. This table also indicates the pertinent factors that led to the selection of each Targeted Local Watershed. The Targeted Local Watersheds are selected on the basis of available data indicating the need and opportunity for local stream and wetlands restoration projects. Factors such as water quality problems, degraded aquatic habitat, cleared riparian buffers, significant natural areas or species, and increasing development pressures in the watershed are weighted heavily in determining these priority watersheds. Also, the presence of existing or planned water quality or habitat restoration projects in the same local watershed can be a significant factor in the choice of these watersheds. In some cases, EEP has used the water quality information alone (e.g., use impairment, potential increases in nonpoint source pollution) to support the selection of a specific Targeted Local Watershed. Targeted local watersheds are presented in Figure C-2.

Table C-2 Ecosystem Enhancement Program Targeted Local Watersheds (2003)

Subbasin	Local Watershed Name and HU code	Impaired Stream(s)[1]	Downward Trend in Water Quality[2]	Public Water Supply[3]	ORW or HQW[4]	Aquatic NHP Elements[5]	Existing, Planned Projects[6]	Municipality(ies); Phase I or II[7]	Local Resource Professional Recommendation[8]
03-08-30	West Fork Catawba 03050101010010	No	No	No	Yes	Yes			
03-08-30	Upper Linville River 03050101030010	No	No	Yes	No	Yes			Yes
03-08-30	Paddy Creek 03050101030030	No	No	Yes	No	No			
03-08-30	North Muddy Creek 03050101040010	Yes	Yes	No	No	Yes	SWCD	Marion Phase II	Yes
03-08-30	South Muddy Creek 03050101040020	No	No	No	No	No	SWCD		Yes
03-08-31	Silver Creek 03050101050050	No	No	Yes	Yes	No		Morganton Phase II	
03-08-31	Lower Johns River 03050101070040	No	No 1997 Data	Yes	Yes	Yes			Yes
03-08-31	Warrior Fork 03050101060020	No	Yes	Yes	Yes	Yes			Yes
03-08-31	Upper Lower Creek 03050101080010	Yes	No	Yes	No	No	LWP	Lenoir Phase II	
03-08-31	Lower Lower Creek 03050101080020	Yes	No	Yes	No	Yes	LWP	Gamewell Phase II	
03-08-31	Irish Creek 03050101060030	Yes	Yes	Yes	No	No			
03-08-31	Hunting Creek 03050101060050	Yes	No 1997 Data	Yes	No	Yes		Morganton Phase II	
03-08-31	Brown Branch 03050101070020	No	No Data	No	Yes	Yes	EEP		
03-08-31	McGalliard Creek 03050101090010	Yes	Yes	Yes	No	No		Valdese Phase II	
03-08-32	Muddy Fork Creek 03050101120030	No	Yes	Yes	No	No			

Table C-2 Ecosystem Enhancement Program Targeted Local Watersheds (2003)

Subbasin	Local Watershed Name and HU code	Impaired Stream(s)[1]	Downward Trend in Water Quality[2]	Public Water Supply[3]	ORW or HQW	Aquatic NHP Elements[5]	Existing, Planned Projects[6]	Municipality(ies); Phase I or II[7]	Local Resource Professional Recommendation[8]
03-08-32	Elk Shoal Creek 03050101130010	No	No	Yes	No	No			
03-08-32	Horseford Creek 03050101090020	No	No Data	No	No	No		Hickory Phase II	
03-08-32	Jumping Run Creek 03050101120040	No	No Data	Yes	No	No	EEP		
03-08-32	Lyle Creek 03050101140010	No	No Data	Yes	No	Yes	EEP		
03-08-33	McDowell Creek 03050101170010	Yes	Yes	Yes	No	No	LWP	Huntersville Phase II	Yes
03-08-34	Long Creek 03050101170020	Yes	No	Yes	No	Yes	LWP	Charlotte Phase I	Yes
03-08-34	Irwin & Sugar Creeks 03050103020020	Yes	Yes	No	No	No	LWP	Charlotte Phase I	Yes
03-08-34	Little Sugar Creek 03050103020030	Yes	Yes	No	No	No	LWP	Charlotte Phase I	Yes
03-08-34	McMullen Creek 03050103020040	No	No	No	No	No	LWP	Charlotte Phase I	Yes
03-08-34	McAlpine Creek 03050103020050	Yes	No	No	No	No	LWP DWQ TMDL	Charlotte Phase I	Yes
03-08-35	Clark Creek 03050102030010	Yes	Yes	No	No	Yes	DWQ WARP Study	Hickory Phase II	
03-08-35	Clark Creek 03050102030020	Yes	Yes	Yes	No	No			
03-08-35	Maiden Creek 03050102030030	Yes	No Data	Yes	No	Yes		Maiden Phase II	
03-08-35	Indian Creek 03050102050010	Yes	Yes	Yes	Yes	No			
03-08-36	Long Creek 03050102070020	No	No	Yes	No	Yes		Gastonia Phase II	

Table C-2 Ecosystem Enhancement Program Targeted Local Watersheds (2003)

Subbasin	Local Watershed Name and HU code	Impaired Stream(s)[1]	Downward Trend in Water Quality[2]	Public Water Supply[3]	ORW or HQW[4]	Aquatic NHP Elements[5]	Existing, Planned Projects[6]	Municipality(ies); Phase I or II[7]	Local Resource Professional Recommendation[8]
03-08-37	Crowders Creek 03050101180010	Yes	No	No	No	No		Gastonia Phase II	
03-08-38	Sixmile Creek 03050101030010	Yes	No	No	No	Yes		Charlotte Phase I	
03-08-38	Twelvemile Creek 03050101030020	No	Yes	No	No	Yes			

1 Stream segments (or entire streams) that do not support their designated uses and are, therefore, considered **impaired** based on declining biological ratings [e.g., due to degraded aquatic habitat] and/or failure to meet NCDWQ water quality standards. As identified in the 2003 Draft Basinwide Water Quality Plan (DWQ, 2003).

2 **Downward Trend in Water Quality** as indicated in the 2003 Draft Basinwide Assessment Report (DWQ, 2003).

3 **Water Supply (WS)** = waters used as water supply sources for drinking, culinary or food processing purposes.

4 **ORW** = outstanding resource waters. **HQW** = high-quality waters, which include critical habitat areas or primary nursery areas.

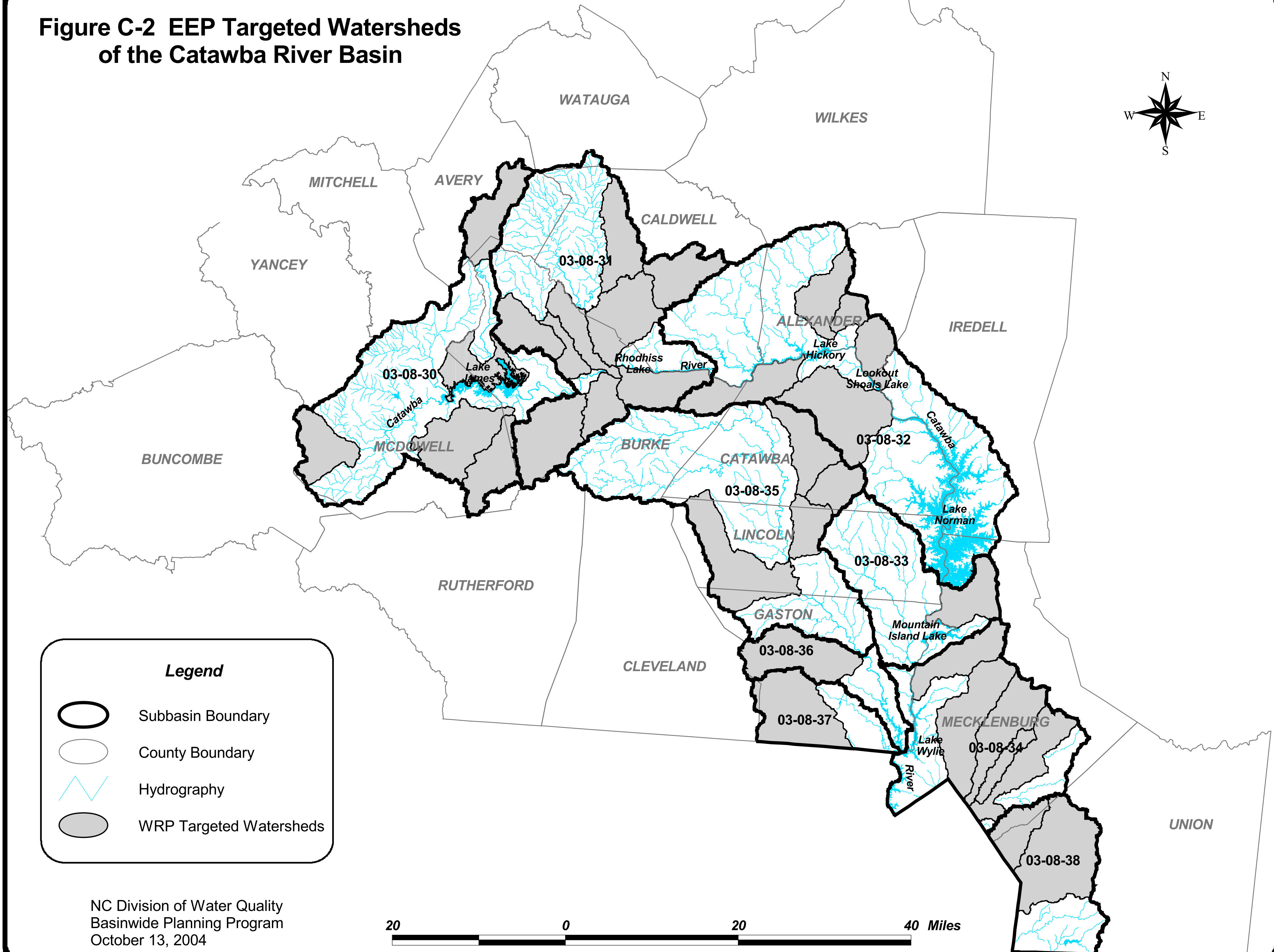
5 **Aquatic Natural Heritage elements** are special species, habitats or community types identified by the NC Natural Heritage Program and that occur, or spend some portion of their life cycle, in wetlands, streams, riparian areas or estuarine waters.

6 **Existing or planned projects** in the following programs: EEP = Ecosystem Enhancement Program; LWP = EEP Local Watershed Plan; CWMTF = Clean Water Management Trust Fund; CES = North Carolina Cooperative Extension Service; 319 = North Carolina Division of Water Quality Section 319 Program; WARP = North Carolina Division of Water Quality Watershed Assessment and Restoration Program.

7 **Associated towns or cities and applicability of NPDES Phase II** stormwater rules, or that are otherwise likely to have significant current or future urban stormwater management issues.

8 **Local Resource Professional Recommendation,** as determined during the outreach process of updating the NCWRP Watershed Restoration Plan.

Figure C-2 EEP Targeted Watersheds of the Catawba River Basin



NC Division of Water Quality
Basinwide Planning Program
October 13, 2004

1.3.3 Clean Water Management Trust Fund

North Carolina's Clean Water Management Trust Fund (CWMTF) was established by the General Assembly in 1996 (Article 13A; Chapter 113 of the North Carolina General Statutes). At the end of each fiscal year, 6.5 percent of the unreserved credit balance in North Carolina's General Fund (or a minimum of $30 million) goes into the CWMTF. Revenues from the CWMTF are then allocated in the form of grants to local governments, state agencies and conservation nonprofit organizations to help finance projects that specifically address water pollution problems. The 18-member, independent, CWMTF Board of Trustees has full responsibility over the allocation of monies from the fund.

The CWMTF provides funding for projects that: 1) enhance or restore degraded waters; 2) protect unpolluted waters; and/or 3) contribute toward a network of riparian buffers and greenways for environmental, educational and recreational benefits. In the Catawba River basin, 61 projects were funded between 1997 and 2003, totaling $30,511,123. Table C-3 lists the individual grants. For more information on the CWMTF or these grants, call (252) 830-3222 or visit the website at http://www.cwmtf.net/.

Table C-3 Projects in the Catawba River Basin Funded by the Clean Water Management Trust Fund (as of 12/02)

FY	Application Name	Proposed Project Description	Amount Funded	Subbasin
2000	Bessemer City – Decommission WWTP and Reroute Waste	Decommission Bessemer City WWTP and rescind permit of 1.5 MGD. Route effluent to Gastonia's nearby regional WWTP. Upgrade Ninth Street Pump Station. Construct new sewer force mains and gravity sewer lines.	$2,000,000.00	03-08-37
2001	Blowing Rock – China Creek / Johns River Land Acquisition	Acquire through fee simple purchase 192 acres of the headwaters of China Creek. CWMTF funds to purchase 80 riparian acres.	$201,000.00	03-08-31
2001	Burke County – Planning / Lake James	Conduct a planning project for the Catawba River WS-IV using spatial growth management decisions.	$62,000.00	03-08-30
1999	Caldwell County – Wilson Creek Acquisition	Acquire through fee simple purchase 4 acres along Wilson Creek.	$51,000.00	03-08-31
2001	Catawba Lands & Foothills Conservancy – Acquisition / Johnston Creek	Provide funds to cover transactional costs on two riparian conservation easements (385 acres). Overall project would protect 525 acres through donated and purchased easements in Mountain Island Lake Watershed along Johnson Creek.	$116,000.00	03-08-33
2001	Catawba Lands Cons – Buck & Smith Tract / South Crowders Creek Acq	Acquire through fee simple purchase and permanent conservation easements 107 acres along South Crowders Creek. CWMTF funds to purchase 27.1 acres and establish a CE on 11.3 acres. Landowner to donate CE on 68.4 acres.	$166,000.00	03-08-37
1998	Catawba Lands Cons – Acq / Ryne Preserve / South Fork Catawba	Acquire through fee simple purchase and permanent conservation easements 245 acres along the South Fork Catawba River and two unnamed tributaries. Acreage includes a donated conservation easement of 185 acres.	$310,000.00	03-08-35
2002	Catawba Lands Cons – Acq / Ramsey Tract, South Fork Catawba River	Acquire 16.4 acres through fee simple purchase along the South Fork Catawba River. An additional 3.5 acres will be donated. A total of 19.9 acres will be protected.	$77,000.00	03-08-35

2002	Catawba Lands Cons – Acq / Anderholt Tract South Fork Catawba River	Acquire through fee simple purchase 75 riparian acres along the South Fork Catawba River.	$343,000.00	03-08-35
2003	Catawba Lands Cons – Donated Minigrant, Colt Thornburg Tract / South Fork Catawba River and Coley Creek	Minigrant to pay for transactional costs for a donated easement on 70 acres along the South Fork Catawba River and Coley Creek.	$10,000.00	03-08-35
2003	Catawba Lands Cons – Donated Minigrant, Friday Farm Tract / Hoyle Creek	Minigrant to pay for transactional costs for a donated easement on 170 acres along the South Fork Catawba River and tributaries.	$16,000.00	03-08-35
2003	Catawba Lands Cons – Donated Minigrant, Oakwood Farm Tract / South Fork Catawba River	Minigrant to pay for transactional costs for a donated easement on 63 acres along the South Fork Catawba River and tributaries.	$25,000.00	03-08-35
1997	Catawba Lands Cons – South Fork Catawba Acquisition Plan	Identify and prioritize riparian buffer protection objectives, meet with landowners to negotiate easements or acquisitions, find funding for acquisitions, and track progress of acquisition through monitoring of water quality and buffer management goals.	$50,000.00	03-08-35
1999	Catawba Lands Cons – South Fork Acquisition	Acquire through fee simple purchase and permanent conservation easements 207 acres along the South Fork Catawba River and tributaries.	$905,000.00	03-08-36
1999	Catawba Lands Cons – South Fork Catawba Acquisition	Acquire through fee simple purchase and permanent conservation easement 284 acres along the South Fork Catawba River. CWMTF funds to purchase a 219-acre tract and landowner to donate permanent conservation easement on another 65 acres.	$811,000.00	03-08-35
2000	Catawba Lands Cons – Acquisition / South Fork Catawba River	Acquire through fee simple purchase 13 acres along the South Fork Catawba River.	$60,000.00	03-08-35
2001	Catawba Lands Cons – Acquisition Minigrant	Provide funds to cover preacquisition costs for 214 acres that border Long and Little Long Creeks.	$25,000.00	03-08-36
2001	Catawba Lands Cons – Acquisition / South Fork Catawba River	Purchase riparian areas and to cover monitoring and transactional costs for two tracts. Total protected acreage (fee simple acquisition) will be 75.6 acres along South Fork Catawba River.	$217,000.00	03-08-35
2003	Catawba Lands Cons – South Fork Catawba Land Acquisition	Acquire through fee simple purchase and permanent conservation easements 252 acres along the South Fork Catawba River. CWMTF funds to purchase 130 acres and landowner to donate a conservation easement on an additional 122 acres.	$420,373.00	03-08-35
1997	Catawba Lands Cons – Acquisition / Rollins & Banker Tracts, South Fork River	Acquire through fee simple purchase and a permanent conservation easement 115 acres along the South Fork Catawba River. CWMTF to purchase 75 riparian acres and landowner to donate an additional 40 acres. Ties in with already protected stream corridor.	$286,000.00	03-08-35
2000	Centralina COG – Acq / Mountain Island Lake	Acquire through fee simple purchase 1,231 acres along Mountain Island Lake on the Catawba River.	$6,560,000.00	03-08-33
2002	Charlotte – Stormwater Demonstration (School Grounds)	Design and construct a wetland system at an elementary school, capable of treating water from 15-acre urban watershed. Maintain wetland system as stormwater treatment works and demonstration site for a minimum of 15 years. Monitor results.	$200,000.00	03-08-34
1997	Charlotte, City of – Acq / Mountain Island Lake, Gar Creek	Acquire through fee simple purchase 13 acres along Gar Creek Cove of Mountain Island Lake. CWMTF funds to purchase 1/2 of the riparian acres.	$250,000.00	03-08-33
2001	Claremont – Acquisition Coulters Branch	Acquire through fee simple purchase 7 acres along Coulters Branch.	$56,000.00	03-08-32

2001	Conover – Sewer Overflow Warning System	Implement sewer collection system overflow prevention and management demo project to expand city's current warning system and install sewer overflow communicators at manholes that have historically overflowed. Remote and trouble spots targeted.	$43,000.00	03-08-32
2001	Cons Trust for NC – Duggers Creek / Upper Linville Gorge Acq	Acquire through fee simple purchase 314 acres along Gulf Branch and Duggers Creek.	$366,000.00	03-08-30
2001	Foothills Conservancy – Acq / Adams Tract, Left Prong Catawba River	Acquire through fee simple purchase 771 acres along the Left Prong Catawba River. CWMTF funds will be used to acquire 320 riparian acres.	$821,000.00	03-08-30
2000	Foothills Conservancy of NC – Acquisition / Phillips Creek	Acquire conservation easements on 80 acres along Phillips Creek. A donated easement on an upland 34 acres will be included.	$131,000.00	03-08-31
2003	Foothills Conservancy of NC – Caldwell County Acquisition Minigrant	Provide funds to cover preacquisition costs for land in Caldwell County.	$25,000.00	03-08-31 & 03-08-32
2003	Foothills Conservancy of NC – Acquisition Blue Ridge Parkway, Linville River	Acquire through fee simple purchase 41 acres along the Linville River. CWMTF funds to purchase 30 riparian acres and landowner to donate an additional 10 acres. Tract is adjacent to the Blue Ridge Parkway and is upstream of Linville Falls.	$328,000.00	03-08-30
1999	Foothills Conservancy of NC Minigrant – Catawba River	Minigrant to pay for transactional costs for fee simple purchase of the 360-acre Watermill Tract on the Catawba River in Burke County.	$25,000.00	03-08-30
2002	Gaston County SWCD – Restoration & Stormwater / Duharts Creek Tributary	Construct four wetland areas to treat runoff from school and other developed areas adjacent to the creek. Monitor results.	$36,000.00	03-08-36
1999	Gastonia – Acquisition and Greenway / Catawba Creek	Acquire through fee simple purchase 77 acres along Catawba and Anthony Creeks.	$347,000.00	03-08-37
2000	Gastonia – Water's Edge Tract Acquisition / Mountain Island Lake	Acquire through permanent conservation easements 425 acres (Water's Edge Tract) along Mountain Island Lake.	$1,000,000.00	03-08-33
1997	Gastonia – Catawba Creek Tributary Restoration	Design and construct natural design stream restoration project along 2,000 feet of stream. Revegetate stream buffer. Place restored area under open space conservation easement.	$219,250.00	03-08-37
1998	Gastonia – Decommission Catawba Creek WWTP and Reroute Waste	Decommission failing Catawba Creek WWTP and convert plant to a 7.5 MGD pumping station. Construct force main (8,400 LF) to take wastewater to Long Creek plant, a "state-of the art" system and a preferred discharge location. Includes backup generator.	$1,000,000.00	03-08-37
1998	Granite Falls – Sewer Rehabilitation / Gunpowder Creek	Replacement of Granite Fall's existing sewer line (15,400 LF) along Bill Branch in order to eliminate discharge of raw sewage into surface waters and to reduce groundwater and rainwater inflow and infiltration into the sanitary sewer system.	$1,228,000.00	03-08-32
2002	Granite Falls, Town of – Acquisition / Lake Rhodhiss	Acquire through fee simple purchase 166 acres along the Lake Rhodhiss and tributaries. CWMTF funds will be used to acquire 80 riparian acres.	$890,000.00	03-08-31
1997	Hildebran – Wastewater Collection System / Drowning Creek	Construct wastewater collection system in the Drowning Creek watershed to eliminate 29 failing residential septic systems.	$136,000.00	03-08-32
1997	Lenoir – Acquisition and Greenway / Zacks Fork	Acquire through fee simple purchase 5 acres along Zacks Fork.	$50,000.00	03-08-31
1997	Maiden – Acquisition / Maiden and Allen Creeks	Acquire a permanent conservation easement on 18 acres along Maiden Creek.	$360,000.00	03-08-35

1998	McDowell County – Wastewater Collection System / Corpening Creek	Design and construct wastewater collection system to serve the Stumptown community and to tie on and treat waste from the Stumptown community.	$1,500,000.00	03-08-30
1997	McDowell County – Stream Restoration / Catawba River Park	Stabilize streambanks (2 reaches) of Youngs Fork Creek in McDowell County Catawba River Park using natural channel design methods. Also develop riparian buffer and greenway plan along Catawba River.	$189,000.00	03-08-30
2001	McDowell Co – Restoration / Upper Catawba River / Catawba River Park	Stabilize 2,000 feet of riverbank along the mainstem of the Upper Catawba River in the county's Catawba River Park.	$200,000.00	03-08-30
1997	Mecklenburg County EPD – Stormwater Demonstration / Edwards Branch	Construct and monitor BMPs in a "built out" 640-acre watershed to demonstrate their effectiveness. Evaluate parking area BMPs, riparian area restoration, wet detention ponds, and structural BMPs (like sand filters, oil and water separators).	$750,000.00	03-08-34
1998	Mecklenburg County Parks and Recreation – Wetland Restoration / McAlpine Creek	Restore pollutant removal of buffers in McAlpine Creek through a 20-acre demonstration site by rerouting direct drainage from adjacent development through the wetland, so that short circuiting in the wetland is minimized.	$209,000.00	03-08-34
2000	Mecklenburg County – Stormwater / Little Sugar Creek, Belmont Branch	Construct stormwater wetland and retention basin for a highly urban 400-acre drainage area on Belmont Branch, which is a tributary to Little Sugar Creek. Includes plantings along buffer and rerouting sanitary and stormwater sewers.	$1,200,000.00	03-08-34
2001	Mecklenburg County – Restoration / Little Sugar Creek Greenway Trail	Fund a stormwater management, stream restoration, and greenway construction project along 5,000 linear feet of Little Sugar Creek.	$400,000.00	03-08-34
2003	Mecklenburg County EPD – Stormwater / Little Sugar Creek	Design and construct a wetland and basin to treat stormwater from 1200 acres of residential neighborhoods, re-route existing stormwater systems to treatment basins and re-vegetate riparian buffers. Monitor results.	$940,000.00	03-08-34
2003	Mecklenburg County- Haymarket Tract / Mountain Island Lake Easement	Acquire through a permanent conservation easement 100 acres along Mountain Island Lake. CWMTF funds to purchase CE on 36 acres of riparian land. County to reinvest $1 grant to acquire other riparian buffers and lands to protect Mountain Island Lake.	$1,000,000.00	03-08-33
1997	Mecklenburg County Storm Water – Restoration and Stormwater Wetlands / Sugar Creek / Hidden Valley Site	Expand existing grant for construction of 13-acre stormwater treatment system and stream restoration. CWMTF funds to relocate 1,500 feet of sewer line, disconnect storm drains, create stormwater wetlands and ponds, vegetate buffers, and water quality monitoring.	$1,300,000.00	03-08-34
2000	Mecklenburg County – Storm / Mountain Island Lake, McDowell Creek	Design and permit stormwater BMPs in the McDowell Creek watershed to treat runoff from 918 acres. BMPs would include four stormwater wetlands and a rain garden.	$200,000.00	03-08-33
2000	Mecklenburg Soil and Water Conservation District – Storm / Briar Creek	Create an Urban Cost Share Program in the Briar Creek watershed. Landowners would contribute 25 percent of the cost for rain gardens, rain barrels, pet waste receptacles, riparian buffers, impervious surface replacement and other BMPs.	$30,000.00	03-08-34
1998	Morganton – Acquisition and Stormwater / Catawba River	Acquire 2-4 acre buffer. Land was leased by the NC Forest Service until 2002. As part of match, city was to install wet detention basins for site drainage and develop planned greenway facilities.	$550,000.00	03-08-31
1998	NC Division Forest Resources – Educational Forest Restoration / Mountain Island Lake	Stabilize eroding roads and close unnecessary roads and vegetate and restore bare riparian buffers in the Mountain Island Educational Forest.	$100,000.00	03-08-33

2003	NC Wildlife Resources Commission – Muddy Creek Restoration	Design and construct natural channel design stream restoration project along 3,500 feet of stream (2,000 feet using CWMTF funds). Conduct watershed assessment. Monitor the stream for changes in sediment and biological aquatic community.	$169,000.00	03-08-30
2001	NC Wildlife Resources Commission – Restoration / Muddy Creek	Restore 2,400 feet of streambank at 10 worst sites. Also will establish vegetated buffers of at least 50 feet (30 feet of trees and shrubs adjacent to the stream) along the targeted 2,400 feet of stream. Fencing will also be installed where needed.	$156,500.00	03-08-30
1997	Pilot View RC&D, Inc. – Restoration / Upper Linville River	Design, permit and prepare easements for natural channel stream restoration on unstable stream reaches downstream of several impoundments in the Upper Linville River watershed.	$257,000.00	03-08-30
2001	Southern Appalachian Highlands Conservancy – Acquisition / Hemphill Tract / Catawba River Headwaters	Protect 318 acres through the purchase of a permanent conservation easement (181 acres) and donated easement (137 acres) in the headwaters of the Catawba River.	$444,000.00	03-08-30
1997	Western Piedmont COG – Revolving Fund / Failing Septic Systems	Capitalize a revolving fund for low-interest loans to low-income families for the repair of failed or illegal on-site wastewater discharges in a four county area. Initially funds should repair 100 units over two years.	$450,000.00	03-08-32

1.3.4 NC Construction Grants and Loans Program

The NC Construction Grants and Loans Section provides grants and loans to local government agencies for the construction, upgrade and expansion of wastewater collection and treatment systems. As a financial resource, the section administers two major programs that assist local governments, the federally funded Clean Water State Revolving Fund (SRF) Program, and the NC Clean Water Revolving Loan and Grant Program. These programs can provide both low interest loan and grant funds for wastewater treatment projects (Table C-4).

As a technical resource, the Construction Grants and Loans Section, in conjunction with the Environmental Protection Agency, has initiated the Municipal Compliance Initiatives Program. It is a free technical assistance program to identify wastewater treatment facilities that are declining but not yet out of compliance. A team of engineers, operations experts and managers from the section work with local officials to analyze the facility's design and operation.

For more information, visit the website at http://www.nccgl.net/. You may also call (919) 715-6212 or email Bobby.Blowe@ncmail.net.

Table C-4 Projects in the Catawba River Basin Funded by the NC Construction Grants and Loans Section

Funded Grant (Clean Water Bond or SRG) Projects		
Applicant	**Grant Offered**	**Project**
Winton	$2,600,000	Sewer Rehab
Troutman	$3,000,000	Sewer Rehab
High Shoals	$2,104,681	Sewer Rehab, WWTP upgrades
Burke County	$1,533,600	Tie in
Burke County	$1,466,400	New Collection lines
Catawba County	$215,653	Tie in
Catawba County	$1,200,000	Tie in
Old Fort	$2,968,579	New Collection System
McDowell County	$3,000,000	New collection lines

Funded Grant State Revolving Loan (SRL) Projects		
Applicant	**Loan Offered**	**Project**
Conover	$4,000,000	WWTP Expansion
Belmont	$2,681,700	Various upgrades to WWTP
Claremont	$2,749,350	New 0.3 MGD McLin WWTP
Hickory	$14,200,000	Expand Henry Fork WWTP, Connect Longview and East Burke County
Long View	$3,925,000	Connect Hildebran and Longview to Henry Fork WWTP
Gastonia	$7,500,000	Expand Long Creek WWTP from 8 to 16 MGD, Outfall relocation and nitrogen upgrades
Stanley	$1,508,400	Dechlorination and Standby Power
Lenoir	$3,863,970	Lower Creek WWTP upgrade and expansion from 4 MGD to 6 MGD
Valdese	$3,032,454	WWTP improvements, I/I repair
Troutman	$1,892,881	Connection to Statesville’s Third Creek WWTP
Lincolnton	$10,000,000	Upgrade to 6 MGD and addition of tertiary treatment

1.3.5 North Carolina Stream Watch

The realization that local residents are best suited to keep an eye on their nearby waterways is what prompted North Carolina to begin project Stream Watch. With Stream Watch, citizens’ groups "adopt" a waterway, or a portion of one, and act on its behalf. Stream Watchers become the adoptive parents of a stream and, as such, become its primary caretakers.

With the help of the Department of Environment and Natural Resources' Division of Water Resources, Stream Watchers become informed stewards, learning how to react to the changing stream conditions. Local efforts combined with state support allow North Carolina's 37,000 miles of waterways to be monitored by those with the best view—local residents. For more information on Stream Watch, call (919) 715-5433 or visit the website at http://www.ncwater.org/Education_and_Technical_Assistance/Stream_Watch/.

1.3.6 South Carolina Department of Health and Environmental Control

In 1991, the South Carolina Department of Health and Environmental Control (SCDHEC) Bureau implemented the Watershed Water Quality Management Strategy in order to more efficiently protect and improve the quality of South Carolina's surface water resources. This management strategy recognizes the interdependence of water quality and all the activities that occur in the associated drainage basin. Under the watershed management approach, monitoring, assessment, problem identification and prioritization, water quality modeling, planning, permitting and other SCDHEC initiatives are coordinated by basin. A watershed water quality assessment document is produced for each basin on a five-year rotating schedule. The first Watershed Water Quality Assessment for the Catawba River basin was published in 1999 and will be updated on a five-year rotational basis.

To obtain a copy of the Watershed Water Quality Assessment or for further information about water quality in the Catawba River basin in South Carolina, contact Mark A. Giffin at (803) 898-4022 or by email giffinma@dhec.sc.gov or visit the website at http://www.scdhec.net/water.

1.3.7 Bi-State Catawba River Commission

In an attempt to ensure that North and South Carolina cooperate on the management of the entire Catawba River, legislators in both states approved bills to create the Bi-State Catawba River Commission. Both bills call for a 14-member commission composed of legislators and representatives of Duke Power, the Bi-State Catawba River Task Force, the economic development agency Carolinas Partnership, the basin's three marine commissions, a NC land trust and a SC water-sewer utility. Although the bills were passed, no funding was allocated to support the initiative. Until appropriate funding is provided, progress on this initiative is not likely.

1.3.8 Catawba River Corridor Project

The SCDNR in cooperation with the SC Department of Parks, Recreation and Tourism and the Catawba Regional Planning Council initiated the Catawba River Corridor Planning process in 1992. The goal of this planning process was to create a vision for the Catawba River and its adjacent lands, to manage future growth in a manner that will protect the natural beauty, unspoiled character, and significant features that shape the Catawba River today. This planning process was citizen-based, to ensure that the resulting plan was wholly produced by members of the community in which it will be implemented.

The Catawba River Task Force was assembled, composed of people with the resources, expertise and interest to provide a comprehensive overview of the river and the commitment to implement a final corridor plan developed by community members. Task force members include local government officials, landowners and representatives of conservation organizations, industries, other local groups, and state agencies. Committees were formed for each of 15 critical issues facing the river corridor, as identified by the task force. Each committee developed a set of policy recommendations and presented them to the task force for discussion and approval. For more information, visit the website at http://www.dnr.state.sc.us/water/envaff/river/catawbaplan.htm.

1.4 Local Initiatives

1.4.1 Mecklenburg County S.W.I.M. Program

On October 15, 1996, the Mecklenburg County Board of County Commissioners (Board) took a stand in support of clean, usable surface waters through the adoption of the community's first "Creek Use Policy" calling for all Mecklenburg County surface waters to be "*...suitable for prolonged human contact and recreational opportunities and supportive of varied species of aquatic life*." At the direction of the Board, a panel of stakeholders was convened in February 1997, including representatives from development and environmental interest groups. This panel worked with staff toward the development of a comprehensive strategy aimed at fulfilling the Board's policy statement. In January 1998, the panel reported back to the Board with a three (3) phased approach for achieving its "Creek Use Policy". The Board approved the approach and the implementation of Phase I began in FY 1998-1999. The approach, entitled Surface Water Improvement and Management or S.W.I.M, prioritized creek basins and tasks using the intent to:

- Prevent further degradation
- Preserve the best waters
- Improve the good waters
- Remediate the worst waters

The following principles are used to guide S.W.I.M. efforts:

- Holistic approach to address the community's water quality, quantity and green space issues
- Basin level community involvement and support
- Basin specific analysis using modeling and stream assessment
- Use proven, scientifically sound watershed management techniques

S.W.I.M. Phase I is aimed at the implementation of measures to address the county's worst pollutants and prevent further water quality degradation. The program has been a tremendous success resulting in significant improvements to water quality conditions in Mecklenburg County including:

1. Enhancement of efforts to enforce erosion control ordinances and educate the development community resulting in a reduction in sediment levels in some streams by as much as 79 percent.
2. Enhancement of measures to protect drinking water supply reservoirs by working in close cooperation with developers to improve land development techniques and protect water quality.
3. Establishment of vegetative stream buffers county wide through the adoption of ordinances. These buffers serve to filter stormwater pollutants and protect water quality.

4. Enhancement of efforts to address elevated bacteria levels in surface waters resulting in reductions in bacteria counts by as much as 76 percent in several urban streams.
5. Implementation of water quality modeling techniques for the development of watershed based management plans aimed at maintaining and restoring water quality conditions.
6. Development of automated water quality monitoring techniques that provide water quality data 24 hours a day, 7 days a week significantly enhancing capabilities for identifying and eliminating pollution problems. This technique was employed in cooperation with NCDOT to ensure the protection of Long Creek from sediment discharges from I-485 construction activities and is being expanded to other locations around the county.
7. Improved coordination between city and county staff involved in stream related activities through the development of the Creek Coordination Committee (CCC), which meets monthly to coordinate stream improvement activities.
8. Implementation of stream inventory and assessment activities to better characterize current stream conditions and identify threats to water quality.
9. Increased public education and involvement resulting in a 75 percent increase in volunteer participation in several water quality restoration initiatives including "Adopt-A-Stream" and "Storm Drain Marking".

S.W.I.M. Phase II was implemented beginning in fiscal year 2002-2003, starting a four-year process aimed at maintaining and/or restoring water quality conditions in identified special interest watersheds to fulfill Mecklenburg County's goal of "swimmable/fishable" waters. During its first year of implementation, S.W.I.M. Phase II made significant progress toward achieving this goal. In general, S.W.I.M. Phase II utilizes the tools developed in S.W.I.M. Phase I, such as water quality monitoring and modeling, to develop a comprehensive watershed based management strategy focusing on the elimination of specific point and nonpoint source pollution problems in special interest watersheds. During FY02-03, these special interest watersheds included McDowell, Gar, Goose, Duck and Stevens Creeks in Mecklenburg County. One of the most progressive water quality ordinances in the southeast was adopted for McDowell and Gar Creeks upstream of the Charlotte-Mecklenburg drinking water intake in Mountain Island Lake as well as those creeks draining to the Rocky River within the jurisdiction of the Town of Huntersville in Mecklenburg County. The objective of this ordinance is to prevent further water quality degradation from continued land development activities utilizing low impact development (LID) techniques and water quality modeling capabilities. In addition, Mecklenburg County is in the process of designing retrofitted structural best management practices (BMPs) to reduce existing pollutant loads in McDowell Creek. For Goose, Duck and Stevens Creeks, which are located within the Town of Mint Hill in Mecklenburg County, a post-construction ordinance utilizing LID and modeling techniques is currently under development with implementation planned for the spring of 2004.

S.W.I.M. Phase III is planned for implementation in 2006 for the purpose of applying the techniques perfected in Phases I and II to the remaining waters county wide with the ultimate goal of achieving the Board's "swimmable/fishable" goal by 2015.

The S.W.I.M. Program is being used to fulfill the Phase II Stormwater Permit requirements for Mecklenburg County and the six towns in the county including Cornelius, Davidson, Huntersville, Matthews, Mint Hill and Pineville. Under the S.W.I.M. Program, a Stormwater Management Program Plan was developed and a joint permit application submitted to the state in February 2003. Implementation of the plan began on July 1, 2003.

1.4.2 The Lake James Task Force

The purpose of The Lake James Task Force is to mobilize public support to protect the existing Burke County Lake James Land Use Ordinance and to educate the public about the issues involved so that Lake James is protected for future generations. The task force participates in legal actions to protect the watershed from development and has created a legal defense fund from which to operate. For more information, visit the website at http://www.savelakejames.org/index.html.

1.4.3 Catawba County

Catawba County, being surrounded by Lakes Hickory, Lookout Shoals and Norman, has taken several proactive approaches to address water quality within the county. In an effort to supplement the state's water quality sampling program, Catawba County has conducted semi-annual water sampling of seven tributaries to Lake Norman for over ten years. These samples are analyzed for several different water quality parameters, such as dissolved oxygen, BOD, nitrogen, phosphorus and fecal coliform. Any infractions found are reported to the NCDENR for follow-up inspection.

In the area of land development ordinances, the county adopted a cluster/open space option for residential subdivisions. This option requires a minimum of 30 percent of the proposed development to be preserved in permanent open space. Priority areas to be preserved are designated floodplains, buffers along streams and ponds, steep slopes and environmentally sensitive areas where development may threaten water quality. Several developers have used the cluster option to preserve approximately 50 percent of the land within their developments.

In an effort to educate its citizenry on the importance of being environmental stewards, Catawba County sponsors a biannual Household Hazardous Waste Day. Citizens are encouraged to bring their household hazardous waste, such as paints and household cleaners, to the collection site for proper disposal (in lieu of disposing in the garbage or pouring down storm drains or in road ditches). The county also operates used motor oil disposal sites at all five of its convenience centers.

1.4.4 Caldwell County

Caldwell County, in cooperation with the municipalities of Granite Falls, Hudson, Cajah Mountain, Sawmills and Gamewell, has begun development of an NPDES Phase II compliant stormwater management program. Caldwell County has hired a professional engineer to oversee the program and has formed the Stormwater Advisory Group (SWAG) to structure the emerging program and tailor it to the community's needs. Caldwell County has begun a Public Education program that targets elected officials and civic leaders, the development community, and realtors. Caldwell County has also begun an inventory of its facilities and operations that could potentially have a detrimental impact on water quality. Caldwell County's Environmental Engineer will be developing Stormwater Pollution Prevention Plans (SWPPP) for priority facilities over the next 12 months.

A preliminary draft of a Stormwater Quality Management and Discharge Control Ordinance has been prepared and will be reviewed by the SWAG in February and March 2004. That draft ordinance envisions post-construction controls that are more effective than the minimum requirements in the state's proposed permanent NPDES Phase II rules (15A NCAC 2H .0126 and 15A NCAC 2H .1014). It also includes provision for two-zone, 50-foot wide riparian buffers along perennial streams and 30-foot wide buffers along intermittent streams. Finally, Caldwell County staff will give a formal presentation to the Caldwell County Commissioners during 2004, seeking approval for local delegation of the Erosion and Sedimentation Control Program. Local delegation of that program, combined with the remainder of Caldwell County's stormwater management efforts, will ensure more effective review and enforcement, while potentially reducing both the time and expense currently required of Caldwell County's development community.

1.4.5 City of Newton

The City of Newton has conducted a local soil erosion sedimentation control program since October 2001. The program is under the direction of the Planning Director/Assistant City Manager and is administered by the current planner. The local program has fit in well with the city's code enforcement and development liaison approach by having one point of contact throughout the development process. The current planner coordinates the development review process for the city and also reviews all site plans and issues zoning permits and soil erosion permits for projects that require them.

The city uses the standard one-acre disturbed benchmark for plan submittal and permitting, but also requires permits for any project disturbing a half-acre or more up to the one-acre standard that triggers plan submittal. By having the plan reviewer/coordinator as the point of contact, the process works very well in terms of communication and compliance. It is felt that having a local program is more responsive to the concerns for water quality and safety of the community and ensures a higher level of water quality and development. The program has permitted 13 sites since the program began.

1.4.6 Gaston County Projects

The Gaston County Natural Resources Department is responsible for planning and establishing the county's natural resources' conservation programs and implementing county, state and federal natural resource statues. Department staff help landowners, citizens, municipal and county governments, and industry to control erosion and sedimentation for improved water quality, obtain grants for stream and wetland restorations for stormwater management, assist municipalities with bio-solids waste management, assist animal facility operators with animal waste management, assist governments with watershed management issues to ensure quality drinking water supplies, and present environmental conservation education programs to students, groups, organizations, clubs and citizenry. GCNR has several water quality projects in progress, all of which may be viewed at http://www.co.gaston.nc.us/NaturalResources/index.htm.

The North Carolina Cooperative Extension Service helps citizens understand things they can do to maintain and protect environmental quality. Extension offers conferences, courses, on-site demonstrations and one-on-one consultations concerning water quality best management practices (BMPs). The Quality of Natural Resources Commission (QNRC) advises county commissioners on environmental issues and guides the development of county policies with environmental impacts. Extension serves as staff to the QNRC. More information about the work of the Gaston County Center can be found at http://www.ces.ncsu.edu/gaston/.

1.4.7 Morganton Greenway

The City of Morganton Comprehensive Long-Term Land Management Plan identifies a six-mile greenway corridor along the Catawba River. An aggressive acquisition and development program began in 1992. The city identified riparian parcels and has initiated negotiations for fee simple acquisition or development of conservation easements. Prioritization of properties was made based upon location, greenway values, and water quality benefit. The greenway is currently a one-mile paved walkway that provides picnic areas, playground, canoe launch, fishing pier, overlooks, and access to shopping and restaurants. It will expand to protect more riparian habitat as funds becomes available.

1.4.8 Burke County

Burke County has several water quality programs underway. In addition to the county's zoning and subdivision ordinances that protect riparian habitat on Lake James, Lake Rhodhiss, Lake Hickory and the mainstem Catawba River, a planning process is currently underway in cooperation with local landowners, the National Park Service Overmountain Victory Trail, and the US Forest Service to plan and establish multi-use trails throughout the Lake James area and along the mainstem of the Catawba River to the Morganton Greenway. Finally, a planning process, funded by the CWMTF, is underway to develop a water supply watershed model that will result in specific recommendations for land use ordinance revisions. The jurisdictions of Morganton and Glen Alpine are also involved in this project.

1.5 Regional Initiatives

1.5.1 Voices and Choices of the Central Carolinas

Voices and Choices of the Central Carolinas (V&C) is dedicated to ensuring a high quality of life for our region's residents by promoting economic and environmental sustainability throughout the 14-county Central Carolinas region. The organization believes that issues affecting quality of life - such as economic prosperity, clean air and water, open pace, and transportation - are best addressed at the regional level, with a diverse coalition of stakeholders involved. Since 1995, V&C has sought to engage individual citizens, corporations, nonprofit organizations and elected officials from city, county and state governments to cooperate on these issues that are so critical to the future of our region.

To update and expand upon previous regional reports, V&C is preparing a publication entitled *The 2003 State of the Region Report*. The report focuses on indicators that reveal favorable and unfavorable growth-related trends in the areas of transportation, land use, environment (air, water, solid waste) and economics. *The 2003 State of the Region Report* will be the first in what will become an annual V&C publication. By highlighting issues affecting quality of life in the four subject areas, V&C hopes to convert discussion into action. For more information, visit the website at http://www.voicesandchoices.org/index.cfm.

1.5.2 Sustainable Environment for Quality of Life

Centralina Council of Governments in cooperation with Catawba Regional Council of Governments actively promotes regional solutions for regional issues. One of Centralina's major new programs is designed to address issues of environmental quality. Centralina COG has been awarded a $275,000 grant from the Environmental Protection Agency to implement and expand regional efforts to protect the quality of life in the bi-state metro Charlotte region. The program is called Sustainable Environment for Quality of Life (SEQL).

The greater Charlotte/Gastonia/Rock Hill region encompasses 15 counties with over 75 political jurisdictions and a population base of 2.1 million people. It is a highly desirable area to live in but faces many challenges: sprawl, air quality problems, and concerns about being the "next Atlanta". SEQL will address these challenges by:

- Allowing local governments the opportunity to work across jurisdictional lines in regional cooperation and collaboration, setting a standard for the nation.
- Providing implementation assistance to local governments on environmental "commitment action items" developed under the Charlotte/Mecklenburg Sustainability Demonstration Project.
- Analyzing multiple air quality issues simultaneously, including ozone, particulate matter and air toxics while also addressing transportation, water, land use, energy use and economic development.

This project will support the region's efforts to develop integrated, long-range plans to ensure economic development and a positive quality of life for its future. The project is structured so that it will be a cooperative undertaking with the Catawba Regional Council of Governments. Centralina and Catawba Regional COGs will work to bring the metro area together.

SEQL will provide an integrated strategy that other local governments across the country could use to address similar quality of life and environmental issues. This initial process began in the fall of 2000, under the leadership of Charlotte Mayor Pat McCrory and past Mecklenburg County Board Chairman Parks Helms. The city received a $100,000 EPA grant for a Sustainability Demonstration Project to bring together 26 of the region's chief elected officials to learn about air quality, water resource and land use issues. The group developed and recommended "toolbox commitment action items" relating to air, water and land use measures for implementation across the region. In spring 2002, EPA approached Charlotte regional and local governments about expanding this partnership to develop a more integrated strategy and refined tools to address air quality, water quality, transportation, land use planning, energy and economic development. A summary of the SEQL project is as follows:

- Implementation of Sustainability Demonstration Project "commitment action items".
- Design of a regional database for improved decision-making.
- Government/public/stakeholder orientation to the concept of integrated cross-sectoral planning and development of methods to implement it.
- Institutionalization of consideration of integrated environmental impacts in local and regional planning and decision-making.
- Build bridges among elected officials, local government planners, environmental advocates and business/development interests.

1.5.3 Catawba Lands Conservancy

Catawba Lands Conservancy is a nonprofit land trust which acquires and permanently protects land and conservation easements in the lower Catawba River Basin and Southern Piedmont of North Carolina, including all or portions of Catawba, Gaston, Iredell, Lincoln, Mecklenburg and Union counties. The conservancy's projects include significant natural areas, stream and river corridors, fields and forests, working farms, and other open and green spaces. The conservancy's land stewardship and community outreach programs also allow residents to learn about land protection and how they can directly impact conservation and quality of life in the region. The conservancy has protected more than 5,400 acres since 1991. For more information, visit the website at http://www.catawbalands.org.

1.5.4 Foothills Conservancy

The Foothills Conservancy of North Carolina, a regional land trust, is dedicated to working cooperatively with landowners and public and private conservation partners to preserve and protect important natural areas and open spaces of the Blue Ridge Foothills region, including watersheds, environmentally significant habitats, forests and farmland, for this and future generations. The conservancy, a 501(c) 3 nonprofit, serves eight counties; Alexander, Burke, Caldwell, Catawba, Cleveland, Lincoln, McDowell and Rutherford; and has succeeded in protecting over 18,0000 acres in the Catawba River basin. For more information, visit the website at http://www.foothillsconservancy.org/index.htm.

1.5.5 Catawba River Foundation

The Catawba River Foundation (CRF) is an environmental advocacy organization dedicated to promoting the obligation to preserve, protect and restore the fragile ecosystem of our Catawba River basin's rivers, lakes and creeks. Through education, enforcement and coordinated efforts, they are committed to halt present abuse, to restore past beauty, and to assure a watchful balance of community and environmental needs for generations to come.

The primary objective of the CRF is the *Catawba* RIVERKEEPER© Program, which has grown substantially since its inception in 1998. Their initial work has focused on water quality monitoring, responding to reports of pollution events, and forming a solid corps of trained volunteers. They achieve their goals by using a multi-pronged approach including: 1) a volunteer network; 2) public education and collaborative efforts; and 3) legal initiatives and enforcement actions. For more information, visit the website at http://www.catawbariverkeeper.org/.

1.5.6 Trout Unlimited

Trout Unlimited's (TU) mission is to conserve, protect and restore North America's trout and salmon fisheries and their watersheds. They accomplish this mission on local, state and national levels with an extensive and dedicated volunteer network. The national office, based just outside of Washington, DC, employs professionals who testify before Congress, publish TU's quarterly magazine, intervene in federal legal proceedings, and work with TU's grassroots volunteers to keep them active and involved in conservation issues. At the state level, TU works closely with state agencies, conservation organizations, corporations, local volunteers and TU members to organize stream clean-ups, public awareness activities and field trips to local streams.

In the Catawba River basin, TU currently has two large restoration/protection projects underway on Steels Creek in Burke County and Muddy Creek in Burke and McDowell counties. The Steel's Creek Watershed Improvement Project is intended to prevent vehicular stream crossings where they occur and to restrict vehicles to designated parking areas nearest the road in order to reduce existing traffic and disturbance in the floodplain. New designated parking areas will be established using wood timbers and gravel. Areas where vehicles are accessing the camping areas will be blocked with large boulders. Storm drainage and erosion issues will be addressed with sediment traps and log ditch checks. Streambank erosion caused by continuous access will be addressed by the creation of designated paths and stone or wood steps. In addition to the watershed improvement activities, there will be removal of hazard trees and trees that fall within the designated parking areas.

TU's Muddy Creek Restoration Project is discussed in detail in Section B, Chapter 1, Part 1.4.4. More information on TU's activities in the basin can be found by visiting the website at http://www.nctu.org/.

1.5.7 American Rivers

American Rivers is a national nonprofit conservation organization dedicated to protecting and restoring healthy natural rivers and the variety of life they sustain for people, fish and wildlife. In 2001, American Rivers rated the Catawba River the 13th most endangered river in America. The associated report stated that explosive urban growth along the Catawba River in North and South Carolina threatens to overwhelm the river's capacity to provide drinking water, assimilate sewage, support wildlife, and serve the recreational needs of Charlotte and growing communities throughout the basin. For the entire report and its recommendations, refer to the website at http://www.amrivers.org/ and enter "Catawba" in the search box.

1.5.8 Catawba-Wateree Relicensing Coalition

The Catawba-Wateree Relicensing Coalition (CWRC) has been working for over three years to facilitate a process to protect, enhance and restore the natural, cultural, recreational and economic resources of the Catawba-Wateree River Basin during the relicensing of Duke Power's 13 hydroelectric facilities and 11 dams. CWRC is dedicated to developing stakeholder consensus on key issues related to this relicensing. The coalition works to achieve full benefit from modern laws and standards that affects two million people, 14 counties, 30 municipalities, two states (NC and SC), 300 miles of river, 1,500 miles of shoreline, and 5,000 square miles of watershed. For more information, visit the website at http://www.cwrc.info/ or email director@cwrc.info.

1.5.9 Catawba Bi-State Task Force

The Catawba Bi-State Task Force's mission is to preserve and enhance the quality of the Catawba River from its headwaters in the mountains of North Carolina to Lake Wateree, South Carolina as the primary drinking water source for citizens and businesses and as a unique environment and recreational resource. It provides a forum for discussing issues among stakeholders in the Catawba River basin. The Bi-State Task Force quarterly meetings are open to the public. Meetings typically consist of experts addressing key topics and a "River Roundtable" that allows anyone in the group to share concerns. The Task Force also sponsors an annual public conference at UNCC on such issues as water allocation, ecosystem management and water quality management.

1.6.0 NC Wildlife Federation

Island Adoption Program

Sponsored by the NCWF and Duke Power, the Island Habitat Adoption Program is being modeled in the rapidly developing Catawba River basin for other areas throughout the state. The goal of the Island Habitat Adoption Program is to provide partnerships that will help keep river and lake islands clean of litter, serve as an educational tool for raising public awareness of the proper disposal of litter on public waters and lands, and work toward protecting and enhancing wildlife habitats. The program seeks fishing clubs, duck hunting groups, conservation organizations, and other wildlife enthusiasts to "adopt" an island. Participating groups agree to periodically clean up the litter from their island while providing data on wildlife species that inhabit their island and note positive and negative habitat characteristics and changes. Adopting groups receive wood duck or blue bird nesting boxes to erect on the island, as well as a handsome sign that denotes their participation in the program. More information is available on the website at http://www.ncwf.org.

1.6.1 Volunteer Water Information Network Program (VWIN) and Lake James Environmental Association

The Volunteer Water Information Network (VWIN) is a partnership of groups and individuals dedicated to preserving water quality in western North Carolina. Organizations such as RiverLink Inc., the Environmental Conservation Organization of Henderson County (ECO), the Pacolet Area Conservancy (PAC), the Lake Lure Lakefront Owners Association, and the Lake James Environmental Association provide administrative support. The UNC-Asheville Environmental Quality Institute (EQI) provides technical assistance through laboratory analysis of water samples, statistical analysis of water quality results, and written interpretation of the data. Volunteers venture out once per month to collect water samples from designated sites along streams and rivers in the region.

An accurate and on-going water quality database, as provided by VWIN, is essential for good environmental planning. The data gathered by the volunteers provides an increasingly accurate picture of water quality conditions and changes in these conditions over time. Communities can use this data to identify streams of high water quality which need to be preserved, as well as streams which cannot support further development without significant water quality degradation. In addition, the information allows planners to assess the impacts of increased development and the success of pollution control measures. Thus, this program provides the water quality data for evaluation of current management efforts and can help guide decisions affecting future management actions. The VWIN program also encourages involvement of citizens in the awareness, ownership and protection of their water resources.

In May 2001, the Lake James Environmental Association began a VWIN program to monitor five selected stream sites and six lake sites in order to assess water quality conditions in streams flowing into Lake James and to provide continuous assessment of the health of the lake (see Section B, Chapter 1, Part 1.4.1).

As problems were noticed immediately at the site on the North Fork of the Catawba River, two new sites were quickly added to assess this problem. With sedimentation and potential eutrophication of the lake a growing concern, many citizens realize the need for continuous monitoring of the streams flowing into the lake as a means of trying to pinpoint sources of problems. Continuous monitoring of the lake itself is vital to understanding the lake cycles and trends as well as identifying problems as they arise. For more information on VWIN and the Lake James Environmental Association visit the website at http://ljea.org/index.html.

1.6.2 The Trust for Public Land

Founded in 1972, the Trust for Public Land (TPL) is a nonprofit working exclusively to protect land for human enjoyment and well-being. TPL helps conserve land for recreation and spiritual nourishment and to improve the health and quality of life of American communities. In the Catawba River Basin, TPL initiated Phase I of the Mountain Island Lake (MIL) Initiative in 1998 with its partners, The Catawba Lands Conservancy, The Foundation for the Carolinas, and the Gaston Community Foundation. The MIL Initiative intends to 80 percent of the shoreline and 80 percent of the major tributaries to Mountain Island Lake. Phase I of the MIL Initiative protected approximately 2,700 acres in the watershed, including the area now known as The Mountain Island Lake State Education Forest, managed by the North Carolina Division of Forest Resources. TPL is now seeking funding to proceed with Phase II of the MIL Initiative.

TPL has recently published a 50-page booklet, *Protecting the Source – Land Conservation and the Future of America's Drinking Water*, in conjunction with the American Water Works Association. TPL is distributing the report to all elected officials in the Mountain Island Lake watershed and key government officials to illustrate the need to protect drinking water supply watersheds. The report can be downloaded at http://www.tpl.org/download_protect_src_report.cfm.

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Appendix I

NPDES Dischargers and Individual Stormwater Permits in the Catawba River Basin

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0006564	Baxter Healthcare Corporation	Baxter Healthcare Corporation	McDowell	Asheville	Industrial Process & Commercial	Major	1.2	03-08-30	North Fork Catawba River
NC0080098	Blue Ridge Country Club Development LLC	Blue Ridge Country Club Development WWTP	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.202	03-08-30	North Fork Catawba River
NC0055221	City of Marion	Marion WTP	McDowell	Asheville	Water Plants and Water Conditioning	Minor	not limited	03-08-30	Nix Creek (Nicks Creek)
NC0071200	City of Marion	Catawba River WWTP	McDowell	Asheville	Municipal , < 1MGD	Minor	0.25	03-08-30	Catawba River
NC0004243	Coats American, Inc	Marion Plant	McDowell	Asheville	Industrial Process & Commercial	Major	2.0	03-08-30	North Fork Catawba River
NC0087076	Columbia Forest Plywood Products	Columbia Forest Plywood Products	McDowell	Asheville	Industrial Process & Commercial	Minor	not limited	03-08-30	Catawba River
NC0039934	Crane Resistoflex	Crane Resistoflex	McDowell	Asheville	Industrial Process & Commercial	Minor	0.016	03-08-30	Catawba River
NC0079481	Harmony Estates Inc	Harmony Estates Incorporated	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.02	03-08-30	North Muddy Creek
NC0076180	Jeld-Wen Inc	Jeld-Wen Fiber of NC	McDowell	Asheville	Industrial Process & Commercial	Minor	0.012	03-08-30	Catawba River
NC0069965	Larry G. Scott	Scotty's Mobile Village	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.01	03-08-30	Catawba River
NC0087751	Linville Heights LP	Linville Heights WWTP	Avery	Asheville	100% Domestic < 1MGD	Minor	0.0612	03-08-30	Linville River
NC0086428	Marion Travel Plaza, Inc.	Marion Travel Plaza Incorporated	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.01	03-08-30	North Muddy Creek
NC0035157	McDowell County Adult Care LLC	Cedarbrook Resiential Center Corp	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.003	03-08-30	South Muddy Creek
NC0067148	McDowell County Schools	Nebo Elementary School WWTP	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.0075	03-08-30	Shadrick Creek
NC0077801	Pete Gibbs	Gibbs Motel And Restaurant	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.009	03-08-30	Catawba River
NC0075353	Rocky Pass Adult Care LLC	Rocky Pass Adult Care LLC	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.01	03-08-30	North Muddy Creek
NC0029831	Sugar Hill Truck Stop	Sugar Hill Truck Stop	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.005	03-08-30	North Muddy Creek
NC0030996	The Switzerland Inn	The Switzerland Inn	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.01	03-08-30	Buchanan Creek
NC0031879	City of Marion	Corpening Creek WWTP	McDowell	Asheville	Municipal , Large	Major	3.0	03-08-30	Youngs Fork (Corpening Creek)
NC0023124	GGCC Utility Inc	GGCC Utility Incorporated	Avery	Asheville	100% Domestic < 1MGD	Minor	0.07	03-08-30	Linville River
NC0060224	Jonas Ridge Nursing Home	Jonas Ridge Nursing Home	Burke	Asheville	100% Domestic < 1MGD	Minor	0.0075	03-08-30	Camp Creek
NC0022756	Linville Land Harbor Prop. Owners Assoc.	Linville Land Harbor POA	Avery	Asheville	100% Domestic < 1MGD	Minor	0.225	03-08-30	Linville River
NC0039446	Linville Resorts, Inc	Linville Resorts Incorporated	Avery	Asheville	100% Domestic < 1MGD	Minor	0.15	03-08-30	Linville River
NC0062413	Linville Ridge Country Club	Linville Ridge Country Club	Avery	Asheville	100% Domestic < 1MGD	Minor	0.015	03-08-30	West Fork Linville River
NC0040339	NC DENR	Corpening Training Center	Avery	Asheville	100% Domestic < 1MGD	Minor	0.018	03-08-30	Linville River
NC0026654	Town of Crossnore	Crossnore WWTP	Avery	Asheville	Municipal , < 1MGD	Minor	0.07	03-08-30	Mill Timber Creek
NC0021229	Town of Old Fort	Old Fort WWTP	McDowell	Asheville	Municipal , Large	Major	1.2	03-08-30	Curtis Creek
NC0060208	Jai-Ambe Company, Inc.	Super 8 Motel	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.019	03-08-30	Hicks Branch
NC0040291	Park Inn International	Days Inn - Marion	McDowell	Asheville	100% Domestic < 1MGD	Minor	0.02	03-08-30	Hicks Branch
NC0040754	NC Outward Bound School	NC Outward Bound School	Burke	Asheville	100% Domestic < 1MGD	Minor	0.0075	03-08-31	Roses Creek (Tablerock Creek)
NC0041696	Town of Valdese	Lake Rhodiss WWTP	Burke	Asheville	Municipal , Large	Major	7.5	03-08-31	Catawba River

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0030783	Caldwell County Schools	Baton Elementary School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.015	03-08-31	Stafford Creek
NC0050075	Caldwell County Schools	Collettsville Elementary School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.01	03-08-31	Johns River
NC0043231	Cedar Rock Country Club	Cedar Rock Country Club	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.009	03-08-31	Lower Creek
NC0023981	City of Lenoir	Lower Creek WWTP	Caldwell	Asheville	Municipal , Large	Major	4.08	03-08-31	Lower Creek
NC0026573	City of Morganton	Catawba River Pollution Control Facility	Burke	Asheville	Municipal , Large	Major	13.0	03-08-31	Catawba River
NC0060194	City of Morganton	Morganton WTP	Burke	Asheville	Water Plants and Water Conditioning	Minor	not limited	03-08-31	Catawba River
NC0040274	Green Mountain Park Resort	Green Mountain Park Resort	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.05	03-08-31	Zacks Fork Creek
NC0047147	L A P Care Services	Quality Care Assisted Living	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.0066	03-08-31	Greasy Creek
NC0048755	Monte Carlo Trailer Park	Monte Carlo Trailer Park	Burke	Asheville	100% Domestic < 1MGD	Minor	0.005	03-08-31	Lower Creek
NC0047627	Sealed Air Corporation	Warrior Plant	Caldwell	Asheville	Industrial Process & Commercial	Minor	0.0095	03-08-31	Blair Fork
NC0005258	SGL Carbon Corporation	SGL Carbon Corporation	Burke	Asheville	Industrial Process & Commercial	Major	not limited	03-08-31	Silver Creek
NC0082546	Town of Granite Falls	Granite Falls WTP	Caldwell	Asheville	Water Plants and Water Conditioning	Minor	not limited	03-08-31	Catawba River
NC0062456	Heater Utilities, Inc.	Riverwood Estates WWTP	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.04	03-08-32	Catawba River
NC0074535	Heater Utilities, Inc.	Pier 16 Marina WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.0185	03-08-32	Catawba River
NC0023736	City of Lenoir	Gunpowder Creek WWTP	Caldwell	Asheville	Municipal , Large	Major	2.0	03-08-32	Gunpowder Creek
NC0025542	Town of Catawba	Town of Catawba WWTP	Catawba	Mooresville	Municipal , < 1MGD	Minor	0.225	03-08-32	Lyle Creek
NC0021890	Town of Granite Falls	Granite Falls WWTP	Caldwell	Asheville	Municipal , < 1MGD	Minor	0.9	03-08-32	Gunpowder Creek
NC0024392	Duke Energy Corporation	McGuire Nuclear Power Plant	Mecklenburg	Mooresville	Industrial Process & Commercial	Major	not limited	03-08-32	Catawba River
NC0041157	Caldwell County Schools	Gateway Alternate School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.004	03-08-32	Upper Little River
NC0041220	Caldwell County Schools	Oak Hill Elementary School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.003	03-08-32	Mountain Run
NC0034967	Carolina Glove Company	Carolina Glove Company	Alexander	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-32	Lower Little River
NC0084565	Carolina Water Service, Inc. of NC	The Harbour WTP	Iredell	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-32	Catawba River
NC0086592	Carolina Water Service, Inc. of NC	The Point WTP	Iredell	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-32	Catawba River
NC0086606	Carolina Water Service, Inc. of NC	Harbour Well System WTP	Iredell	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-32	Catawba River
NC0044164	City of Lenoir	Lake Rhodhiss WTP	Caldwell	Asheville	Water Plants and Water Conditioning	Minor	not limited	03-08-32	Catawba River
NC0062430	DENR - Division of Parks and Recreation	Lake Norman State Park/Swimming	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.01	03-08-32	Hicks Creek
NC0062448	DENR - Division of Parks and Recreation	Lake Norman State Park/Campground	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-32	Catawba River
NC0056154	Heater Utilities, Inc.	Bridgeport WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.08	03-08-32	Catawba River
NC0067784	Heater Utilities, Inc.	Governor's Island WWTP	Lincoln	Mooresville	100% Domestic < 1MGD	Minor	0.02	03-08-32	Catawba River
NC0074772	Heater Utilities, Inc.	Diamond Head WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.1	03-08-32	Balls Creek (Murrays Mill Lake)
NC0075205	Heater Utilities, Inc.	Alexander Island WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-32	Catawba River
NC0080691	Heater Utilities, Inc.	Windemere WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.09	03-08-32	Catawba River

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0025135	Huffman Finishing, Inc.	Huffman Finishing	Caldwell	Asheville	Industrial Process & Commercial	Major	0.25	03-08-32	Catawba River
NC0074900	Hydraulics LTD	Hydraulics LTD	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.1	03-08-32	Catawba River
NC0084573	Lincoln County	Lincoln County WTP	Lincoln	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-32	Catawba River
NC0035211	Shuford Mills, Inc.	Dudley Shoals Plant	Caldwell	Asheville	100% Domestic < 1MGD	Minor	0.0054	03-08-32	Upper Little River
NC0025917	Town of Rhodhiss	Rhodhiss WWTP	Burke	Asheville	Municipal , < 1MGD	Minor	0.096	03-08-32	Catawba River
NC0026271	Town of Taylorsville	Taylorsville WWTP	Alexander	Mooresville	Municipal , < 1MGD	Minor	0.83	03-08-32	Lower Little River
NC0048712	Alcoa Extrusions Inc	Alcoa Extrusions Inc - Catawba	Catawba	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-32	Terrapin Creek
NC0069345	Catawba County Historical Association	Catawba Co Historical Association	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.0125	03-08-32	Balls Creek
NC0044059	Catawba County Schools	Bunker Hill High School	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-32	Lyle Creek
NC0045438	Catawba County Schools	Sherrills Ford Elementary School	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.007	03-08-32	Mountain Creek
NC0051608	Catawba County Schools	Bandys High School	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-32	Battle Run
NC0086304	Catawba County Schools	Mill Creek Middle School	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.0065	03-08-32	Balls Creek
NC0024252	City of Conover	Northeast WWTP	Catawba	Mooresville	Municipal , Large	Major	1.5	03-08-32	Lyle Creek
NC0024279	City of Conover	Southeast WWTP	Catawba	Mooresville	Municipal , < 1MGD	Minor	0.6	03-08-32	McLin Creek
NC0020401	City of Hickory	Northeast WWTP	Catawba	Mooresville	Municipal , Large	Major	6.0	03-08-32	Catawba River
NC0044121	City of Hickory	Hickory City/WTP	Catawba	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-32	Catawba River
NC0034754	Commscope Incorporated	Commscope Incorporated	Catawba	Mooresville	Industrial Process & Commercial	Minor	0.02	03-08-32	Terrapin Creek
NC0022497	Cross Country Campground	Cross Country Campground	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.065	03-08-32	Reed Creek
NC0032972	Dogwood Hills Mobile Home Park	C & C Mobile Home Park	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-32	Lyle Creek
NC0004987	Duke Energy Corporation	Marshall Steam Station	Catawba	Mooresville	Industrial Process & Commercial	Major	not limited	03-08-32	Catawba River
NC0058742	Heater Utilities, Inc.	Country Valley WWTP	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.0265	03-08-32	Hagan Fork
NC0060593	Heater Utilities, Inc.	Spinnaker Bay WWTP	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.0125	03-08-32	Mountain Creek
NC0062481	Heater Utilities, Inc.	Mallard Head WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	0.01	03-08-32	Reed Creek
NC0063355	Heater Utilities, Inc.	Killian Crossroads WWTP	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.05	03-08-32	Reed Creek
NC0064599	Lake Norman Motel	Lake Norman Motel	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.0075	03-08-32	Mountain Creek
NC0071528	Lake Norman Woods Homeowners Assoc.	Lake Norman Woods WWTP	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.025	03-08-32	Catawba River
NC0044253	NC Lions	NC Lions/ Camp Dogwood	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.01	03-08-32	Mountain Creek
NC0026549	City of Claremont	South WWTP	Catawba	Mooresville	Municipal , < 1MGD	Minor	0.1	03-08-32	McLin Creek
NC0032662	City of Claremont	North WWTP	Catawba	Mooresville	Municipal , < 1MGD	Minor	0.1	03-08-32	Mull Creek
NC0081370	City of Claremont	McLin Creek WWTP	Catawba	Mooresville	Municipal , < 1MGD	Minor	0.3	03-08-32	McLin Creek
NC0034860	Schneider Mills Inc	Schneider Mills Incorporated	Alexander	Mooresville	Industrial Process & Commercial	Major	0.78	03-08-32	Muddy Fork
NC0085545	Mooresville Oil	Express Food Mart	Catawba	Mooresville	Groundwater Remediation	Minor	0.0115	03-08-32	Mundy Creek

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0036277	Charlotte-Mecklenburg Utilities	McDowell Creek WWTP	Mecklenburg	Mooresville	Municipal , Large	Major	6.0	03-08-33	McDowell Creek
NC0084387	Charlotte-Mecklenburg Utilities	North Mecklenburg WTP	Mecklenburg	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-33	McDowell Creek
NC0021156	City of Mount Holly	City of Mount Holly WWTP	Gaston	Mooresville	Municipal , Large	Major	4.0	03-08-33	Catawba River
NC0084689	City of Mount Holly	City of Mount Holly WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	0.1	03-08-33	Catawba River
NC0004961	Duke Energy Corporation	Riverbend Steam Station	Gaston	Mooresville	Industrial Process & Commercial	Major	not limited	03-08-33	Catawba River
NC0080781	Duke Energy Corporation	Lincoln Combustion Turbine Plant	Lincoln	Mooresville	Industrial Process & Commercial	Minor	0.4	03-08-33	Killian Creek
NC0072621	Fa Be Enterprises Inc	Fa Be Enterprises Incorporated	Lincoln	Mooresville	100% Domestic < 1MGD	Minor	0.012	03-08-33	Forney Creek
NC0041360	Gaston County BOE	East Gaston High School	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.025	03-08-33	Taylors Creek
NC0074012	Lincoln County	Forney Creek WWTP	Lincoln	Mooresville	Municipal , < 1MGD	Minor	0.75	03-08-33	Forney Creek
NC0086185	Lincoln County Schools	Pumpkin Center Schools WWTP	Lincoln	Mooresville	100% Domestic < 1MGD	Minor	0.012	03-08-33	Ore Bank Branch
NC0024937	Charlotte-Mecklenburg Utilities	Sugar Creek WWTP	Mecklenburg	Mooresville	Municipal , Large	Major	20.0	03-08-34	Little Sugar Creek
NC0024945	Charlotte-Mecklenburg Utilities	Irwin Creek WWTP	Mecklenburg	Mooresville	Municipal , Large	Major	15.0	03-08-34	Irwin Creek
NC0086002	Livingstone Coating Corporation	Livingstone Coating Corporation	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.0216	03-08-34	Long Creek
NC0086673	SNL Corporation	Aqua-Air Site	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.0864	03-08-34	Steele Creek
NC0023540	Belmont Textile Machinery Co	Belmont Textile Machinery Co	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.005	03-08-34	Fites Creek
NC0021181	City of Belmont	Belmont WWTP	Gaston	Mooresville	Municipal , Large	Major	5.0	03-08-34	Catawba River
NC0084549	Charlotte-Mecklenburg Utilities	Franklin WTP	Mecklenburg	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-34	Stewart Creek
NC0086517	Cousins Real Estate	Charlotte Gateway Village, LLC	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.05	03-08-34	Irwin Creek
NC0004979	Duke Energy Corporation	Plant Allen Steam Station	Gaston	Mooresville	Industrial Process & Commercial	Major	not limited	03-08-34	Catawba River
NC0063789	Heater Utilities, Inc.	Mint Hill Festival WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.035	03-08-34	Irvins Creek (McEwen Lake)
NC0029181	Carolina Water Service, Inc. of NC	Forest Ridge WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.15	03-08-34	Irvins Creek (McEwen Lake)
NC0059579	Carolina Water Service, Inc. of NC	Emerald Point WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.06	03-08-34	Catawba River
NC0062383	Carolina Water Service, Inc. of NC	Queens Harbor WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.1	03-08-34	Catawba River
NC0071242	Carolina Water Service, Inc. of NC	Riverpointe WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.1	03-08-34	Catawba River
NC0029220	Charlotte-Mecklenburg Utilities	McDowell Park WWTP	Mecklenburg	Mooresville	Municipal , < 1MGD	Minor	0.03	03-08-34	Catawba River
NC0004723	Charter Triad Terminals LLC	Paw Creek Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Paw Creek
NC0021962	CITGO Petroleum Corporation	Paw Creek Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Gum Branch
NC0083887	City of Charlotte	Charlotte Douglas International Airport	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Coffey Creek
NC0004375	Clariant Corporation	Mount Holly East (MHE) Facility	Mecklenburg	Mooresville	Industrial Process & Commercial	Major	3.9	03-08-34	Catawba River
NC0031038	Colonial Pipeline Company	Paw Creek Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Gum Branch
NC0046531	Crown Central Petroleum Corporation	Paw Creek Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	0.0432	03-08-34	Gum Branch
NC0004839	ExxonMobil Refining and Supply Company	Charlotte Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	0.057	03-08-34	Long Creek

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0086886	First Union Commons	First Union Commons	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.086	03-08-34	Little Sugar Creek
NC0063860	Heater Utilities, Inc.	Harbor Estates WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.075	03-08-34	Catawba River
NC0057401	Hideways WWTP	Hideways WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.2	03-08-34	Catawba River
NC0046213	Marathon Ashland Petroleum LLC	Charlotte Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Long Creek
NC0068705	Mariners Watch Homeowners Assoc.	Mariners Watch WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.0025	03-08-34	Catawba River
NC0028711	Mecklenburg County Schools	Berryhill Elementary School WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.006	03-08-34	Catawba River
NC0022187	Motiva Enterprises LLC	Paw Creek Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Gum Branch
NC0046892	Motiva Enterprises LLC	Charlotte South Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Long Creek
NC0079758	National Welders Supply Co Inc	National Welders Supply Co	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	0.0143	03-08-34	Taggart Creek (Taggard Creek)
NC0032891	Phillips Pipe Line Company	Charlotte Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Gum Branch
NC0084280	Plantation Pipe Line Company	Stifford Ferry Road Site	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.072	03-08-34	Catawba River
NC0085731	Shorenstein Realty Investors	Shorenstein Realty Investors	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.0316	03-08-34	Irwin Creek
NC0005771	TransMontaigne Terminaling, Inc.	Charlotte/Paw Creek Terminal #1	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Paw Creek
NC0021971	TransMontaigne Terminaling, Inc.	Charlotte/Paw Creek Terminal #2	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Paw Creek
NC0085057	Unocal Corporation	Orr Road Remediation Site	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.0432	03-08-34	Brier Creek
NC0005185	Williams Terminals Holdings LP	Charlotte II Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	0.259	03-08-34	Long Creek
NC0074705	Williams Terminals Holdings LP	Charlotte/Southern Facilities Terminal	Mecklenburg	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-34	Paw Creek
NC0084301	Celanese Acetate LLC	Celanese Acetate LLC	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.1152	03-08-34	Little Sugar Creek
NC0024970	Charlotte-Mecklenburg Utilities	McAlpine Creek WWTP	Mecklenburg	Mooresville	Municipal , Large	Major	64.0	03-08-34	McAlpine Creek (Waverly Lake)
NC0058084	Gough Econ Inc	Gough Econ Incorporated	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	0.0012	03-08-34	Catawba River
NC0085928	American Truetzschler Inc	American Truetzschler Incorporated	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.05	03-08-34	Catawba River
NC0087513	The Boulevard 715 N Church	The Boulevard 715 N Church	Mecklenburg	Mooresville	Groundwater Remediation	Minor	0.072	03-08-34	Little Sugar Creek
NC0072940	City of High Shoals	State Street WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.0159	03-08-35	South Fork Catawba River
NC0025496	City of Lincolnton	Lincolnton WWTP	Lincoln	Mooresville	Municipal , Large	Major	6.0	03-08-35	South Fork Catawba River
NC0080195	Forest Hills Mobile Home Estate	Forest Hills Mobile Home Estate WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-35	Hoyle Creek
NC0050920	Catawba Country Club	Catawba Country Club	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.0075	03-08-35	Henry Fork
NC0029297	Catawba County Schools	Fred T. Foard High School	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.03	03-08-35	Pott Creek
NC0074233	Catawba County Schools	Blackburn Elementary School	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.015	03-08-35	Haas Creek
NC0071447	Catholic Conference Center	Catholic Conference Center	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.02	03-08-35	Camp Creek
NC0044440	City of Cherryville	City of Cherryville WWTP	Gaston	Mooresville	Municipal , Large	Major	2.0	03-08-35	Indian Creek
NC0040797	City of Hickory	Henry Fork WWTP	Catawba	Mooresville	Municipal , Large	Major	9.0	03-08-35	Henry Fork
NC0024155	City of High Shoals	River Street WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.018	03-08-35	South Fork Catawba River

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0039853	City of High Shoals	High Shoals WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	0.008	03-08-35	South Fork Catawba River
NC0085588	City of Lincolnton	Lincolnton WTP	Lincoln	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-35	South Fork Catawba River
NC0036196	City of Newton	Clark Creek WWTP	Catawba	Mooresville	Municipal , Large	Major	7.5	03-08-35	Clark Creek (Shooks Lake)
NC0006190	Delta Apparel, Inc.	Delta Apparel Incorporated	Catawba	Mooresville	Industrial Process & Commercial	Major	1.0	03-08-35	Clark Creek (Shooks Lake)
NC0076643	General Electric Co Hickory	General Electric Co-Hickory	Catawba	Mooresville	Groundwater Remediation	Minor	0.12	03-08-35	Cline Creek
NC0041246	Lincoln County Schools	West Lincoln High School	Lincoln	Mooresville	100% Domestic < 1MGD	Minor	0.01	03-08-35	Indian Creek
NC0023761	National Fruit Product Company, Inc	National Fruit Product Co Inc	Lincoln	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-35	Carpenter Creek
NC0036935	Pine Mountain Property Owners Assoc.	Pine Mountain Lakes WWTP	Burke	Asheville	100% Domestic < 1MGD	Minor	0.0696	03-08-35	Jacob Fork
NC0036871	Sherrill Furniture	Sherrill Furniture - Precedent	Catawba	Mooresville	100% Domestic < 1MGD	Minor	0.008	03-08-35	Bills Branch (Bili Branch)
NC0022934	Sonoco Products Co	Sonoco Products Co-Long Shoal	Gaston	Mooresville	Industrial Process & Commercial	Minor	0.0053	03-08-35	South Fork Catawba River
NC0082694	Town of Dallas	Dallas WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-35	South Fork Catawba River
NC0039594	Town of Maiden	Town of Maiden WWTP	Catawba	Mooresville	Municipal , Large	Major	1.0	03-08-35	Clark Creek
NC0080837	Town of Maiden	Maiden WTP	Catawba	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-35	Maiden Creek
NC0020036	Town of Stanley	Lola Street WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.5	03-08-35	Mauney Creek
NC0032760	Carolina Water Service, Inc. of NC	Kings Grant WWTP	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.07	03-08-36	Duharts Creek
NC0033421	Carolina Water Service, Inc. of NC	College Park WWTP	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.022	03-08-36	Little Long Creek
NC0020184	City of Gastonia	Long Creek WWTP	Gaston	Mooresville	Municipal , Large	Major	16.0	03-08-36	Long Creek
NC0040070	City of Gastonia	Gastonia WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	1.2	03-08-36	Long Creek
NC0025861	City of Lowell	Lowell WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.6	03-08-36	South Fork Catawba River
NC0004812	Pharr Yarns, Inc.	Pharr Yarns Industrial WWTP	Gaston	Mooresville	Industrial Process & Commercial	Major	1.0	03-08-36	South Fork Catawba River
NC0056855	Pharr Yarns, Inc.	Complex 46 WWTP	Gaston	Mooresville	Industrial Process & Commercial	Minor	not limited	03-08-36	South Fork Catawba River
NC0006033	Town of Cramerton	Eagle Road WWTP	Gaston	Mooresville	Municipal , Large	Major	4.0	03-08-36	South Fork Catawba River
NC0068888	Town of Dallas	Dallas WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.6	03-08-36	Long Creek
NC0020052	Town of McAdenville	Church Street WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.13	03-08-36	South Fork Catawba River
NC0020966	Town of Spencer Mountain	Spencer Mountain WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	0.05	03-08-36	South Fork Catawba River
NC0066141	Town of Spencer Mountain	Spencer Mountain WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	0.01	03-08-36	South Fork Catawba River
NC0005274	Yorkshire Americas Inc	Yorkshire Americas Incorporated	Gaston	Mooresville	Industrial Process & Commercial	Major	0.4	03-08-36	South Fork Catawba River
NC0077763	City of Belmont	Belmont WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-36	South Fork Catawba River
NC0005177	FMC Corporation	Lithium Division Plant	Gaston	Mooresville	Industrial Process & Commercial	Major	0.615	03-08-37	Abernethy Creek
NC0074799	Pines Mobile Home Park	Pines Mobile Home Park	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.011	03-08-37	Crowders Creek
NC0062278	Berkley Oaks LLC	Berkley Oaks LLC	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.036	03-08-37	McGill Branch

NPDES Dischargers for the Catawba River Basin (as of June 16, 2003)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0060755	Carolina Water Service, Inc. of NC	Saddlewood WWTP	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.009	03-08-37	Crowders Creek
NC0074268	City of Gastonia	Crowders Creek WWTP	Gaston	Mooresville	Municipal , Large	Major	6.0	03-08-37	Crowders Creek
NC0081744	D.R. Hoover, Inc.	Hoover Machine Company	Gaston	Mooresville	Groundwater Remediation	Minor	0.072	03-08-37	Catawba Creek
NC0069035	Heater Utilities, Inc.	Southgate WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-37	Catawba Creek
NC0072061	Heater Utilities, Inc.	Fox Run WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-37	Crowders Creek
NC0084468	Heater Utilities, Inc.	Keltic Meadows WTP #2	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-37	Catawba Creek
NC0086142	Heater Utilities, Inc.	Oakley Park WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	0.001	03-08-37	McGill Branch
NC0086193	Heater Utilities, Inc.	Maplecrest WTP	Gaston	Mooresville	Water Plants and Water Conditioning	Minor	not limited	03-08-37	Catawba Creek
NC0084638	Rhodia Inc	Rhodia Incorporated	Gaston	Mooresville	Groundwater Remediation	Minor	0.1944	03-08-37	Crowders Creek
NC0069175	Ridge Community Sewer Association	Ridge Community WWTP	Gaston	Mooresville	100% Domestic < 1MGD	Minor	0.01	03-08-37	Blackwood Creek
NC0004260	SKF USA, Inc.	SKF Gastonia Facility	Gaston	Mooresville	Industrial Process & Commercial	Minor	0.0144	03-08-37	Crowders Creek
NC0084662	Textron, Inc.	Textron Incorporated	Gaston	Mooresville	Groundwater Remediation	Minor	0.3	03-08-37	Crowders Creek
NC0028517	Union County Public Schools	Parkwood Middle School	Union	Mooresville	100% Domestic < 1MGD	Minor	0.012	03-08-38	Waxhaw Creek
NC0085359	Union County Public Works Department	Twelve Mile Creek WWTP	Union	Mooresville	Municipal , Large	Major	2.5	03-08-38	Twelvemile Creek

NPDES Individual Stormwater Permits in the Catawba River Basin (as of July 3, 2003)

Permit Number	Facility Name	Receiving Stream	Subbasin	County
NCS000359	Collins and Aikman - Old Fort Landfill	UT Brevard Creek	03-08-30	McDowell
NCS000332	Borden Chemical, Inc.	Little Silver Creek	03-08-31	Burke
NCS000009	SGL Carbon Corporation	Silver Creek	03-08-31	Burke
NCS000066	Southeastern Adhesives	UT Lower Creek	03-08-31	Caldwell
NCS000007	Synthron, Inc.	UT Hunting Creek	03-08-31	Burke
NCS000051	Arcona Leather Company	Little Gunpowder Creek	03-08-32	Caldwell
NCS000061	Lenoir Mirror Company	Gun Powder Creek	03-08-32	Caldwell
NCS000020	McGuire Nuclear Site	Catawba River & Lake Norman	03-08-32	Mecklenburg
NCS000041	Clariant Corporation	Catawba River	03-08-33	Gaston
NCS000380	Acme Southern, Inc.	Little Hope Creek	03-08-34	Mecklenburg
NCS000322	AquaSol Corporation	Sugar Creek	03-08-34	Mecklenburg
NCS000315	Ashland Distribution Co.	Charlotte MSSS to Stewarts Creek	03-08-34	Mecklenburg
NCS000161	B F Goodrich Textile Chemicals, Inc.	Paw Creek	03-08-34	Mecklenburg
NCS000356	BASF Corporation	Stewarts Creek	03-08-34	Mecklenburg
NCS000361	Carolina Paper Board Corporation	Stewart Creek	03-08-34	Mecklenburg
NCS000083	Celanese Acetate, LLC	Little Sugar Creek	03-08-34	Mecklenburg
NCS000040	Charlotte Pipe & Foundry	Irwin Creek	03-08-34	Mecklenburg
NCS000037	Clariant Corp.	Long Creek & Catawba River	03-08-34	Mecklenburg
NCS000313	Continental General Tire Inc.	Big Sugar Creek	03-08-34	Mecklenburg
NCS000343	Continental Industrial Chemicals, Inc. - Mecklenburg	UT Stewarts Creek	03-08-34	Mecklenburg
NCS000213	Detrex Corporation	Little Sugar Creek	03-08-34	Mecklenburg
NCS000339	Durable Wood Preserves, Inc.	UT McAlpine Creek	03-08-34	Mecklenburg
NCS000079	Forshaw Chemicals, Inc.	Stewart Creek	03-08-34	Mecklenburg
NCS000049	Henkel Corp.	Steele Creek	03-08-34	Mecklenburg
NCS000312	Heritage Environmental Ser.	Stewart Creek	03-08-34	Mecklenburg
NCS000176	INX International Ink Company	Sugar Creek	03-08-34	Mecklenburg
NCS000334	JCI Jones Chemicals, Inc.	Paw Creek	03-08-34	Mecklenburg
NCS000357	Monarch Color Corporation	UT Stewart Creek	03-08-34	Mecklenburg
NCS000045	National Welders	UT Taggart Creek	03-08-34	Mecklenburg
NCS000184	Radiator Specialty Company	Irwin Creek	03-08-34	Mecklenburg
NCS000021	Siemens Westinghouse Turbine Generator Plant	Lake Wylie	03-08-34	Mecklenburg
NCS000029	Hickory Springs Manufacturing Co.	Cline Creek	03-08-35	Catawba
NCS000304	AmeriSteel Corporation	UT of Long Creek	03-08-36	Mecklenburg
NCS000074	Globe Manufacturing Corp.	UT Kaglar Creek	03-08-36	Gaston
NCS000321	B F Goodrich Performance	UT Crowders Creek	03-08-37	Gaston
NCS000163	Color Mate, Inc.	Crowder Creek Basin	03-08-37	Gaston
NCS000311	UniRoyal Chemical Company Inc	Catawba Creek	03-08-37	Gaston

Appendix II

Biological Water Quality Data Collected by DWQ

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

Benthic Macroinvertebrate Sampling Methods and Criteria

Freshwater Wadeable and Flowing Waters

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

Several data analysis summaries (metrics) can be produced to detect water quality problems. These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

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

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

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

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

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

Flow Measurement

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. Some between-year changes in the macroinvertebrates, however, may be due largely to changes in flow. High flow years magnify the potential effects of nonpoint source runoff, leading to scour, substrate instability and reduced periphyton. Low flow years may accentuate the effect of point source dischargers by providing less dilution of wastes.
For these reasons, all between-year changes in the biological communities are considered in light of flow conditions (high, low or normal) for one month prior to the sampling date. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term mean flows. High flow is defined as a mean flow >140 percent of the long-term mean for that time period, usually July or August. Low flow is defined as a mean flow <60 percent of the long-term mean, while normal flow is 60-140 percent of the mean. While broad scale regional patterns are often observed, there may be large geographical variation within the state, and large variation within a single summer period.

Habitat Evaluation

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

Table A-II-1 Benthic macroinvertebrate data collected in the Catawba River Basin, 1983 - 2002 (Current basinwide sites are in bold font.)

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
03-08-30									
Catawba R	SR 1274 at end	McDowell	11-(1)	8/8/02	---	26	---	2.75	Good-Fair
		McDowell		8/7/97	---	24	---	2.88	Good-Fair
Catawba R	SR 1273	McDowell	11-(1)	4/18/85	99	49	4.24	2.97	Good
Mill Cr	at Graphite ab RR	McDowell	11-7	8/7/97	---	31	---	1.63	Excellent
				7/9/92	85	49	2.62	2.13	Excellent
				2/10/92	---	39	1.65	1.65	Good
Mill Cr	SR 1400/1407	McDowell	11-7	1/12/98	---	40	---	2.49	Good
				6/15/94	81	43	3.40	2.33	Excellent
Mill Cr	SR 1401	McDowell	11-7	1/12/98	---	37	---	2.73	Good
				8/7/97	---	18	---	3.26	Fair
Swannanoa Cr	SR 1400/1407	McDowell	11-7-9	8/8/02	---	31	---	2.26	Excellent
				1/12/99	---	35	---	2.75	Excellent
				1/12/98	---	16	---	2.31	Fair
				4/8/97	---	18	---	1.34	Fair
				6/15/94	---	35	---	1.90	Excellent
Catawba R	off SR 1234	McDowell	11-(8)	4/18/85	82	39	4.51	3.17	Good-Fair
Catawba R	I-40, be Old Fort	McDowell	11-(8)	7/23/87	74	30	5.75	4.66	Good-Fair
Catawba R	SR 1234	McDowell	11-(8)	8/8/02	89	36	4.72	3.55	Good
				8/7/97	70	31	5.32	4.18	Good-Fair
				7/9/92	102	41	4.13	3.20	Good
				7/26/90	84	38	4.43	3.71	Good
				4/18/85	86	28	6.29	4.02	Fair
Catawba R	SR 1221	McDowell	11-(8)	8/7/02	73	27	5.38	4.11	Good-Fair
				8/6/97	75	35	4.46	3.89	Good
				7/8/92	90	42	4.42	3.60	Good
				7/26/90	77	43	4.27	3.77	Good
				8/11/88	86	31	5.60	4.74	Good-Fair
				7/28/88	---	27	---	3.88	Good-Fair
				7/21/86	78	26	5.74	4.11	Good-Fair
				8/15/85	73	24	5.50	4.38	Good-Fair
				8/23/84	63	23	4.99	4.42	Good-Fair
				8/9/83	70	27	5.64	4.61	Good-Fair
Curtis Cr	off SR 1227	McDowell	11-10-(6)	8/8/02	---	30	---	3.35	Good
				8/7/97	---	34	---	2.46	Good
				2/10/92	---	42	2.13	2.10	Good
				4/19/85	97	44	3.86	2.37	Good
Curtis Cr	US 70 below WWTP	McDowell	11-10-(14)	6/15/94	---	30	---	2.65	Good
				4/18/85	56	25	5.76	3.11	Fair
Crooked Cr	SR 1135	McDowell	11-12	8/7/02	74	32	4.41	3.65	Good
				8/6/97	69	38	4.25	3.74	Good
				7/8/92	---	32	---	3.02	Good
Mackey Cr	SR 1453	McDowell	11-15-(3.5)	8/8/02	---	23	---	3.32	Not Impaired
				8/6/97	---	29	---	2.92	Good
				2/11/92	---	45	---	1.98	Excellent
Mackey Cr	above US 70	McDowell	11-15-(3.5)	3/25/98	68	37	3.60	2.72	Good
				10/2/96	68	30	4.36	3.82	Good
Mackey Cr	below US 70	McDowell	11-15-(3.5)	8/6/02	67	30	4.24	3.68	Good
				3/25/98	29	15	4.44	3.92	Fair
				10/2/96	43	25	4.90	4.47	Good-Fair
Buck Cr	off NC 80	McDowell	11-19-(1)	8/5/02	---	31	---	3.03	Good
				8/6/97	---	38	---	2.58	Excellent
				6/14/94	75	41	3.28	2.47	Excellent
				2/10/92	---	42	---	2.19	Excellent
Buck Cr	US 70	McDowell	11-19-(14)	6/14/94	58	20	4.64	3.40	Good-Fair
L Buck Cr	SR 1436	McDowell	11-19-11	8/6/02	---	35	---	2.74	Good
				8/6/97	---	37	---	2.44	Excellent
				2/10/92	---	43	---	2.00	Excellent
				7/9/91	60	37	2.75	2.31	Good

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
Toms Cr	SR 1434	McDowell	11-21-(2)	8/5/02	---	26	---	2.41	Not Impaired
				8/4/97	62	33	3.17	2.59	Good
				7/7/92	75	37	3.54	2.68	Excellent
				2/10/92	---	49	---	2.29	Excellent
N Fk Catawba R	Linville Falls	McDowell	11-24-(1)	1/9/91	---	37	---	1.89	Good
N Fk Catawba R	US 221	McDowell	11-24-(1)	1/9/91	---	42	---	2.57	Good
N Fk Catawba R	SR 1573	McDowell	11-24-(1)	8/6/02	---	28	---	3.78	Good
				8/8/97	---	37	---	2.74	Excellent
				1/9/91	---	37	---	2.83	Good
N Fk Catawba R	SR 1560	McDowell	11-24-(1)	8/6/02	74	23	5.90	4.92	Fair
				8/5/97	81	39	3.89	3.09	Good
				7/7/92	95	41	4.19	3.30	Good
				1/9/91	---	44	---	2.60	Excellent
N Fk Catawba R	below Sevier	McDowell	11-24-(1)	8/5/97	84	39	4.52	3.48	Good
				7/7/92	88	43	4.03	3.27	Excellent
Laurel Br	US 221	McDowell	11-24-3	1/8/91	---	32	---	1.37	Good
Pond Br	SR 1560	McDowell	11-24-4	1/9/91	---	24	---	1.54	Good
Stillhouse Br	SR 1560	McDowell	11-24-6	1/9/91	---	25	---	1.55	Good
Honeycutt Cr	US 221	McDowell	11-24-8	1/9/91	---	44	---	2.60	Good
Pepper Cr	US 221	McDowell	11-24-10	1/8/91	---	42	---	2.53	Good
Armstrong Cr	end of FS Rd	McDowell	11-24-14-(1.5)	8/6/02	---	38	---	2.80	Excellent
				8/5/97	---	36	---	2.15	Excellent
				7/7/92	---	38	---	2.10	Excellent
Three Mile Cr	SR 1443	McDowell	11-24-14-10	6/14/94	---	40	---	2.17	Excellent
Cox Cr	OFF NC 226	McDowell	11-24-14-12	6/14/94	---	37	---	2.89	Excellent
Armstrong Cr	off NC 226		11-24-14-(13.5)	6/14/94	99	48	3.47	2.60	Excellent
Paddy Cr	NC 126	Burke	11-29	5/19/99	---	36	---	2.80	Good
Linville R	off NC 105 ab golf course	Avery	11-29-(1)	6/9/97	60	32	2.90	1.86	Good
Linville R	NC 105, near Briery Knob	Avery	11-29-(1)	6/9/97	---	32	---	2.18	Good
				11/8/89	---	27	---	3.30	Good-Fair
Linville R	US 221	Avery	11-29-(1)	8/6/02	---	28	---	3.90	Good
				8/5/97	---	27	---	3.25	Good-Fair
				6/10/97	---	24	---	3.24	Good-Fair
				7/6/92	---	30	---	3.27	Good
				11/8/89	---	22	---	3.98	Good-Fair
L Grassy Cr	off NC 105 ab golf course	Avery	11-29-2	6/9/97	60	37	1.83	1.06	Excellent
W Fk Linville R	SR 1349	Avery	11-29-4	11/8/89	---	39	---	1.76	Good
Grandmother Cr	SR 1511	Avery	11-29-5-(2)	11/7/89	---	30	---	2.62	Good
Linville R	NC 126	Burke	11-29-(23)	8/23/02	91	48	4.21	3.47	Excellent
				8/7/02	90	47	3.98	3.20	Excellent
				8/4/97	107	53	4.05	3.11	Excellent
				7/7/92	108	48	4.14	3.14	Excellent
				7/9/91	84	43	4.03	3.02	Excellent
				1/8/91	---	48	---	2.51	Excellent
				10/24/90	94	47	3.81	2.75	Excellent
				7/27/90	104	46	4.22	3.13	Excellent
				4/10/90	113	54	3.70	2.39	Excellent
				1/22/90	---	49	---	2.14	Excellent
				1/22/90	94	56	3.45	2.50	Excellent
				11/7/89	100	54	3.42	2.62	Excellent
				11/7/89	---	48	---	2.52	Excellent
				8/8/89	---	45	---	3.10	Excellent
				8/8/89	99	46	3.93	2.75	Excellent
				3/29/89	89	43	3.67	3.18	Good
				2/15/89	113	59	3.83	2.88	Excellent
				2/15/89	---	41	---	2.77	Excellent
				8/3/87	---	42	---	3.30	Excellent
				7/23/87	113	48	4.52	3.32	Excellent
				8/16/85	101	41	5.11	3.69	Good
				8/10/83	105	45	4.61	3.45	Good

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
Catawba R	SR 1147	Burke	11-(31)	8/8/02	60	21	4.03	2.97	Good
				8/8/97	66	30	4.25	3.21	Good
				8/12/88	79	34	4.83	3.36	Good
N Muddy Cr	SR 1750	McDowell	11-32-1-(0.5)	8/5/02	77	32	5.53	4.61	Good-Fair
				8/4/97	63	33	4.76	4.26	Good
				7/8/92	80	32	4.95	4.46	Good-Fair
				4/17/85	85	35	5.48	4.16	Good-Fair
Youngs Fk	SR 1819	McDowell	11-32-1-4	8/7/02	66	22	5.79	4.65	Good-Fair
				4/9/01	52	15	5.36	4.73	Fair
				8/8/97	---	16	---	5.02	Fair
				9/12/90	55	17	6.11	5.36	Fair
				4/17/85	64	19	6.67	4.80	Fair
Youngs Fk	off NC 226	McDowell	11-32-1-4	4/9/01	30	5	7.46	6.52	Poor
Jacktown Cr	US 226	McDowell	11-32-1-4-1	4/9/01	54	19	4.88	3.93	Fair
Youngs Fk	SR 1794	McDowell	11-32-1-4	4/9/01	62	16	6.20	4.16	Fair
				9/12/90	44	8	7.16	6.61	Poor
				4/17/85	58	17	6.62	4.60	Fair
S Muddy Cr	SR 1764	McDowell	11-32-2-(8.5)	8/5/02	---	23	---	4.21	Good-Fair
		McDowell		8/4/97	---	24	---	3.67	Good-Fair
		McDowell		7/8/92	---	27	---	3.64	Good-Fair
High Shoals Cr	SR 1798	McDowell	11-32-2-6	7/22/86	76	32	4.30	2.91	Good
Canoe Cr	SR 1250	Burke	11-33-(2)	8/21/02	---	28	---	3.50	Good
				8/04/97	---	19	---	4.05	Good-Fair
				8/03/92	---	25	---	3.13	Good-Fair
03-08-31									
Catawba R	NC 181	Burke	11-(31)	08/22/02	46	21	4.44	3.54	Good-Fair
				08/04/97	57	23	4.56	3.12	Good-Fair
				07/06/92	76	30	4.79	3.71	Good
Silver Cr	SR 1127	Burke	11-34-(0.5)	08/21/02	---	25	---	3.74	Good-Fair
Silver Cr	SR 1149	Burke	11-34-(0.5)	08/04/97	73	32	5.26	4.48	Good-Fair
				08/03/92	71	29	5.53	4.46	Good-Fair
Clear Cr	Ab Hospital Reservoir	Burke	11-34-6-(1)	12/12/91	---	30	---	2.38	Good
Bailey Fork	SR 1102	Burke	11-34-8-(2)	08/03/92	---	24	---	3.30	Good-Fair
Warrior Fk	SR 1440	Burke	11-35-(1)	08/21/02	---	34	---	3.30	Good
				08/04/97	---	41	---	3.25	Excellent
Upper Cr	NC 181	Burke	11-35-2-(1)	09/22/88	---	46	---	2.38	Excellent
Upper Cr	USFS Rd 128	Burke	11-35-2-(1)	03/29/89	---	44	---	2.53	Good
				10/24/88	---	34	---	2.73	Good
				09/21/88	---	26	---	3.37	Good-Fair
Upper Cr	Ab USFS Rd 982	Burke	11-35-2-(1)	06/13/94	100	51	3.58	2.60	Excellent
				06/08/93	94	47	3.54	2.61	Excellent
UT Upper Cr	Ab Timbered Br	Burke	11-35-2-(1)	06/13/94	56	27	3.30	2.20	Excellent
				06/08/93	63	27	3.69	2.15	Excellent
Timbered Br	USFS Road 982	Burke	11-35-2-9	06/13/94	79	47	2.86	2.28	Not Rated
				06/08/93	74	38	3.15	2.10	Not Rated
				09/21/88	---	20	---	2.98	Good-Fair
Upper Cr	Be USFS Rd 982	Burke	11-35-2-(8.5)	06/13/94	103	57	3.45	2.63	Excellent
				06/08/93	108	58	3.44	2.38	Excellent
Upper Cr	At Optimist's Park	Burke	11-35-2-(10)	09/21/88	108	45	4.47	3.12	Excellent
Steels Cr	USFS Rd 128	Burke	11-35-2-12-(1)	05/17/90	---	48	---	1.73	Excellent
				09/22/88	---	38	---	2.70	Excellent
Gingercake Cr	USFS Rd 496	Burke	11-35-2-12-3	05/17/90	---	39	---	1.68	Excellent
				10/25/88	---	31	---	1.38	Excellent
Buck Cr	Ab Steels Cr	Burke	11-35-2-12-4	05/17/90	---	40	---	1.78	Excellent
Little Fork	USFS Rd 128	Burke	11-35-2-12-6	09/21/88	---	38	---	2.45	Excellent
				03/19/86	102	45	3.27	2.38	Excellent
Steels Cr	Ab NC 181	Burke	11-35-2-12-(7)	05/17/90	---	49	---	2.12	Excellent
				09/22/88	105	43	4.50	3.33	Good
Upper Cr	SR 1407	Burke	11-35-2-(13)	10/25/88	---	34	---	3.35	Good
Upper Cr	SR 1439	Burke	11-35-2-(13)	09/20/88	100	42	4.77	3.60	Good

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
Johns R	SR 1367	Caldwell	11-38-(1)	03/28/89	---	45	---	2.25	Good
Johns R	SR 1356	Caldwell	11-38-(9)	08/22/02	---	42	---	3.46	Excellent
				08/05/97	---	49	---	2.56	Excellent
				08/03/92	---	43	---	3.15	Excellent
				03/28/89	---	40	---	2.69	Good
				10/30/84	108	48	4.10	2.85	Excellent
Gragg Pr	SR 1462	Caldwell	11-38-10	03/27/89	---	47	---	2.34	Good
Anthony Cr	Ab Gragg Pr	Caldwell	11-38-10-3	03/27/89	---	30	---	2.30	Good-Fair
Johns R	SR 1438	Burke	11-38-(28)	08/22/02	---	35	---	3.44	Good
				03/28/89	116	63	3.90	2.76	Excellent
				08/10/83	89	43	4.04	3.31	Excellent
Mulberry Cr	SR 1368	Caldwell	11-38-32-(11)	03/27/89	---	53	---	2.59	Excellent
Mulberry Cr	SR 1310	Caldwell	11-38-32-(15)	03/27/89	---	43	---	2.86	Good
Wilson Cr	US 221	Avery	11-38-34	07/23/90	65	32	2.65	1.32	Excellent
				08/08/88	81	37	3.16	1.63	Excellent
				07/24/86	67	36	2.58	1.54	Excellent
				08/28/84	38	20	2.64	1.19	Good
Wilson Cr	SR 1358	Caldwell	11-38-34	07/09/91	92	50	3.78	2.88	Excellent
				03/29/89	---	57	---	2.14	Excellent
				07/24/86	106	49	3.68	2.65	Excellent
Wilson Cr	off SR 1328 Be Mortimer	Caldwell	11-38-34	08/22/02	85	45	3.33	2.48	Excellent
Wilson Cr	SR 1335	Caldwell	11-38-34	08/05/97	---	47	---	2.68	Excellent
Harper Cr	SR 1328	Caldwell	11-38-34-14	08/22/02	---	42	---	2.78	Excellent
N Harper Cr	USFS Rd 58	Avery	11-38-34-14-2	08/06/86	90	43	3.68	2.36	Excellent
Lower Cr	NC 90	Caldwell	11-39-(0.5)	09/09/02	45	9	6.46	5.35	Poor
				06/10/97	51	22	5.21	4.50	Good-Fair
Lower Cr	Harrisburg St, Lenoir	Caldwell	11-39-(0.5)	09/15/87	65	22	5.92	4.73	Fair
Lower Cr	SR 1303, Fairview Rd	Caldwell	11-39-(0.5)	09/10/02	57	13	6.67	5.53	Fair
				06/10/97	43	18	5.36	4.35	Fair
Zacks Fk Cr	SR 1531	Caldwell	11-39-1	09/09/02	54	19	5.67	5.02	Not Impaired
Zacks Fk Cr	NC 18/321A	Caldwell	11-39-1	09/10/02	32	6	6.87	6.15	Not Rated
				06/10/97	---	18	---	4.54	Fair
				09/15/87	55	19	6.05	5.39	Fair
Spainhour Cr	SR 1303	Caldwell	11-39-3	06/11/97	---	14	---	5.03	Fair
Spainhour Cr	NC 18 Bus	Caldwell	11-39-3	09/09/02	49	15	6.46	5.82	Fair
UT Spainhour Cr	SR 1513	Caldwell	11-39-3	09/09/02	32	13	4.66	4.38	Not Rated
Blair Fk	NC 90	Caldwell	11-39-3-1	09/09/02	24	5	6.42	5.58	Not Rated
Greasy Cr	NC 18	Caldwell	11-39-4	09/10/02	45	14	5.70	5.19	Not Rated
				06/11/97	---	15	---	4.31	Fair
Greasy Cr	SR 1305	Caldwell	11-39-4	09/10/02	47	13	4.86	3.99	Not Rated
Abingdon Cr	NC 18 Bypass	Caldwell	11-39-6	09/10/02	57	20	5.60	5.11	Not Impaired
Lower Cr	SR 1142, Calico Rd	Caldwell	11-39-(6.5)	09/10/02	50	11	6.52	5.54	Fair
				06/11/97	39	16	5.91	4.86	Fair
Lower Cr	SR 1501	Burke	11-39-(6.5)	09/11/02	55	14	6.14	4.96	Fair
				06/10/97	46	19	5.52	4.87	Fair
				08/03/92	55	20	5.85	4.80	Fair
				07/10/90	62	19	6.59	5.23	Fair
				07/23/87	61	18	6.82	4.85	Fair
				08/07/84	60	20	6.39	5.00	Fair
Celia Cr		Caldwell	11-39-7-1-(1)	09/11/02	39	10	5.78	4.77	Not Rated
Husband Cr	Old NC 18	Caldwell	11-39-7-(2)	09/11/02	59	24	5.28	4.54	Not Impaired
Husband Cr	NC 18	Caldwell	11-39-7-(2)	09/11/02	36	14	5.24	4.34	Not Rated
				06/11/97	---	20	---	4.77	Good-Fair
Bristol Cr	NC 18	Caldwell	11-39-8	09/11/02	55	12	5.56	4.39	Not Rated
				06/10/97	---	15	---	4.61	Fair
White Mill Cr	Piney Rd	Caldwell	11-39-8-1-(2)	09/11/02	37	12	4.74	3.06	Not Rated
Smoky Cr	SR 1515	Burke	11-41-1	08/21/02	---	26	---	3.55	Good-Fair
				08/05/97	---	32	---	3.58	Good
				08/04/92	---	30	---	3.22	Good
McGalliard Cr	SR 1538	Burke	11-44-(0.5)	08/21/02		16	---	5.09	Fair
				08/05/97	---	21	---	4.81	Good-Fair
				08/04/92	66	22	5.60	4.56	Good-Fair

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
03-08-32									
Huffman Br	Sta 2, be Huffman Finishing	Burke	11-(51)-1	10/11/84	13	0	9.30	---	Poor
Huffman Br	Sta 3	Burke	11-(51)-1	10/11/84	19	1	9.25	6.22	Poor
Huffman Br	Sta 4	Burke	11-(51)-1	10/11/84	20	0	8.94	N/A	Poor
Horseford Cr	16th Ave NW	Catawba	11-54-(0.5)	09/12/02	32	8	6.58	6.34	Fair
Gunpowder Cr	SR 1718	Caldwell	11-55-(1.5)	08/21/02	---	23	---	4.68	Good-Fair
Gunpowder Cr	SR 1002	Caldwell	11-55-(1.5)	08/05/97	---	25	---	4.27	Good-Fair
Upper Little R	SR 1740	Caldwell	11-58-(5.5)	08/20/02	83	33	4.91	3.93	Good
				08/06/97	90	39	4.35	3.47	Good
				08/04/92	74	38	4.17	3.55	Good
Middle Little R	SR 1153	Alexander	11-62	08/20/02		18	---	3.74	
				08/06/97	---	26	---	3.95	Good-Fair
				08/04/92	32	32	4.14	4.14	Good
Duck Cr	NC 127	Alexander	11-62-2-(4)	08/20/02	---	33	---	3.76	Good
				08/06/97	---	26	---	3.93	Good-Fair
				O8/04/92	---	26	---	3.42	Good-Fair
Lower Little R	SR 1313	Alexander	11-69	07/28/88	87	32	5.19	3.51	Good-Fair
				08/27/88	---	29	---	4.42	Good
				08/08/85	53	18	5.78	5.42	Fair
Lower Little R	SR 1131	Alexander	11-69	08/20/02	61	28	4.85	3.92	Good-Fair
				08/06/97	74	34	4.94	4.19	Good
				08/04/92	70	29	4.60	3.85	Good
Muddy Fk	Ab Schneider Mills	Alexander	11-69-4	06/17/92	70	19	5.53	4.46	Good-Fair
Muddy Fk	NC 16, Be WWTP	Alexander	11-69-4	06/16/92	66	19	6.79	4.92	Fair
Muddy Fk	SR 1313	Alexander	11-69-4	08/19/02	---	12	---	6.05	Fair
				08/06/97	76	22	6.26	5.42	Good-Fair
Elk Shoal Cr	SR 1605	Alexander	11-73-(0.5)	08/20/02	---	16	---	5.03	Good-Fair
				08/07/97	---	18	---	4.48	Good-Fair
				08/05/92	---	15	---	4.92	Good-Fair
Lyle Cr	US 64/70	Catawba	11-76-(3.5)	08/19/02	---	22	---	4.69	Good-Fair
				09/07/97	51	23	4.95	4.22	Good-Fair
				08/05/92	62	22	5.66	4.88	Good-Fair
McLin Cr	SR 1722	Catawba	11-76-5-(0.7)	08/19/02	---	23	---	5.14	Good-Fair
				08/07/97	57	27	5.17	4.33	Good-Fair
03-08-33									
McDowell Cr	SR 2128	Mecklenburg	11-115-(1)	8/20/02	48	8	6.6	5.7	Fair
				9/13/90	54	17	6.2	5.4	Good-Fair
McDowell Cr	SR 2136	Mecklenburg	11-115-(1.5)	9/13/90	55	15	6.5	5.8	Fair
Gar Cr	SR 2074	Mecklenburg	11-116-(1)	8/20/97	---	21	---	4.9	Good
				6/8/94	64	20	5.6	4.9	Good
				8/20/92	87	24	5.5	4.6	Good
Dutchmans Cr	SR 1918	Gaston	11-119-(0.5)	8/21/02	---	19	---	5.0	Good-Fair
				8/19/97	73	33	5.2	4.5	Good
				6/8/94	66	26	5.1	4.5	Good
				8/6/92	77	33	5.6	4.7	Good
				7/26/88	83	34	5.3	4.7	Excellent
Leepers Cr	SR 1354	Lincoln	11-119-1-(1)	6/9/94	---	31	---	3.4	Excellent
Leepers Cr	NC 73	Lincoln		6/9/94	71	30	5.0	4.3	Excellent
Leepers Cr	NC 150	Lincoln		6/12/84	86	30	4.9	4.3	Excellent
Leepers Cr	SR 1820	Gaston	11-119-1-(12)	6/8/94	---	29	---	4.3	Excellent
Killian Cr	SR 1511	Lincoln	11-119-2-(0.5)	8/20/02	---	12	---	5.0	Fair
				8/19/97	---	24	---	3.9	Good
				6/8/94	82	33	5.1	4.9	Excellent
				8/5/92	---	28	---	4.9	Excellent

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
03-08-34									
Long Cr	SR 2042	Mecklenburg	11-120-(7)	7/12/879	65	17	6.1	5.7	Good-Fair
Sugar Cr	SC 160	York, SC	11-137	8/19/02	34	7	6.4	6.1	Fair
				8/21/97	57	12	6.9	6.1	Fair
				8/19/92	58	21	6.7	5.6	Good-Fair
				7/8/91	49	14	6.7	6.1	Fair
				7/24/90	39	7	7.0	5.6	Fair
				7/25/88	53	9	7.9	6.6	Poor
				7/23/86	40	2	8.5	8.9	Poor
				8/6/84	45	9	8.0	6.1	Poor
				11/8/83	30	3	8.2	6.1	Poor
Sugar Cr	SR 1156	Mecklenburg	11-137-1	8/20/02	---	5	---	7.0	Poor
				8/21/97	---	7	---	6.1	Fair
Irwin Cr	I-77	Mecklenburg	11-137-1	8/18/92	55	8	7.7	6.7	Poor
Irwin Cr	SR 2523	Mecklenburg	11-137-1	2/28/90	52	17	6.0	5.0	Good-Fair
Irwin Cr	Ab Landfill	Mecklenburg	11-137-1	10/17/84	50	13	7.4	6.1	Fair
Irwin Cr	Bel Landfill	Mecklenburg	11-137-1	10/17/84	36	11	7.6	6.0	Fair
Irwin Cr	Ab WWTP	Mecklenburg	11-137-1	11/9/83	23	2	8.2	6.9	Poor
Stewart Cr	SR 2050	Mecklenburg	11-137-1-2	2/27/90	37	14	6.6	3.9	Not Rated
McCullough Br	NC 51	Mecklenburg	11-137-7	2/27/90	34	5	7.6	6.9	Not Rated
L Sugar Cr	Polk Street	Mecklenburg	11-137-8	8/19/02	---	6	---	6.7	Poor
L Sugar Cr	NC 51	Mecklenburg	11-137-8	8/21/97	---	7	---	6.9	Fair
				9/19/92	43	3	8.1	6.3	Poor
L Sugar Cr	Archdale Rd	Mecklenburg	11-137-8	11/9/83	15	1	8.8	7.4	Poor
UT Edwards Br	Shefield Park	Mecklenburg	11-137-8-2-1	8/10/00	10	0	7.1	0	Not Rated
Edwards Br	Campbell St	Mecklenburg	11-137-8-2-1	8/10/00	13	3	7.7	7.5	Not Rated
Edwards Br	Shefield St	Mecklenburg	11-137-8-2-1	8/10/00	14	3	7.8	6.7	Not Rated
McAlpine Cr	NC 51	Mecklenburg	11-137-9	8/19/02	43	7	7.0	6.0	Fair
				8/21/97	59	17	6.9	6.0	Fair
				8/19/92	55	9	7.2	5.7	Fair
McAlpine Cr	Dorman Rd	York, SC	11-137-9	8/19/92	40	11	7.0	6.3	Fair
McAlpine Cr	Ab WWTP	Mecklenburg	11-137-9	3/26/87	33	5	7.5	5.3	Poor
McAlpine Cr	Bel WWTP	Mecklenburg	11-137-9	3/26/87	18	2	7.8	3.7	Poor
McAlpine Cr	Sardis Rd	Mecklenburg	11-137-9	3/26/87	45	12	6.1	5.0	Fair
				11/9/83	61	12	6.7	5.8	Fair
McAlpine Cr	NC 521	Mecklenburg	11-137-9	11/9/83	24	3	8.5	6.4	Poor
Walker Br	NC 49	Mecklenburg	11-137-10-1	2/27/90	68	18	6.1	5.5	Good-Fair
03-08-35									
S Fk Catawba R	NC 10	Catawba	11-129-(0.5)	8/18/97	60	25	5.56	4.70	Good
				8/17/92	75	24	6.20	5.05	Good-Fair
				7/9/90	56	16	6.57	5.27	Fair
				7/28/88	67	24	6.25	5.07	Good-Fair
				7/21/86	49	12	6.59	4.68	Fair
				8/7/84	67	26	5.28	4.15	Good-Fair
S Fk Catawba R	NC 27	Lincoln	11-129-(3.5)	9/10/84	77	29	5.58	4.17	Good
Henry Fk	SR 1854	Burke	11-129-1-(1)	9/13/01	38	18	5.5	5.2	Fair
Henry Fk	SR 1803	Burke	11-129-1-(1)	9/12/01	79	33	5.1	4.3	Good-Fair
Henry Fk	SR 1918	Burke	11-129-1-(1)	4/18/88	106	53	3.29	2.11	Excellent
Henry Fk	SR 1922	Burke	11-129-1-(2)	4/19/88	116	62	3.59	2.52	Excellent
Henry Fk	NC 18	Burke	11-129-1-(2)	4/20/88	127	65	3.84	2.68	Excellent
UT Henry Fk	SR 1915	Burke		4/20/88	110	52	3.83	2.33	Good
He Cr	Ab Water Intake	Burke	11-129-1-4-(1)	4/20/88	---	45	---	2.01	Excellent
Ivy Cr	SR 1919	Burke	11-129-1-6	4/19/88	---	42	---	2.36	Good
Long Br	SR 1917	Burke	11-129-1-8	4/19/88	---	46	---	2.87	Excellent
Rock Cr	SR 1915	Burke	11-129-1-12	4/19/88	---	43	---	2.84	Good
Henry Fk	SR 1124	Catawba	11-129-1-(12.5)	8/22/02	95	38	4.7	3.3	Good
				8/18/97	76	38	3.90	3.30	Good
				8/22/92	74	38	4.58	3.75	Good
				7/10/89	64	27	4.65	4.22	Good
				7/22/87	73	25	5.09	4.01	Good-Fair
				7/21/86	79	28	5.39	3.88	Good-Fair
Henry Fk	SR 1008	Catawba	11-129-1-(12.5)	11/16/83	27	5	6.87	4.20	Poor

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
UT Henry Fk	SR 1213	Catawba		6/20/85	29	8	6.34	4.23	Fair
				6/20/85	31	7	6.24	2.71	Fair
UT Henry Fk	SR 1148	Burke		2/9/87	---	36	---	2.13	Excellent
UT Henry Fk	US 64	Burke		2/9/87	---	0	---	0	Poor
UT Henry Fk	Be Discharge	Burke		2/9/87	---	5	---	5.96	Poor
UT Henry Fk	I-40	Burke		2/9/87	---	17	---	3.40	Good-Fair
Jacob Fk	S Mt St Pk	Burke	11-129-2-(1)	5/18/90	---	42	---	2.49	Excellent
Jacob Fk	SR 1904	Burke	11-129-2-(1)	5/18/90	---	42	---	2.31	Excellent
Jacob Fk	SR 1924	Burke	11-129-2-(1)	8/22/02	---	35	---	3.3	Good
				8/18/97	99	47	4.06	3.20	Excellent
				8/20/92	104	48	4.48	3.32	Excellent
				10/24/90	102	50	3.95	2.60	Excellent
				7/10/90	92	45	4.77	4.01	Excellent
				5/18/90	---	48	---	2.56	Excellent
				1/25/90	86	55	3.41	2.87	Excellent
				7/22/87	96	35	4.96	3.76	Good
				8/6/85	75	32	5.14	3.99	Good-Fair
Shinny Cr	S Mt St Pk	Burke	11-129-2-3	5/18/90	---	41	---	2.13	Excellent
Jacob Fk	NC 27	Catawba	11-129-2-(9.5)	11/16/83	79	35	---	---	Good
Jacob Fk	SR 1139	Catawba	11-129-2-(9.5)	11/16/83	69	23	---	---	Good-Fair
Hop Cr	SR 1131	Catawba	11-129-2-14	6/19/85	86	36	4.56	3.44	Good
Howards Cr	SR 1200	Lincoln	11-129-4	8/21/02	---	17	---	4.5	Good-Fair
				8/19/97	---	25	---	4.15	Good
				8/17/92	---	25	---	4.33	Good
Clark Cr	US 64	Catawba	11-129-5-(0.3)	9/12/84	57	15	6.14	5.15	Good-Fair
Clark Cr	SR 1149	Catawba	11-129-5-(0.3)	4/17/01	49	20	5.6	4.6	Good-Fair
				7/26/00	37	13	6.0	5.6	Fair
				8/5/92	---	16	---	5.74	Good-Fair
				9/12/84	60	16	6.65	5.81	Good-Fair
Clark Cr	SR 2014	Catawba	11-129-5-(0.3)	9/12/90	50	13	7.16	6.46	Fair
				9/12/84	59	15	6.79	6.17	Fair
				6/12/84	59	16	6.25	5.80	Good-Fair
Clark Cr	SR 2012	Catawba	11-129-5-(0.3)	7/26/00	38	13	6.0	5.6	Fair
				9/12/90	40	6	7.11	5.33	Fair
				9/12/84	64	19	7.11	6.26	Good-Fair
				6/12/84	46	14	6.51	5.81	Good-Fair
Clark Cr	SR 1274	Catawba	11-129-5-(9.5)	9/12/84	70	16	6.92	6.06	Fair
Clark Cr	16th St	Catawba	11-129-5-(9.5)	4/17/01	28	9	7.2	5.7	Not Rated
Clark Cr	Sweetwater Rd	Catawba	11-129-5-(9.5)	4/17/01	19	3	7.6	6.5	Not Rated
				7/18/00	22	8	6.6	6.4	Not Rated
Clark Cr	20th Ave	Catawba	11-129-5-(9.5)	8/14/00	42	10	6.5	6.0	Fair
Clark Cr	SR 1008	Lincoln	11-129-5-(9.5)	8/21/02	47	9	6.2	5.1	Fair
				8/19/97	48	16	5.72	5.16	Good-Fair
				8/5/92	48	10	6.67	5.63	Fair
				7/27/88	54	11	6.78	6.11	Fair
				8/5/85	48	13	7.14	6.25	Fair
				9/11/84	79	27	6.62	5.40	Good
				11/16/83	38	9	---	---	Fair
Cline Cr	SR 1164	Catawba	11-129-5-2	7/26/00	37	16	5.5	5.2	Not Rated
				9/12/84	50	11	7.16	6.21	Fair
Town Cr	US 321	Catawba	11-129-5-4	8/14/00	49	14	5.6	5.4	Good-Fair
Pinch Gut Cr	SR 2007	Catawba	11-129-5-7	4/17/01	76	29	5.3	4.3	Good
Maiden Cr	SR 1858	Catawba	11-129-5-7-2-(1)	3/18/93	55	22	4.85	4.02	Good
Maiden Cr	SR 1810	Catawba	11-129-5-7-2-(3)	8/21/02	31	5	7.1	6.4	Fair
				3/18/93	67	26	4.93	4.26	Good
Maiden Cr	SR 2007	Catawba	11-129-5-7-2-(3)	9/11/84	86	18	6.55	5.76	Good-Fair
Shady Br	SR 2005	Catawba	11-129-5-7-3	9/11/84	32	1	8.86	7.37	Poor
Carpenter Cr	US 321	Lincoln	11-129-5-9	4/17/01	57	27	4.6	4.4	Not Rated
Carpenter Cr	US 301	Lincoln	11-129-5-9	6/9/94	64	28	4.47	3.90	Good
				9/11/84	85	30	4.94	4.61	Excellent
Walker Cr	SR 1405	Lincoln	11-129-5-10	9/11/84	75	18	7.09	6.11	Good-Fair

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
Indian Cr	SR 1177	Lincoln	11-129-8-(5)	8/21/02	---	13	---	4.8	Fair
Indian Cr	SR 1252	Lincoln	11-129-8-(5)	8/19/97	73	24	5.23	4.63	Good
				8/17/92	79	29	6.06	5.38	Good
				7/22/87	67	18	6.33	5.52	Good-Fair
				7/23/86	77	18	6.58	5.40	Good-Fair
				11/16/83	50	6	6.90	5.36	Fair
				8/12/83	51	12	6.39	6.00	Good-Fair
Hoyle Cr	SR 1836	Gaston	11-129-15-(4)	11/15/83	50	15	6.12	4.88	Good-Fair
Mauney Cr	SR 1831	Gaston	11-129-15-5	5/13/97	49	11	6.73	5.34	Fair
03-08-36									
S Fk Catawba R	SR 2003	Gaston	11-129-(15.5)	8/11/83	49	19	6.51	5.65	Good-Fair
S Fk Catawba R	NC 7	Gaston	11-129-(15.5)	8/20/97	61	16	6.02	5.05	Good-Fair
				8/18/92	63	18	6.70	5.40	Good-Fair
				7/11/89	62	15	6.32	4.72	Good-Fair
				7/20/87	65	23	6.50	5.43	Good-Fair
				8//585	55	16	7.02	5.34	Fair
				11/15/83	7	2	7.82	5.64	Poor
Limekiln Cr	Kiser Dairy	Gaston	11-129-16-2	5/21/01	60	6	7.4	3.2	Not Rated
Limekiln Cr	SR 1409	Gaston	11-129-16-2	4/20/98	71	22	5.2	4.3	Good
Long Cr	SR 1409	Gaston	11-129-16-(2.3)	4/18/95	67	14	5.84	4.78	Good-Fair
Long Cr	SR 1408	Gaston	11-129-16-(2.3)	4/4/94	81	29	5.28	4.39	Good
Long Cr	SR 1405	Gaston	11-129-16-(2.3)	4/5/93	83	31	5.21	3.80	Good
				4/11/92	73	26	5.47	4.43	Good
				4/3/91	63	24	5.53	4.55	Good
				4/18/95	---	22	---	5.07	Good-Fair
				4/4/94	89	29	5.63	4.70	Good
Long Cr	NC 274	Gaston	11-129-16-(4)	4/5/93	75	28	4.90	3.95	Good
				4/2/92	73	25	5.58	4.91	Good
				4/3/91	63	21	5.69	4.90	Good-Fair
				4/19/95	79	19	5.82	5.22	Good-Fair
				4/5/95	90	24	6.35	4.92	Good-Fair
Long Cr	SR 1443	Gaston	11-129-16-(4)	4/5/94	90	37	5.09	4.35	Good
Long Cr	SR 1446	Gaston	11-129-16-(4)	4/6/93	98	35	5.22	4.40	Good
				4/11/92	65	25	5.30	4.80	Good
				4/4/91	54	20	5.58	4.87	Good-Fair
				4/4/94	76	24	6.20	5.40	Good-Fair
				4/3/93	70	23	5.52	4.68	Good
Long Cr	SR 1448	Gaston	11-129-16-(4)	4/1/92	76	26	4.97	4.19	Good
				4/4/91	62	22	5.57	4.89	Good-Fair
				4/19/95	80	23	5.82	5.15	Good
				4/4/94	86	30	5.83	5.04	Good
Long Cr	NC 275	Gaston	11-129-16-(4)	4/5/93	89	31	5.51	4.54	Good
				4/1/92	59	21	5.45	5.0	Good
				4/5/91	51	21	5.55	5.07	Good-Fair
				4/18/95	72	20	6.36	5.47	Good-Fair
				4/4/94	84	21	6.26	5.17	Good-Fair
Long Cr	SR 1456	Gaston	11-129-16-(4)	8/20/97	62	21	5.81	4.79	Good-Fair
				7/25/90	67	18	6.42	5.39	Good-Fair
				7/20/87	71	19	6.59	5.61	Good-Fair
				8/6/84	62	17	6.25	5.44	Good-Fair
Long Cr	SR 2003	Gaston	11-129-16-(4)	7/25/90	54	14	7.33	6.30	Fair
				11/15/83	20	3	8.61	4.93	Poor
UT Long Cr	SR 1446	Gaston	11-129-16-(4)	4/5/94	---	26	---	4.89	Good-Fair
				4/4/91	76	25	5.46	4.39	Good
UT Long Cr	SR 1456	Gaston	11-129-16-(4)	4/5/91	55	26	4.44	4.25	Good
UT Long Cr	Dallas WWTP	Gaston	11-129-16-(4)	6/17/92	42	10	6.45	6.11	Good-Fair
UT Long Cr	SR 2275	Gaston	11-129-16-(4)	6/17/92	39	8	7.60	6.40	Fair
Kiser Br	Kiser Dairy	Gaston	11-129-16-(4)	5/21/01	60	6	7.4	3.2	Not Rated
				4/20/98	60	10	6.7	4.0	Fair
				6/13/96	59	8	7.09	6.13	Fair
Kaglor Br	Rankin Park	Gaston	11-129-16-5	4/20/98	33	9	6.3	5.4	Not Rated
				6/13/96	55	8	6.29	5.8	Not Rated

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
03-08-37									
Catawba Cr	SR 2446	Gaston	11-130	7/26/90	42	10	6.94	6.66	Fair
				5/8/85	55	16	7.09	6.13	Fair
Catawba Cr	SR 2439	Gaston	11-130	7/25/90	43	1	8.12	7.40	Poor
				5/8/85	38	5	8.55	6.07	Poor
Catawba Cr	SR 2435	Gaston	11-130	5/8/85	43	6	8.44	6.50	Poor
Crowders Cr	SR 1118	Gaston	11-135	5/21/02	31	10	5.1	5.0	Not Rated
				9/12/89	50	14	6.02	4.73	Good-Fair
Crowders Cr	SR 1125	Gaston	11-135	5/21/02	63	21	5.4	5.1	Good-Fair
				9/12/89	55	13	7.07	6.11	Fair
Crowders Cr	SR 1131	Gaston	11-135	5/22/02	54	14	6.2	5.3	Fair
				9/13/89	46	7	7.69	7.00	Fair
Crowders Cr	NC 321	Gaston	11-135	9/13/89	46	10	6.81	5.64	Fair
Crowders Cr	SR 2424	Gaston	11-135	9/13/89	51	15	6.86	5.87	Fair
Crowders Cr	SC 564	York, SC	11-135	5/20/02	57	14	6.3	5.9	Fair
				8/20/97	67	11	6.56	5.94	Fair
				8/18/92	66	18	6.55	5.65	Good-Fair
				9/14/89	61	15	6.83	6.13	Fair
				7/26/88	43	4	8.30	7.50	Poor
McGill Cr	Ab WWTP	Gaston	11-135-2	9/12/89	---	4	---	7.43	Poor
McGill Cr	SR 1300	Gaston	11-135-2	9/12/89	---	6	---	7.09	Poor
Abernethy Cr	SR 1302 Ab UT	Gaston	11-135-4	5/21/02	56	18	5.5	5.1	Not Impaired
				3/23/93	56	20	5.76	4.95	Good-Fair
				9/12/89	---	12	---	4.93	Fair
				6/10/87	67	13	7.40	5.81	Fair
Abernethy Cr	SR 1302 Bel UT	Gaston	11-135-4	5/21/02	38	12	6.4	5.7	Fair
				3/23/93	51	19	6.49	5.39	Good-Fair
				6/10/87	43	4	7.78	7.53	Poor
Abernethy Cr	Ab WWTP	Gaston	11-135-4	9/12/89	---	3	---	6.90	Poor
Abernethy Cr	Bel WWTP	Gaston	11-135-4	9/12/89	---	1	---	6.57	Poor
UT Abernethy Cr	Bel Lithium	Gaston	11-135-4	5/21/02	44	12	5.7	3.5	Not Rated
				3/23/93	40	5	7.77	7.52	Poor
				6/10/87	25	0	7.90	0	Poor
Blackwood Cr	Davis Park Rd	Gaston	11-135-7	5/21/02	35	8	6.3	6.2	Not Rated
S Fk Crowders Cr	SC 148	York, SC	11-135-10	5/20/02	---	13	---	4.7	Fair
S Fk Crowders Cr	SC 79	York, SC	11-135-10	5/20/02	---	19	---	4.3	Good-Fair
S Crowders Cr	SR 1103	Gaston	11-135-10-1	5/9/85	89	31	5.31	4.41	Good-Fair
S Crowders Cr	SR 1109	Gaston	11-135-10-1	5/20/02	59	18	5.7	5.1	Good-Fair
				9/13/89	---	16	---	5.56	Good-Fair
UT Crowders Cr	SR 2416	Gaston		5/20/02	67	15	6.2	5.1	Good-Fair
				9/13/89	---	11	---	6.62	Fair
03-08-38									
Twelvemile Cr	NC 16	Union	11-138	2/27/90	---	30	---	4.93	Good-Fair
				7/11/89	71	20	6.25	5.37	Good-Fair
				11/8/83	50	7	7.15	6.33	Fair
Sixmile Cr	SR 3445	Mecklenburg	11-138-3	3/26/87	67	22	5.26	3.58	Good-Fair
Waxhaw Cr	SR 1103	Union	11-139	8/19/92	---	14	---	5.53	Good-Fair
				11/8/83	38	6	6.82	5.39	Fair

Fish Community Sampling Methods and Criteria

Wadeable Stream Sampling Methods

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

NCIBI Analysis

The assessment of biological integrity using the North Carolina Index of Biotic Integrity (NCIBI) is provided by the cumulative assessment of 12 parameters or metrics. The values provided by the metrics are converted into scores on a 1, 3 or 5 scale. A score of 5 represents conditions which would be expected for undisturbed reference streams in the specific river basin or ecoregion, while a score of 1 indicates that the conditions deviate greatly from those expected in undisturbed streams of the region. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Finally, the score (an even number between 12 and 60) is then used to determine the ecological integrity class of the stream from which the sample was collected.

The NCIBI has recently been revised (NCDENR, 2001). Currently, the focus of using and applying the NCIBI has been restricted to wadeable streams that can be sampled by a crew of four persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (Biological Assessment Unit Memorandum 09222000) (Table 1).

Table 1 Revised Scores and Classes for Evaluating the Fish Community of a Wadeable Stream Using the North Carolina Index of Biotic Integrity (NCIBI) in the Broad, Catawba, Savannah and Yadkin River Basins

NCIBI Scores	NCIBI Classes
> 54	Excellent
48 - 52	Good
42 - 46	Good-Fair
36 - 40	Fair
≤ 34	Poor

Table 2 Fish Community Structure Data Collected in the Catawba River Basin, 1993 – 2002 (Current basinwide sites are in bold font.)

Subbasin/Waterbody	Location	County	Index No.	Date	NCIBI Score	NCIBI Rating
03-08-30						
Catawba R	SR 1110	McDowell	11-1	04/29/02	46	Good-Fair
				05/07/97	50	Good
Mill Cr	SR 1400	McDowell	11-7-(0.5)	06/08/99	58	Excellent
Curtis Cr	US 70	McDowell	11-10	04/30/02	60	Excellent
Crooked Cr	SR 1135	McDowell	11-12	04/30/02	56	Excellent
Mackey Cr	US 70/SR 1413	McDowell	11-15-(3.5)	03/25/98	48	Good
Mackey Cr	US 70	McDowell	11-15-(3.5)	04/29/02	52	Good
				03/25/98	18	Poor
Armstrong Cr	SR 1456	McDowell	11-24-14-(1)	09/23/99	54	Excellent
				06/22/99	56	Excellent
				04/15/99	54	Excellent
				05/07/97	56	Excellent
Paddy Cr	NC 126	Burke	11-28	05/01/02	46	Good-Fair
				05/05/97	40	Fair
North Muddy Cr	SR 1760	McDowell	11-32-1	04/30/02	48	Good
				05/07/97	52	Good
Corpening Cr	SR 1794	McDowell	11-32-1-4	09/23/02	40	Fair
South Muddy Cr	SR 1764	McDowell	11-32-2	05/01/02	48	Good
				07/02/97	50	Good
				06/28/93	50	Good
Canoe Cr	SR 1250	Burke	11-33-(2)	05/02/02	50	Good
				05/05/97	54	Excellent
				05/10/93	46	Good-Fair
03-08-31						
Silver Cr	SR 1149	Burke	11-34-(0.5)	05/01/02	60	Excellent
Upper Cr	SR 1439	Burke	11-35-2-(13)	09/22/99	56	Excellent
				06/21/99	54	Excellent
				04/16/99	56	Excellent
				07/01/97	54	Excellent
Irish Cr	SR 1439	Burke	11-35-3-(2)	05/02/02	38	Fair
Hunting Cr	SR 1512	Burke	11-36-(0.3)	05/01/02	38	Fair
Gragg Prong	SR 1367	Caldwell	11-38-10	05/25/99	56	Excellent
				10/01/98	56	Excellent
Mulberry Cr	NC 90	Caldwell	11-38-32-(15)	09/22/99	60	Excellent
				06/21/99	58	Excellent
				04/16/99	56	Excellent
				05/08/97	60	Excellent
Lower Cr	SR 1142	Caldwell	11-39-(6.5)	05/10/93	44	Good-Fair
Lower Cr	SR 1501	Burke	11-39-(6.5)	05/02/02	42	Good-Fair
				10/24/97	44	Good-Fair
Smoky Cr	SR 1515	Burke	11-41-(1)	05/03/02	58	Excellent
McGalliard Cr	SR 1538	Burke	11-44-(0.5)	05/03/02	40	Fair
				05/06/97	48	Good
				05/10/93	38	Fair
03-08-32						
Upper Little R	SR 1786	Caldwell	11-58-(5.5)	05/24/02	42	Good-Fair
Middle Little R	SR 1002	Alexander	11-62	05/23/02	56	Excellent
				05/08/97	52	Good
				05/11/93	46	Good-Fair
Duck Cr	NC 90	Alexander	11-62-2-(1)	05/23/02	48	Good
				05/08/97	48	Good
				05/11/93	40	Fair
Lower Little R	SR 1318	Alexander	11-69-(0.5)	05/23/02	38	Fair
				05/09/97	48	Good
				05/11/93	28	Poor

Subbasin/Waterbody	Location	County	Index No.	Date	NCIBI Score	NCIBI Rating
Elk Shoal Cr	SR 1605	Alexander	11-73-(0.5)	05/23/02	48	Good
				05/09/97	54	Excellent
				05/11/93	48	Good
Lyle Cr	US 70	Catawba	11-76-(3.5)	07/01/97	48	Good
				05/11/93	50	Good
Buffalo Shoals Cr	SR 1503	Iredell	11-78-(0.5)	06/04/97	58	Excellent
03-08-33						
McDowell Cr	SR 2136	Mecklenburg	11-115-(1.5)	05/20/02	22	Poor
				06/12/97	40	Fair
Dutchmans Cr	SR 1918	Gaston	11-119-(0.5)	06/30/93	50	Good
Leepers Cr	NC 73	Lincoln	11-119-1-(1)	05/20/97	52	Good
				06/29/93	56	Excellent
Killian Cr	NC 73	Lincoln	11-119-2-(0.5)	05/21/02	46	Good-Fair
				05/20/97	52	Good
Killian Cr	SR 1511	Lincoln	11-119-2-(0.5)	06/29/93	56	Excellent
03-08-34						
Sugar Cr	SR 1156	Mecklenburg	11-137-1	04/15/99	28	Poor
				06/30/97	32	Poor
				06/30/93	18	Poor
Little Sugar Cr	NC 51	Mecklenburg	11-137-8	04/15/99	42	Good-Fair
				06/30/97	40	Fair
03-08-35						
Henry Fork	SR 1922	Burke	11-129-1-(2)	09/28/98	52	Good
Henry Fork	SR 1916	Burke	11-129-1-(2)	05/06/97	46	Good-Fair
Jacob Fork	SR 1924	Burke	11-129-2-(4)	05/03/99	54	Excellent
				09/28/98	52	Good
				05/06/97	56	Excellent
Pott Cr	SR 1217	Lincoln	11-129-3-(0.7)	05/21/02	50	Good
				05/21/97	50	Good
Maiden Cr	SR 1858	Catawba	11-129-5-7-2-(1)	03/18/93	42	Good-Fair
Maiden Cr	off SR 1892	Catawba	11-129-5-7-2-(1)	03/18/93	30	Poor
Indian Cr	SR 1252	Lincoln	11-129-8-(6.5)	05/21/02	38	Fair
				07/01/97	38	Fair
Beaverdam Cr	SR 1609	Gaston	11-129-9-(0.7)	05/21/02	50	Good
Hoyle Cr	SR 1836	Gaston	11-129-15-(1.5)	05/22/02	42	Good-Fair
				06/12/97	48	Good
03-08-36						
Long Cr	US 321	Gaston	11-129-16-(4)	05/22/02	46	Good-Fair
				05/20/97	40	Fair
				06/30/93	30	Poor
03-08-37						
Catawba Cr	SR 2435	Gaston	11-130	05/22/02	40	Fair
				05/19/97	42	Good-Fair
Crowders Cr	SR 1108	Gaston	11-135	05/22/02	38	Fair
				05/19/97	36	Fair
03-08-38						
Twelvelmile Cr	NC 16	Union	11-138	05/20/02	42	Good-Fair
				06/11/97	48	Good
Sixmile Cr	SR 1312	Union	11-138-3	05/20/02	38	Fair
				06/11/97	40	Fair
Waxhaw Cr	SR 1103	Union	11-139	06/11/97	56	Excellent

Lake Assessment Program

Lakes Monitored

Ten lakes in the basin were monitored as part of the Lakes Assessment Program in 2002 (Table 3). Surface physical and photic zone chemistry data collected from 1997 through 2002 (from 1992 for Newton City and Bessemer City Lakes) are presented in Table 5.

Lake Sampling Methods

Lake monitoring stations are sited to provide representative samples of lake water quality based on morphology, size and site-specific features such as coves and tributaries. Physical field measurements (dissolved oxygen, pH, water temperature and conductivity) are made with a calibrated Hydrolab^{TM}. Readings are taken at the surface of the lake (0.15 meters) and at one-meter increments to the bottom of the lake. Secchi depths are measured at each sampling station with a weighted Secchi disk attached to a rope marked off in centimeters. Surface water samples are collected for chloride, hardness, fecal coliform bacteria and metals.

A LablineTM sampler is used to composite water samples within the photic zone (a depth equal to twice the Secchi depth). Nutrients, chlorophyll *a*, solids, turbidity and phytoplankton are collected at this depth. Nutrients and chlorophyll *a* from the photic zone are used to calculate the North Carolina Trophic State Index score. The LablineTM sampler is also used to collect a grab water samples near the bottom of the lake for nutrients. Water samples are collected and preserved in accordance with specified protocols (NCDEHNR, 1996; and subsequent updates).

Data Interpretation

The North Carolina water quality standards per 15A NCAC 2B .0200 are used in determining if a lake is meeting its designated uses. In addition to data collected through field sampling efforts, lake water quality assessments are also based on information obtained from other lake monitoring programs such as those implemented by municipalities and major hydroelectric companies. Observations and comments from citizens, local government personnel, water treatment facility staff, and others are also considered in the assessment process.

Table 3 Lakes Monitored in the Catawba River Basin during the 2001 – 2002 Sampling Effort

Subbasin/ Lake	County	Classification	Surface Area (ac)	Mean Depth (ft.)	Volume ($X10^6 m^3$)	Watershed (mi^2)	Mean Retention Time (days)
03-08-30							
Lake Tahoma	McDowell	WS-II, B Tr, HQW	1,61	30	0.7	23	
Lake James	Burke	WS-IV, V, B Tr	6,510	46	36.9	380	208
03-08-31							
Lake Rhodhiss	Burke-Caldwell	WS-IV, B, CA	3,515	20	36.7	1,090	21
03-08-32							
Lake Hickory	Alexander-Catawba	WS-IV, V, B, CA	4,100	33	17.0	1,310	33
Lookout Shoals Lake	Catawba Iredell	WS-IV, V, B, CA	1,270	30	4.6	1,450	7
Lake Norman	Mecklenburg - Lincoln	WS-IV, B, CA	32,510	33	131.5	1,790	239
03-08-33							
Mountain Island Lake	Mecklenburg - Gaston	WS-IV, B, CA	3,235	16	71.0	1,860	12
03-08-34							
Lake Wylie	Mecklenburg - York, SC	WS-IV, V, B, CA	12,450	23	35.3	3,020	39
03-08-35							
Newton City Lake	Catawba	WS-III, CA	17	10	0.1	100	
03-08-36							
Bessemer City Lake	Gaston	WS-II, HQW, CA	15	10	0.02	0.4	

In addition to determining use support, data collected during ambient lakes monitoring are 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 of 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 used to produce a NCTSI score for each lake, using the equations:

$$\text{TON Score} = ((\text{Log}(\text{TON}) + 0.45)/0.24)*0.90$$

$$\text{TPScore} = ((\text{Log}(\text{TP}) + 1.55)/0.35)*0.92$$

$$\text{SDScore} = ((\text{Log}(\text{SD}) - 1.73)/0.35)*-0.82$$

$$\text{CHLScore} = ((\text{Log}(\text{CHL}) - 1.00)/0.48)*0.83$$

$$\text{NCTSI} = \text{TONScore} + \text{TPScore} + \text{SDScore} + \text{CHLScore}$$

In general, NCTSI scores relate to trophic classifications (Table 4). When scores border between classes, best professional judgment is used to assign an appropriate classification. Scores may be skewed by highly colored water typical of dystrophic lakes. Some variation in the trophic state between years is not unusual because of the variability of data collections, which usually involve sampling a limited number of times during the growing season.

Table 4 Lakes Classification Criteria

NCTSI Score	**Trophic Classification**
< -2.0	Oligotrophic
-2.0 – 0.0	Mesotrophic
0.0 – 5.0	Eutrophic
> 5.0	Hypereutrophic

Oligotrophic lakes are characteristically found in the mountains or in undisturbed watersheds. Many mesotrophic and eutrophic lakes are found in the central piedmont. There are a few hypereutrophic lakes where point or nonpoint sources of pollution contribute to high levels of nutrients.

References

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Appendix III

Use Support Methodology
and
Use Support Ratings

Introduction to Use Support

All surface waters of the state are assigned a classification appropriate to the best-intended uses of that water. Waters are assessed to determine how well they are meeting the classified or best-intended uses. The assessment results in a use support rating for the use categories that apply to that water.

Use Support Categories

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the use of five use support categories: aquatic life, recreation, fish consumption, water supply, and shellfish harvesting. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. Waters are Supporting if data and information used to assign a use support rating meet the criteria for that use category. If these criteria are not met, then the waters are Impaired. Waters with inconclusive data and information are Not Rated. Waters where no data or information are available to make an assessment are No Data. The table below specifies which use support categories apply to which primary classifications.

A single water may have more than one use support rating corresponding to one or more of the use support categories, as shown in the following table. For many waters, a use support category will not be applicable (N/A) to the classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina* (15A NCAC 2b .0100 and .0200). Information can also be found at http://h2o.enr.state.nc.us/wqs/.

Use Support Categories

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

Assessment Period

Data and information are used to assess water quality and assign use support ratings using a five-year data window that ends on August 31 of the year of basinwide biological sampling. For example, if biological data are collected in a basin in 2004, then the five-year data window for use support assessments would be September 1, 1999 to August 31, 2004. There are occasionally some exceptions to this data window, especially when follow up monitoring is needed to make decisions on samples collected in the last year of the assessment period.

Assessment Units

DWQ identifies waters by index numbers and assessment unit numbers (AU). The AU is used to track defined stream segments or waterbodies in the water quality assessment database, for the 303(d) Impaired waters list, and in the various tables in basin plans and other water quality documents. The AU is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU indicates that the AU is smaller than the DWQ index segment. No letter indicates that the AU and the DWQ index segment are the same.

Interpretation of Data and Information

When interpreting the use support ratings, it is important to understand the associated limitations and degree of uncertainty. Although these use support methods are used for analyzing data and information and determining use support ratings, best professional judgment is applied during these assessments. Use support ratings are intended to provide an assessment of water quality using a five-year data window, to describe how well surface waters support their classified uses, and to document the potential stressors contributing to water quality degradation and the sources of these contributions.

Use support methods continue to improve over time, and the information and technology used to make use support determinations also continue to become more accurate and comprehensive. These improvements sometimes make it difficult to make generalizations comparing water quality between basin plans. However, technology and methods improvements result in more scientifically sound use support assessments.

Assessment Methodology

Introduction

Many types of data and information are used to determine use support ratings and to identify stressors and sources of water quality degradation. All existing data pertaining to a stream segment for each applicable use support category are entered into a use support database and may include its use support ratings, basis of assessment, biological and ambient monitoring data, stressors and potential sources. Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, swimming advisories and shellfish sanitation growing area classifications from the NC Division of Environmental Health (as appropriate), and available land cover and land use information.

The following describes the data and methodologies used to conduct use support assessments. These methods will continue to be refined as additional information and technology become available.

Basis of Assessment

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

Rating Basis	**Use Support Category**	**Assessment Applicability***
S/M	AL	Biological community data or ambient water quality parameters do not exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
S/M	REC	Ambient fecal bacteria parameter does not exceed criteria in AU or AU with RECMON sites is posted with advisories for 61 days or less during assessment period.
S/M	FC	AU does not have site-specific advisory and is not under a mercury advice or drains to areas within a mercury advice, or fish tissue data do not exceed criteria.
S/M	SH	AU is a DEH Approved shellfish growing area.
I/M	AL	Biological community data or ambient water quality parameters exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
I/M	REC	Ambient fecal bacteria parameter exceeds criteria in AU or AU with RECMON sites is posted with advisories for more than 61 days during assessment period.
I/M	FC	Fish tissue data collected in AU during assessment period and basin are under mercury advice or site-specific advisory.
I/M	SH	AU is a DEH Conditionally-Approved, Prohibited or Restricted shellfish growing area.
NR/M	AL	Biological community is Not Rated or inconclusive, or ambient water quality parameters are inconclusive in AU during assessment period. Biological and ambient data are independently applied.
NR/M	REC	Ambient fecal bacteria parameter exceeds annual screening criteria, but does not exceed assessment criteria of five samples in 30 days in AU during assessment period.
S/E	AL	AU is a tributary to a S/M AU and land use is similar between AUs.
S/E	WS	AU is classified as WS, and DEH report notes no significant closures at time of assessment.
I/E	FC	AU is in basin under a mercury advice or drains to areas within a mercury advice and has no fish tissue data.
NR/E	AL	AU is tributary to I/M AU, or AU is in watershed with widespread and changing land use, or other information suggests negative water quality impacts to AU. Discharger in AU has noncompliance permit violations or has failed three or more WET tests during the last two years of the assessment period.
NR/E	REC	Discharger has noncompliance permit violations of fecal bacteria parameter during last two years of assessment period.
ND	AL, REC, FC, SH	No data available in AU during assessment period.

Note: S/M = Supporting/Monitored; I/M = Impaired/Monitored; NR/M = Not Rated/Monitored
S/E = Supporting/Evaluated; I/E = Impaired/Evaluated; NR/E = Not Rated/Evaluated
ND = No Data
AL = Aquatic Life; REC = Recreation; FC = Fish Consumption
SH = Shellfish Harvesting; WS = Water Supply
AU = Assessment Unit; WET = Whole Effluent Toxicity
DEH = Division of Environmental Health; * = for lakes assessments

Supporting ratings are extrapolated up tributaries from monitored streams when there are no problematic dischargers with permit violations or changes in land use/cover. Supporting ratings may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem stressors or sources (except general NPS) are not generally applied to unmonitored tributaries. Impaired ratings are not extrapolated to unmonitored tributaries.

Stressors

Biological and ambient samplings are useful tools to assess water quality. However, biological sampling does not typically identify the causes of impairment, and ambient sampling does not always link water quality standards to a biological response. Linking the causes of impairment and the biological response are a complex process (USEPA, 2000) that begins with an evaluation of physical, chemical or biological entities that can induce an adverse biological response. These entities are referred to as stressors. A stressor may have a measurable impact to aquatic health. Not all streams will have a primary stressor or cause of impairment. A single stressor may not be sufficient to cause impairment, but the accumulation of several stressors may result in impairment. In either case, impairment is likely to continue if the stressor or the various cumulative stressors are not addressed. Use support assessments evaluate the available information related to potential stressors impacting water quality.

A stressor identification process may be initiated after a stream appears on the 303(d) list in order to address streams that are Impaired based on biological data. Intensive studies are required to summarize and evaluate potential stressors to determine if there is evidence that a particular stressor plays a substantial role in causing the biological impacts. Intensive studies consider lines of evidence that include benthic macroinvertebrate and fish community data, habitat and riparian area assessment, chemistry and toxicity data, and information on watershed history, current watershed activities and land uses, and pollutant sources. These studies result in decisions regarding the probable stressors contributing to or causing impairment. The intensity of a stressor study may be limited due to a lack of resources. In these cases, it may still be appropriate to include stressors in use support assessments, but to also note where additional information is needed in order to evaluate other stressors.

Where an ambient parameter is identified as a potential concern, the parameter is noted in the DWQ database and use support summary table. Where habitat degradation is identified as a stressor, DWQ and others attempt to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools or riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Aquatic Life Category

The aquatic life category is an ecosystem approach to assessing the biological integrity of all surface waters of the state. The biological community data and ambient water quality data are used in making assessments in this category. These represent the most important monitoring data for making water quality assessments in the aquatic life category. Evaluation information such as compliance and whole effluent toxicity information from NPDES dischargers, land cover, and other more anecdotal information are also used to identify potential problems and to refine assessments based on the monitoring data. The following is a description of each monitoring data type and the criteria used in assigning use support ratings. Criteria used to evaluate the other information and assign use support ratings are also described. Refer to page 14 for lakes and reservoir assessment methods as applied in the aquatic life category.

Biological Data

Benthic macroinvertebrate (aquatic insects) community and fish community samples are the best way to assess the biological integrity of most waterbodies. Unfortunately, these community measures cannot be applied to every stream size and are further limited by geographic region. These community measures are designed to detect current water quality and water quality changes that may be occurring in the watershed. However, they are only directly applied to the assessment unit where the sample was collected.

Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated for use support assessments. When two biological monitoring data types conflict, best professional judgment is used to determine an appropriate use support rating. Where both ambient monitoring data and biological data are available, biological data may be given greater weight; however, each data type is assessed independently.

Benthic Macroinvertebrate Criteria

Criteria have been developed to assign bioclassifications to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera* and *Trichoptera* (EPTs); and the Biotic Index (BI), which summarizes tolerance data for all taxa in each sample. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored.

If a Fair macroinvertebrate bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will not be Not Rated until the second sample is obtained.

Use support ratings are assigned to assessment units using benthic macroinvertebrate bioclassifications as follows.

Waterbody Sample Type or Criteria	Bioclassification	Use Support Rating
Mountain, piedmont, coastal A	Excellent	Supporting
Mountain, piedmont, coastal A	Good	Supporting
Swamp[1]	Natural	Supporting
Mountain, piedmont, coastal A	Good-Fair	Supporting
Smaller than criteria but Good-Fair[2]	Not Impaired	Supporting
Swamp[1]	Moderate Stress	Supporting
Mountain, piedmont, coastal A	Fair	Impaired
Swamp[1]	Severe Stress	Impaired
Mountain, piedmont, coastal A	Poor	Impaired
Criteria not appropriate to assign bioclassification	Not Rated	Not Rated

[1] Swamp streams for benthos sampling are defined as streams in the coastal plain that have no visible flow for a part of the year, but do have flow during the February to early March benthic index period.

[2] This designation may be used for flowing waters that are too small to be assigned a bioclassification (less than three square miles drainage area), but have a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria.

Fish Community Criteria

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored. Use support ratings are assigned to assessment units using the NCIBI bioclassifications as follows:

NCIBI	Use Support Rating
Excellent	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

If a Fair macroinvertebrate bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will not be given a use support rating until validation is obtained.

The NCIBI was recently revised (NCDENR, 2001), and the bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a). NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamlico, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

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

NCIBI criteria have not been developed for:

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

Ambient Water Quality Monitoring Criteria

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring Program statewide and NPDES discharger coalitions in some basins. All samples collected (usually monthly) during the five-year assessment period are used to assign a use support rating. Ambient water quality data are not direct measures of biological integrity, but the chemical/physical parameters collected can provide an indication of conditions that may be impacting aquatic life. Because these data represent water quality conditions with a high degree of confidence, use support ratings assigned using these data are considered monitored. Where both ambient data and biological data are available, each data type is assessed independently.

The parameters used to assess water quality in the aquatic life category include dissolved oxygen, pH, chlorophyll *a* and turbidity. Criteria for assigning use support ratings to assessment units with ambient water quality data of a minimum of ten samples are as follows:

Ratings Criteria	Rating
Numerical standard exceeded in ≤10% of samples	Supporting
Numerical standard exceeded in >10% of samples	Impaired
Less than 10 samples collected	Not Rated
DO and pH standard exceeded in swamp streams	Not Rated

Multiple Monitoring Sites

There are assessment units with more than one type of monitoring data. When the data from multiple biological data types are not in agreement, best professional judgment is used to assign a bioclassification and use support rating for that assessment unit. Biological monitoring is typically assessed independent of ambient monitoring data and either may be used to assign a use support rating for an assessment unit. Monitoring data are always used over the evaluation information; however, evaluation information can be used to lengthen or shorten monitored assessment units and to assign use support ratings on an evaluated basis to non-monitored assessment units.

NPDES Wastewater Whole Effluent Toxicity (WET) Information

Whole Effluent Toxicity (WET) tests are required for all major NPDES discharge permit holders, as well as those minor NPDES dischargers with complex effluent (defined as not being of 100 percent domestic waste). WET tests are evaluated to determine if the discharge could be having negative water quality impacts. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data or has no ambient water quality data, and that facility has failed three or more WET tests in the last two years of the assessment period, the assessment unit is Not Rated. Because this information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored. Problems associated with WET test failures are addressed through NPDES permits.

NPDES Discharger Daily Monitoring Report Information

NPDES effluent data monthly averages of water quality parameters are screened for the last two years of the assessment period. If facilities exceed the effluent limits by 20 percent for two or more months during two consecutive quarters, or have chronic exceedances of permit limits for four or more months during two consecutive quarters, then the assessment unit is Not Rated if no biological or ambient monitoring data are available. If biological or ambient data are available, that data will be used to develop a use support rating for appropriate stream segments. Because this information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored.

Fish Consumption Category

The fish consumption category is a human health approach to assess whether humans can safely consume fish from a waterbody. This category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories or advice as issued by the NC Department of Health and Human Services (NCDHHS). The fish consumption category is different from other categories in that assessments are based on the existence of a DHHS fish consumption advice or advisory at the time of assessment. The advice and advisories are based on DHHS epidemiological studies and on DWQ fish tissue data, so a fish tissue monitoring site will constitute a monitored assessment unit (AU) and all other AUs will be evaluated. DWQ fish tissue data are used to inform DHHS of potential fish tissue toxicity. DHHS is responsible for proclaiming a fish tissue advisory for any waterbody. Fish tissue monitoring data are not used directly for assigning a use support rating in this category.

If a limited site-specific fish consumption advisory or a no consumption advisory is posted at the time of assessment, the water is Impaired. If there are no site-specific advisories posted or the stream is not in a basin where mercury advice is applied, then the assessment unit will be Supporting in this category.

The NCDHHS has developed regional fish consumption advice (all waters south and east of I-85) for certain fish species shown to have elevated levels of mercury in their tissue. DWQ applies the DHHS fish consumption advice for mercury on a basinwide scale rather than an AU scale in recognition that fish move up and downstream regardless of the presence of I-85. All AUs draining below or intersecting I-85 are Impaired in the fish consumption category. AUs with monitoring data are considered Impaired/Monitored, and AUs with no monitoring data are considered Impaired/Evaluated. When a DHHS site-specific advisory is in place for a parameter other than mercury, the assessment is based on that advisory and the mercury advice will take a lower ranking in the assessment. Therefore, when a site-specific advisory is in place in a basin with a mercury advice and the AU has fish tissue monitoring data, the AU will be considered Impaired/Monitored for the specific parameter, rather than Impaired/Evaluated for mercury.

Basins under the mercury advice are the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, White Oak and Yadkin-Pee Dee. All waters in these basins are Impaired in the fish consumption category, even when there is a site-specific advisory. All waters are also considered Monitored or Evaluated, dependent upon the availability of monitoring data.

Only a small portion of the Catawba River basin is intersected by I-85 (lower Mecklenberg, Union and Gaston counties). Due to the presence of dams that impede fish travel throughout the Catawba River basin, only those waters draining to and entering the mainstem Catawba below I-85 and are not impeded by dams are considered Impaired/Evaluated.

Basins not under the mercury advice are the Broad, French Broad, Hiwassee, Little Tennessee, New, Savannah and Watauga. All waters in these basins are Supporting the fish consumption category if there is no site-specific advisory; waters are Impaired if there is a site-specific advisory. All waters are also considered Monitored or Evaluated, dependent upon the availability of monitoring data.

In order to separate this regional advice from other fish consumption advisories and to identify actual fish populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps.

Recreation Category

This human health related category evaluates waters for the support of primary recreation activities such as swimming, water-skiing, skin diving, and similar uses usually involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for these uses are classified as Class B, SB and SA. This category also evaluates other waters used for secondary recreation activities such as wading, boating, and other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized or incidental basis. Waters of the state designated for these uses are classified as Class C, SC and WS.

The use support ratings applied to this category are currently based on the North Carolina fecal coliform bacteria water quality standard where ambient monitoring data are available or on the duration of local or state health agencies posted swimming advisories. Use support ratings for the recreation category may be based on other bacteriological indicators and standards in the future.

DWQ conducts monthly ambient water quality monitoring that includes fecal coliform bacteria testing. The Division of Environmental Health (DEH) tests coastal recreation waters (beaches) for bacteria levels to assess the relative safety of these waters for swimming. If an area has elevated bacteria levels, health officials will advise that people not swim in the area by posting a swimming advisory and by notifying the local media and county health department.

The North Carolina fecal coliform bacteria standard for freshwater is: 1) not to exceed the geometric mean of 200 colonies per 100 ml of at least five samples over a 30-day period; and 2) not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. The AU being assessed for the five-year data window is Supporting in the recreation category if neither number (1) nor (2) of the standard are exceeded. The AU being assessed is Impaired in the recreation category if either number (1) or (2) is exceeded. Waters without sufficient fecal coliform data are Not Rated, and waters with no data are noted as having No Data.

Assessing the water quality standard requires significant sampling efforts beyond the monthly ambient monitoring sampling and must include at least five samples over a 30-day period. Decades of monitoring have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, multiple samples over a 30-day period are needed to evaluate waters against the North Carolina water quality standard for recreational use support. Waters classified as Class SA, SB and B are targeted for this extra sampling effort due to the greater potential for human body contact. Therefore, some waters will be Not Rated in this category based on a DWQ yearly screening of all waters where an AU is above 200 colonies per 100 ml, or more than 20 percent of samples are above 400 colonies per 100 ml, and where the extra sampling effort has not been conducted.

Waters with beach monitoring sites will be Impaired if the area is posted with an advisory for greater than 61 days of the assessment period. Waters with beach monitoring sites with advisories posted less than 61 days will be Supporting. Other information can be used to Not Rate unmonitored waters.

DWQ Ambient Monitoring Fecal Coliform Screening Criteria

As with other information sources, all available information and data are evaluated for the recreation category using the assessment period. However, DWQ conducts an annual screening of DWQ ambient fecal coliform data to assess the need for additional monitoring or immediate action by local or state health agencies to protect public health.

Each March, DWQ staff will review bacteria data collections from ambient monitoring stations statewide for the previous sampling year. Locations with annual geometric means greater than 200 colonies per 100 ml, or when more than 20 percent of the samples are greater than 400 colonies per 100 ml, are identified for potential follow-up monitoring conducted five times within 30 days as specified by the state fecal coliform bacteria standard. If bacteria concentrations exceed either portion of the state standard, the data are sent to DEH and the local county health director to determine the need for posting swimming advisories. DWQ regional offices will also be notified.

Due to limited resources and the higher risk to human health, primary recreation waters (Class B, SB and SA) will be given monitoring priority for an additional five times within 30 days sampling. Follow-up water quality sampling for Class C waters will be performed as resources permit. Any waters on the 303(d) list of Impaired waters for fecal coliform will receive a low priority for additional monitoring because these waters will be further assessed for TMDL development.

DWQ attempts to determine if there are any swimming areas monitored by state, county or local health departments or by DEH. Each January, DEH, county or local health departments are asked to list those waters which were posted with swimming advisories in the previous year.

Shellfish Harvesting Use Support

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

Division of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows.

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

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

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to DWQ Class SA (shellfish harvesting) waters. It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. This will result in a difference of acreage between DEH areas classified as CAC, PRO and RES, and DWQ waters rated as Impaired. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are rated as Impaired.

The DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this information will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting frequency of closures. In the interim, DWQ has been identifying the frequency of closures in Class SA waters using an interim methodology based on existing databases and GIS shapefiles. There will be changes in reported acreages in future assessments using the permanent methods and tools that result from this project.

Past Interim Frequency of Closure-Based Assessment Methodology

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

Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	Supporting
Closed ≤10% of data window	Portion of CAO closed ≤10% of data window	Supporting
Closed >10% of the data window	Portion of CAO closed >10% of data window	Impaired
N/A	CAC and PRO/RES**	Impaired

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

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

For CAO areas, DWQ worked with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during the assessment period. For each growing area with CAO Class SA waters, DEH and DWQ defined subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed was determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to preemptive closures because of named storms was not counted. For example, all waters in growing area E-9 were preemptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for ten days after the APP waters were reopened.

Current Assessment Methodology

Use support assessment for the 2005 Cape Fear River basin will be conducted such that only the DEH classification will be used to assign a use support rating. By definition, CAO areas are areas that DEH has determined do not, or likely do not, meet water quality standards and these areas will be rated Impaired, along with CAC and PRO/RES areas. Only APP areas will be rated Supporting.

Growing areas that have been reclassified by DEH during the assessment period from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to any other classification during the assessment period will be rated Impaired.

Over the next few years, DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms.

Water Supply Use Support

This human health related use support category is used to assess all Class WS waters for the ability of water suppliers to provide potable drinking water. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

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

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

Use of Outside Data

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

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

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

Lakes and Reservoir Use Assessment

Like streams, lakes are classified for a variety of uses. All lakes monitored as part of North Carolina's Ambient Lakes Monitoring Program carry the Class C (aquatic life) classification, and most are classified Class B and SB (recreation) and WS-I through WS-V (water supply). The surface water quality numeric standard specifically associated with recreation is fecal coliform. For water supplies, there are 29 numeric standards based on consumption of water and fish. Narrative standards for Class B and Class WS waters include aesthetics such as no odors and no untreated wastes. There are other numeric standards that also apply to lakes for the protection of aquatic life and human health. These standards also apply to all other waters of the state and are listed under the Class C rules.

When possible, lake use support assessments are made using standards based methodologies similar to those used for free-flowing waters. Parameters with sufficient (ten or more observations), quality-assured observations are compared to surface water quality standards. When standards are exceeded in more than 10 percent of the assessment period, portions or all of the waterbody are rated Impaired. However, in many cases, the standards based approach is incapable of characterizing the overall health of a reservoir.

For nutrient enrichment, one of the main causes of impacts to lakes and reservoirs, a more holistic or weight of evidence approach is necessary since nutrient impacts are not always reflected by the parameters sampled. For instance, some lakes have taste and odor problems associated with particular algal species, yet these lakes do not have chlorophyll *a* concentrations above 40 µg/l frequently enough to impair them based on the standard. In addition, each reservoir possesses unique traits (watershed area, volume, depth, retention time, etc.) that dramatically influence its water quality, but that cannot be evaluated through standards comparisons. In such waterbodies, aquatic life may be Impaired even though a particular indicator is below the standard. Where exceedances of surface water quality standards are not sufficient to evaluate a lake or reservoir, the weight of evidence approach can take into consideration indicators and parameters not in the standards to allow a more sound and robust determination of water quality.

The weight of evidence approach uses the following sources of information to determine the eutrophication (nutrient enrichment) level as a means of assessing lake use support in the aquatic life category:

- Quantitative water quality parameters - dissolved oxygen, chlorophyll *a*, pH, etc.
- Algal bloom reports
- Fish kill reports
- Hydrologic and hydraulic characteristics – watershed size, lake volume, retention time, volume loss, etc.
- Third party reports – citizens, water treatment plant operators, state agencies, etc.
    - Taste and odor
    - Sheens
    - Odd colors
    - Other aesthetic and safety considerations

One of the major problems associated with lakes and reservoirs is increasing eutrophication related to nutrient inputs. Several water quality parameters help to describe the level of eutrophication. In implementing the weight of evidence approach for eutrophication, more consideration is given to parameters that have water quality standards. Each parameter is assessed for percent exceedance of the state standard. The eutrophication-related parameters and water quality indicators without numeric standards are reviewed based on interpretation of the narrative standards in 15A NCAC 2B .0211(2) and (3). The following table lists the information considered during a lake/reservoir use assessment, as well as the criteria used to evaluate that information.

A modification to lake use assessment is the evaluation and subsequent rating of a lake or reservoir by segments. In some portions of a waterbody, such as shallow coves, there may be documented water quality problems while other areas of that waterbody do not demonstrate significant problems. In such cases, the portion with documented problems (sufficient data, ambient data above standards, and supporting public data) will be rated as Impaired while the other portions are rated as Supporting or Not Rated. The following table highlights the weight of evidence approach for assessing lake water quality.

Lake/Reservoir Weight of Evidence Use Assessment for Aquatic Life Category	
Assessment Type	**Criteria**
EUTROPHICATION	
Water Quality Standards	
Chl *a*	>10% above standard (N>9) = P; exceeding 40 µg/l but not 10% of time = C
DO	Below or above standard >10% of samples (N>9)
pH	Below or above standard >10% of samples (N>9)
Turbidity	>10% above standard (N>9)
% Total Dissolved Gases	>10% above standard (N>9)
Temperature	Minor and infrequent excursions of temperature standards due to anthropogenic activity. No impairment of species evident (N>9).
Metals (excluding copper, iron and zinc)	>10% above standard (N>9)
Other Data	
% Saturation DO	>10% above >120%
Algae	Blooms during 2 or more sampling events in 1 year with historic blooms.
Fish	Kills related to eutrophication.
Chemically/ Biologically Treated	For algal or macrophyte control - either chemicals or biologically by fish, etc.
Aesthetics Complaints	Documented sheens, discoloration, etc. - written complaint and follow-up by a state agency.
TSI	Increase of 2 trophic levels from one 5-year period to next.
Historic DWQ Data	Conclusions from other reports and previous use support assessments.
AGPT	Algal Growth Potential Test 5-9 mg/l = C 10 or more mg/l = P
Macrophytes	Limiting access to public ramps, docks, swimming areas; reducing access by fish and other aquatic life to habitat; clogging intakes.
Taste and Odor	Public complaints = P; Potential based on algal spp = C
Sediments	Clogging intakes - dredging program necessary.

Note: C = of notable Concern or productive P = Problematic or highly productive
E = parameter is Exceeded, but in less than 10 percent of the measurements

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____. 2001a. *Standard Operating Procedure*. *Biological Monitoring*. *Stream Fish Community Assessment and Fish Tissue*. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. Raleigh, NC.

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USEPA. 2000. *Stressor Identification Guidance Document*. EPA/822/B-00/025. Office of Water. Washington, DC.

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis	Problem Parameters	Potential Sources
Abernethy Creek	11-135-4b	From First Creek to Crowders Creek	C	03-08-37	1.8	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Abernethy Creek	11-135-4a	From source to First Creek	C	03-08-37	3.2	mi.	S	M		
Abingdon Creek	11-39-6	From source to Lower Creek	C	03-08-31	5.6	mi.	S	M		
Armstrong Creek	11-24-14-(1)	From source to Hickory Botton Creek	C Tr HQW	03-08-30	10.8	mi.	S	M		
Beaverdam Creek	11-129-9-(0.7)	From a point 0.3 mile upstream of Gaston County SR 1626 to South Fork Catawba River	WS-IV	03-08-35	8.3	mi.	S	M		
Blackwood Creek	11-135-7	From source to Crowders Creek	C	03-08-37	4.4	mi.	NR	M		
Blair Fork	11-39-3-1	From source to Spainhour Creek	C	03-08-31	2.6	mi.	NR	M		
Bristol Creek	11-39-8	From source to Lower Creek	WS-IV	03-08-31	5.6	mi.	NR	M		
Buck Creek (Lake Tahoma)	11-19-(1)	From source to Dam at Lake Tahoma	WS-II & B Tr	03-08-30	166.4	ac.	S	M		
Canoe Creek	11-33-(2)	From Burke County SR 1248 to Catawba River	WS-IV	03-08-30	5.6	mi.	S	M		
Carpenter Creek (Horseshoe Lake)	11-129-5-9	From source to Clark Creek	C	03-08-35	3.6	mi.	NR	M		
Catawba Creek	11-130c	From SR 2439 to Lake Wylie	C	03-08-37	4.9	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
CATAWBA RIVER	11-(1)	From source to Old Fort Finishing Plant Water Supply Intake	C Tr	03-08-30	7.6	mi.	S	M		
CATAWBA RIVER (including backwaters of Lake James below elevation 1200)	11-(8)	From Dam at Old Fort Finishing Plant Water Supply Intake to North Fork Catawba River	C	03-08-30	23.5	mi.	S	M		
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31.5)	From a point 0.6 mile upstream of Muddy Creek to a point 1.2 mile upstream of Canoe Creek	WS-IV	03-08-30	9.8	mi.	S	M		
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(32.7)	From a point 0.7 mile upstream of Canoe Creek to a point 0.6 mile upstream of Warrior Fork	WS-IV	03-08-31	3.9	mi.	S	M		
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(51)	From Rhodhiss Dam to US Highway 321 Bridge	WS-IV & B CA	03-08-32	263.1	ac.	NR	M		
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(53)	From US Highway 321 Bridge to NC Highway 127	WS-IV & B CA	03-08-32	1232.8	ac.	NR	M		
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(59.5)	From NC Highway 127 to Oxford Dam	WS-V & B	03-08-32	2093.6	ac.	NR	M		
CATAWBA RIVER (Lake James below elevation 1200)	11-(23)	From North Fork Catawba River to Bridgewater Dam	WS-V & B	03-08-30	2040.9	ac.	S	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis	Problem Parameters	Potential Sources
CATAWBA RIVER (Lake James below elevation 1200)	11-(27.5)	From North Fork Catawba River to Bridgewater Dam	WS-V & B	03-08-30	3769.5	ac.	S	M		
CATAWBA RIVER (Lake Norman below elevation 760)	11-(74)	From Lookout Shoals Dam to Lyle Creek	WS-IV CA	03-08-32	265.3	ac.	S	M		
CATAWBA RIVER (Lake Norman below elevation 760)	11-(75)	From Lyle Creek to Cowan's Ford Dam	WS-IV & B CA	03-08-32	31331.6	ac.	S	M		
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(117)	From Mountain Island Dam to Interstate Highway 85 Bridge at Belmont	WS-IV CA	03-08-33	375.3	ac.	NR	M	Organic Enrichment	Source Unknown
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	From I-85 bridge to the upstream side of Paw Creek Arm of Lake Wylie, Catawba River	WS-IV & B CA	03-08-34	601.1	ac.	I	M	Organic Enrichment	Source Unknown
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	From the upstream side of Paw Creek Arm of Lake Wylie to North Carolina-South Carolina State Line	WS-V & B	03-08-34	3418.5	ac.	I	M	Organic Enrichment	Source Unknown
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(67)	From Oxford Dam to a point 0.6 mile upstream of mouth of Lower Little River	WS-IV	03-08-32	182.7	ac.	S	M		
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(68.5)	From a point 0.6 mile upstream of mouth of Lower Little River to Elk Shoal Creek (East Side)	WS-IV CA	03-08-32	95.4	ac.	S	M		
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(72)	From Elk Shoal Creek (East Side) to a point 0.5 mile upstream of Lookout Shoals Dam	WS-IV & B CA	03-08-32	577.8	ac.	S	M		
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(73.5)	From a point 0.5 mile upstream of Lookout Shoals Dam to Lookout Shoals Dam	WS-IV & B CA	03-08-32	175.4	ac.	S	M		
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(112)	From Cowan's Ford Dam to Water Intake at River Bend Steam Station	WS-IV CA	03-08-33	389.4	ac.	S	M		
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(114)	From Water Intake at River Bend Steam Station to Mountain Island Dam (Town of Mount Holly water supply intake)	WS-IV & B CA	03-08-33	1937.1	ac.	S	M		
CATAWBA RIVER (Rhodhiss Lake below elevation 995)	11-(37)	From Johns River to Rhodhiss Dam	WS-IV & B CA	03-08-31	1848.5	ac.	I	M	Organic Enrichment	Source Unknown

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis	Problem Parameters	Potential Sources
Celia Creek	11-39-7-1-(2)	From a point 0.5 mile upstream of Caldwell County SR 1325 to Husband Creek	WS-IV	03-08-31	1.3	mi.	NR	M		
Clark Creek	11-129-5-(9.5)	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba River	WS-IV	03-08-35	1.8	mi.	I	M	Copper	Industrial Point Sources
Clark Creek (Shooks Lake)	11-129-5-(0.3)b	Source to Sweetwater Rd	C	03-08-35	14.3	mi.	I	M	Unknown toxicity	Industrial Point Sources
Clark Creek (Shooks Lake)	11-129-5-(0.3)a	From source to Miller Branch	C	03-08-35	3.3	mi.	NR	M		
Cline Creek	11-129-5-2	From source to Clark Creek	C	03-08-35	3.1	mi.	S	M		
Crooked Creek	11-12	From source to Catawba River	C	03-08-30	16.0	mi.	S	M		
Crowders Creek	11-135b	From State Route 1118 to State Route 1122	C	03-08-37	3.1	mi.	S	M		
Crowders Creek	11-135a	From source to SR 1118	C	03-08-37	1.9	mi.	NR	M		
Crowders Creek	11-135g	South Carolina State Line	C	03-08-37	1.5	mi.	I	M	Fecal Coliform	Urban Runoff/Storm Sewers
Crowders Creek	11-135c	From State Route 1122 to State Route 1131	C	03-08-37	3.3	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Crowders Creek	11-135d	From State Route 1131 to State Route 1108	C	03-08-37	7.3	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Curtis Creek	11-10	From source to Catawba River	C Tr	03-08-30	9.7	mi.	S	M		
Duck Creek	11-62-2-(4)	From NC Highway 90 to Middle Little River	C	03-08-32	4.4	mi.	S	M		
Dutchmans Creek	11-119-(0.5)	From source to a point 0.8 mile downstream of Taylors Creek	WS-IV	03-08-33	7.4	mi.	S	M		
Elk Shoal Creek (East Side)	11-73-(0.5)	From source to a point 1.4 miles upstream of mouth	WS-IV	03-08-32	7.8	mi.	S	M		
Gragg Prong	11-38-10	From source to Johns River	C Tr	03-08-31	4.0	mi.	S	M		
Greasy Creek	11-39-4	From source to Lower Creek	C	03-08-31	4.6	mi.	NR	M		
Gunpowder Creek (Old Mill Pond)	11-55-(1.5)	From a point 0.5 mile downstream of Caldwell County SR 1127 to a point 0.8 mile downstream of Billy Branch	WS-IV	03-08-32	13.4	mi.	S	M		
Harper Creek	11-38-34-14	From source to Wilson Creek	C Tr ORW	03-08-31	9.1	mi.	S	M		
Henry Fork	11-129-1-(2)	From Morganton Water Intake to Laurel Creek	C ORW	03-08-35	19.5	mi.	S	M		
Henry Fork	11-129-1-(12.5)a	From Laurel Creek to State Route 1124	C	03-08-35	10.3	mi.	I	M		
Henry Fork	11-129-1-(12.5)c	From State Route 1143 to Jacob Fork	C	03-08-35	8.6	mi.	S	M		
Henry Fork	11-129-1-(12.5)b	From State Route 1124 to State Route 1143	C	03-08-35	4.8	mi.	S	M		
Horseford Creek	11-54-(0.5)	From Frye Creek to a point 0.7 mile upstream of mouth	WS-IV	03-08-32	0.4	mi.	I	M	Unknown toxicity	Urban Runoff/Storm Sewers
Howards Creek	11-129-4	From source to South Fork Catawba River	C	03-08-35	13.8	mi.	S	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis	Problem Parameters	Potential Sources
Hoyle Creek	11-129-15-(6)	From a point 0.2 mile downstream of Mauney Creek to South Fork Catawba River	WS-IV CA	03-08-35	0.5	mi.	S	M		
Hunting Creek	11-36-(0.7)	From a point 1.0 mile upstream of Burke County SR 1940 to a point 0.4 mile downstream of Pee Dee Branch	WS-IV	03-08-31	7.4	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Husband Creek	11-39-7-(1)	From source to a point 0.5 mile upstream of Celia Creek	C	03-08-31	6.0	mi.	S	M		
Indian Creek	11-129-8-(6.5)	From a point 0.3 mile upstream of Lincoln County SR 1169 to South Fork Catawba River	WS-IV	03-08-35	6.0	mi.	I	M	Cause Unknown	
Irish Creek	11-35-3-(2)b	From Roses Creek to Warrior Fork	WS-III	03-08-31	3.0	mi.	I	M	Habitat degradation	Crop-related Sources
Irwin Creek	11-137-1	From source to Sugar Creek	C	03-08-34	11.8	mi.	I	M	Fecal Coliform	Urban Runoff/Storm Sewers
Jacktown Creek	11-32-1-4-1	From source to Youngs Fork	C	03-08-30	2.4	mi.	I	M	Cause Unknown	Land Development
Jacob Fork	11-129-2-(4)	From Little River to Camp Creek	WS-III ORW	03-08-35	6.8	mi.	S	M		
Johns River	11-38-(35.5)	From a point 0.5 mile upstream of Sims Branch to a point 0.7 mile downstream of NC Highway 18	WS-IV HQW	03-08-31	6.9	mi.	S	M		
Killian Creek	11-119-2-(0.5)b	From Anderson Creek to a point 1.2 miles upstream of mouth	C	03-08-33	3.2	mi.	I	M	Cause Unknown	Land Development
Killian Creek	11-119-2-(0.5)a	From source to Anderson Creek	C	03-08-33	11.6	mi.	S	M		
Limekiln Creek	11-129-16-2	From source to Long Creek	WS-II	03-08-36	1.9	mi.	S	M		
Linville River	11-29-(4.5)	Falls	B Tr	03-08-30	15.3	mi.	S	M		
Linville River	11-29-(19)	From southern Boundary of Daniel Boone Wildlife Management Area to Lake James, Catawba River	B HQW	03-08-30	7.1	mi.	S	M		
Little Buck Creek	11-19-11	From source to Lake Tahoma, Buck Creek	WS-II & B Tr	03-08-30	4.4	mi.	S	M		
Little Sugar Creek	11-137-8b	From Arcdale Road to NC 51	C	03-08-34	5.5	mi.	I	M	Fecal Coliform	Urban Runoff/Storm Sewers
Long Creek	11-120-(2.5)	From a point 0.6 mile downstream of Mecklenburg County SR 2074 to a point 0.4 mile upstream of Mecklenburg County SR 1606	WS-IV	03-08-34	11.3	mi.	I	M	Habitat degradation	Breached Mill Dam
Long Creek	11-129-16-(4)	From Mountain Creek to South Fork Catawba River	C	03-08-36	15.3	mi.	S	M		
Lower Creek	11-39-(0.5)a	From source to Zack’s Fork	C	03-08-31	8.8	mi.	I	M	Habitat degradation	Urban Runoff/Storm Sewers
Lower Creek	11-39-(0.5)b	From Zack’s Fork to Caldwell County SR 1143	C	03-08-31	5.1	mi.	I	M	Habitat degradation	Urban Runoff/Storm Sewers
Lower Creek	11-39-(6.5)	From Caldwell County SR 1143 to a point 0.7 mile downstream of Bristol Creek	WS-IV	03-08-31	6.8	mi.	I	M	Habitat degradation	Urban Runoff/Storm Sewers

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis	Problem Parameters	Potential Sources
Lower Little River	11-69-(0.5)	From source to a point 0.5 mile upstream of mouth of Stirewalt Creek	C	03-08-32	14.0	mi.	I	M	Habitat degradation	Source Unknown
Lower Little River	11-69-(5.5)	From a point 0.5 mile upstream of of mouth Stirewalt Creek to a point 0.8 mile upstream of mouth	WS-IV	03-08-32	8.6	mi.	S	M		
Lyle Creek	11-76-(3.5)	From Bakers Creek to US Highways 64 and 70	WS-IV	03-08-32	6.3	mi.	S	M		
Mackey Creek	11-15-(3.5)a	From Laurel Fork Creek to US 70	C	03-08-30	1.8	mi.	S	M		
Mackey Creek	11-15-(3.5)b	From US 70 to Catawba River	C	03-08-30	0.8	mi.	S	M		
Maiden Creek	11-129-5-7-2-(1)	From source to a point 0.7 mile upstream from backwaters of Maiden Reservoir	WS-II	03-08-35	4.9	mi.	I	M	Cause Unknown	
McAlpine Creek (Waverly Lake)	11-137-9c	From NC 51 to NC 521	C	03-08-34	4.6	mi.	I	M	turbidity	Urban Runoff/Storm Sewers
McDowell Creek	11-115-(1.5)b	From SR 2136 Mecklengurg Co to a point 0.7 mile upstream of mouth	WS-IV	03-08-33	2.9	mi.	I	M	Cause Unknown	Land Development
McDowell Creek	11-115-(1.5)a	From US Highway 21 to SR 2136 Mecklenburg Co	WS-IV	03-08-33	4.4	mi.	I	M	Cause Unknown	Land Development
McGalliard Creek	11-44-(3)	From a point 0.6 mile upstream of mouth to Rhodhiss Lake, Catawba River	WS-IV CA	03-08-31	3.9	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
McLin Creek	11-76-5-(3)	From a point 0.2 mile upstream of Catawba County SR 1722 to Lyle Creek	WS-IV CA	03-08-32	0.7	mi.	S	M		
Middle Little River	11-62	From source to Duck Creek	C	03-08-32	21.5	mi.	S	M		
Mill Creek	11-7-(0.5)	From source to Swannanoa Creek	C Tr HQW	03-08-30	5.0	mi.	S	M		
Muddy Fork	11-69-4	From source to SR 1409	C	03-08-32	6.8	mi.	S	M		
Mulberry Creek	11-38-32-(15)	From Dam at Mulberry Beach to Johns River	C	03-08-31	5.4	mi.	S	M		
North Fork Catawba River	11-24-(2.5)a	From mouth of Laurel Branch to Stillhouse Branch	B Tr	03-08-30	7.1	mi.	S	M		
North Fork Catawba River	11-24-(2.5)b	From Stillhouse Branch to Armstrong Creek	B Tr	03-08-30	3.5	mi.	I	M		
North Fork Catawba River	11-24-(13)	From Armstrong Creek to Lake James, Catawba River	C	03-08-30	7.0	mi.	NR	M		
North Muddy Creek	11-32-1	From source to Muddy Creek	C	03-08-30	18.4	mi.	S	M		
Paddy Creek	11-28	From source to 1.5 mi upstream of Lake James	C Tr	03-08-30	4.6	mi.	S	M		
Pinch Gut Creek	11-129-5-7	From source to Clark Creek	C	03-08-35	7.2	mi.	S	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Pott Creek	11-129-3-(0.7)	From a point 0.3 mile upstream of Lincoln County SR 1217 to South Catawba Fork River	WS-IV	03-08-35	3.2 mi.	S	M		
Silver Creek	11-34-(0.5)	From source to a point 1.3 miles downstream of Clear Creek	C	03-08-31	15.4 mi.	S	M		
Silver Creek	11-56-(2)	From a point 0.7 mile upstream of mouth to Lake Hickory, Catawba River	WS-IV CA	03-08-32	0.8 mi.	S	M		
Sixmile Creek	11-138-3	From source to North Carolina-South Carolina State Line	C	03-08-38	8.8 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Smoky Creek	11-41-(1)	From source to a point 0.6 mile upstream of mouth	WS-IV	03-08-31	7.5 mi.	S	M		
South Fork Catawba River	11-129-(0.5)	From source to Catawba-Lincoln County Line	WS-V	03-08-35	8.4 mi.	S	M		
South Fork Catawba River	11-129-(15.5)	From a point 0.4 mile upstream of Long Creek to Cramerton Dam and Lake Wylie at Upper Armstrong Bridge	WS-V	03-08-36	18.1 mi.	S	M		
South Fork Crowders Creek	11-135-10	North Carolina Portion	C	03-08-37	5.7 mi.	NR	M		
South Muddy Creek	11-32-2	From source to Muddy Creek	C	03-08-30	16.1 mi.	S	M		
Spainhour Creek	11-39-3	From source to Lower Creek	C	03-08-31	4.7 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Sugar Creek	11-137a	From source to below WWTP, SR 1156, Mecklenburg	C	03-08-34	0.3 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Sugar Creek	11-137b	From SR 1156 Mecklenburg to Highway 51	C	03-08-34	10.9 mi.	NR	M	Cause Unknown	Urban Runoff/Storm Sewers
Swannanoa Creek	11-7-9	From source to Mill Creek	C Tr	03-08-30	3.2 mi.	S	M		
Toms Creek	11-21-(2)	From Harris Creek to McDowell County SR 1434	C HQW	03-08-30	6.6 mi.	S	M		
Town Creek	11-129-5-4	From source to Clark Creek	C	03-08-35	3.8 mi.	S	M		
Twelvemile Creek	11-138	From source to North Carolina-South Carolina State Line	C	03-08-38	3.0 mi.	S	M		
Upper Creek	11-35-2-(13)	From Dam at Clear Water Beach Lake to Warrior Fork	WS-III Tr HQW	03-08-31	4.3 mi.	S	M		
Upper Little River (Cedar Creek)	11-58-(5.5)	From Morris Creek to a point 0.5 mile upstream of mouth	WS-IV	03-08-32	9.8 mi.	S	M		
Warrior Fork	11-35-(1)	From source to a point 0.6 mile upstream of City of Morganton water supply intake	WS-III	03-08-31	4.9 mi.	S	M		
White Mill Creek	11-39-8-1-(2)	From a point 0.6 mile downstream of Burke County-Caldwell County Line to Bristol Creek	WS-IV	03-08-31	3.4 mi.	NR	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis	Problem Parameters	Potential Sources
Wilson Creek	11-38-34	From source to Johns River	B Tr ORW	03-08-31	23.3	mi.	S	M		
Youngs Fork (Corpening Creek)	11-32-1-4a	From source to Marion WWTP	C	03-08-30	3.6	mi.	I	M	Cause Unknown	Major Municipal Point Source
Youngs Fork (Corpening Creek)	11-32-1-4b	From Marion WWTP to North Muddy Creek	C	03-08-30	1.9	mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Zacks Fork Creek	11-39-1	From source to Lower Creek	C	03-08-31	8.0	mi.	S	M		

NOTES

"Rating" = Use Support Rating

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"Habitat degradation" is identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and stream bed scour.

ABBREVIATION KEY

p = Point Source Pollution (Major source)

np = Nonpoint Source Pollution

M = Monitored

S = Supporting

I = Impaired

NR = Not Rated

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis
CATAWBA RIVER (including backwaters of Lake James below elevation 1200)	11-(8)	From Dam at Old Fort Finishing Plant Water Supply Intake to North Fork Catawba River	C	03-08-30	23.5	mi.	S	M
North Fork Catawba River	11-24-(13)	From Armstrong Creek to Lake James, Catawba River	C	03-08-30	7.0	mi.	S	M
Linville River	11-29-(19)	From southern Boundary of Daniel Boone Wildlife Management Area to Lake James, Catawba River	B HQW	03-08-30	7.1	mi.	S	M
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31)	From Bridgewater Dam (Linville Dam) to a point 0.6 mile upstream of Muddy Creek	WS-V	03-08-30	1.1	mi.	S	M
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31.5)	From a point 0.6 mile upstream of Muddy Creek to a point 1.2 mile upstream of Canoe Creek	WS-IV	03-08-30	9.8	mi.	S	M
Wilson Creek	11-38-34	From source to Johns River	B Tr ORW	03-08-31	23.3	mi.	S	M
Lower Creek	11-39-(6.5)	From Caldwell County SR 1143 to a point 0.7 mile downstream of Bristol Creek	WS-IV	03-08-31	6.8	mi.	NR	M
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(53)	From US Highway 321 Bridge to NC Highway 127	WS-IV&B CA	03-08-32	1232.8	ac.	S	M
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(59.5)	From NC Highway 127 to Oxford Dam	WS-V&B	03-08-32	2093.6	ac.	S	M
Lower Little River	11-69-(0.5)	From source to a point 0.5 mile upstream of mouth of Stirewalt Creek	C	03-08-32	14.0	mi.	NR	M
CATAWBA RIVER (Lake Norman below elevation 760)	11-(74)	From Lookout Shoals Dam to Lyle Creek	WS-IV CA	03-08-32	265.3	ac.	S	M
CATAWBA RIVER (Lake Norman below elevation 760)	11-(75)	From Lyle Creek to Cowan’s Ford Dam	WS-IV&B CA	03-08-32	31331.6	ac.	S	M
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(114)	From Water Intake at River Bend Steam Station to Mountain Island Dam (Town of Mount Holly water supply intake)	WS-IV&B CA	03-08-33	1937.1	ac.	S	M
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(117)	From Mountain Island Dam to Interstate Highway 85 Bridge at Belmont	WS-IV CA	03-08-33	375.3	ac.	S	M
Dutchmans Creek	11-119-(0.5)	From source to a point 0.8 mile downstream of Taylors Creek	WS-IV	03-08-33	7.4	mi.	S	M

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area		Rating	Basis
Long Creek	11-120-(2.5)	From a point 0.6 mile downstream of Mecklenburg County SR 2074 to a point 0.4 mile upstream of Mecklenburg County SR 1606	WS-IV	03-08-34	11.3	mi.	NR	M
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	From I-85 bridge to the upstream side of Paw Creek Arm of Lake Wylie, Catawba River	WS-IV&B CA	03-08-34	601.1	ac.	S	M
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	From the upstream side of Paw Creek Arm of Lake Wylie to North Carolina-South Carolina State Line	WS-V&B	03-08-34	3418.5	ac.	S	M
South Fork Catawba River	11-129-(0.5)	From source to Catawba-Lincoln County Line	WS-V	03-08-35	8.4	mi.	S	M
Henry Fork	11-129-1-(12.5)c	From State Route 1143 to Jacob Fork	C	03-08-35	8.6	mi.	S	M
Henry Fork	11-129-1-(12.5)b	From State Route 1124 to State Route 1143	C	03-08-35	4.8	mi.	S	M
Clark Creek	11-129-5-(9.5)	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba River	WS-IV	03-08-35	1.8	mi.	NR	M
Indian Creek	11-129-8-(5)	From a point 0.4 mile upstream of mouth of Lick Fork to a point 0.3 mile upstream of Lincoln County SR 1169	C	03-08-35	2.6	mi.	S	M
South Fork Catawba River	11-129-(15.5)	From a point 0.4 mile upstream of Long Creek to Cramerton Dam and Lake Wylie at Upper Armstrong Bridge	WS-V	03-08-36	18.1	mi.	S	M
Long Creek	11-129-16-(4)	From Mountain Creek to South Fork Catawba River	C	03-08-36	15.3	mi.	NR	M
Crowders Creek	11-135e	From State Route 1108 To NC 321	C	03-08-37	1.5	mi.	I	M
Crowders Creek	11-135b	From State Route 1118 to State Route 1122	C	03-08-37	3.1	mi.	I	M
Crowders Creek	11-135a	From source to SR 1118	C	03-08-37	1.9	mi.	I	M
Crowders Creek	11-135g	South Carolina State Line	C	03-08-37	1.5	mi.	I	M
Crowders Creek	11-135f	From State Route 321 to State Route 2424	C	03-08-37	1.4	mi.	I	M
Crowders Creek	11-135c	From State Route 1122 to State Route 1131	C	03-08-37	3.3	mi.	I	M
Crowders Creek	11-135d	From State Route 1131 to State Route 1108	C	03-08-37	7.3	mi.	I	M
Blackwood Creek	11-135-7	From source to Crowders Creek	C	03-08-37	4.4	mi.	I	M
Sugar Creek	11-137a	From source to below WWTP, SR 1156, Mecklenburg	C	03-08-34	0.3	mi.	NR	M

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis
Sugar Creek	11-137b	From SR 1156 Mecklenburg to Highway 51	C	03-08-34	10.9 mi.	NR	M
Irwin Creek	11-137-1	From source to Sugar Creek	C	03-08-34	11.8 mi.	NR	M
Little Sugar Creek	11-137-8b	From source to Arcdale Road	C	03-08-34	5.5 mi.	NR	M
McAlpine Creek (Waverly Lake)	11-137-9a	From source to SR 3356, (Sardis Road)	C	03-08-34	8.5 mi.	NR	M
Twelvemile Creek	11-138	From source to North Carolina-South Carolina State Line	C	03-08-38	3.0 mi.	NR	M

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Appendix IV

303(d) Listing
and
Reporting Methodology

Integrated 305(b) and 303(d) Report Summary

The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports of previous years. The *305(b) Report* is compiled biennially to update the assessment of water quality in North Carolina and to meet the Section 305(b) reporting requirement of the Clean Water Act. The 305(b) reports present how well waters support designated uses (e.g., swimming, aquatic life support, water supply), as well as likely causes (e.g., sediment, nutrients) and potential sources of impairment. The term "Use Support" refers to the process mandated by 305(b). The *303(d) List* is a comprehensive public accounting of all Impaired waterbodies that is derived from the 305(b) Report/Use Support. An Impaired waterbody is one that does not meet water quality uses, such as water supply, fishing or propagation of aquatic life. Best professional judgement along with numeric and narrative standards criteria and anti-degradation requirements defined in 40 CFR 131 is considered when evaluating the ability of a waterbody to serve its uses.

Section 303(d) of the federal Clean Water Act (CWA) which Congress enacted in 1972 required States, Territories and authorized Tribes to identify and establish a priority ranking for waterbodies for which technology-based effluent limitations required by Section 301 are not stringent enough to attain and maintain applicable water quality standards, establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the list of Impaired waterbodies and TMDLs to the US Environmental Protection Agency (EPA). Current federal rules require states to submit 303(d) lists biennially, by April 1st of every even numbered year. EPA is required to approve or disapprove the state-developed 303(d) list within 30 days. For each water quality limited segment Impaired by a pollutant and identified in the 303(d) list, a Total Maximum Daily Load (TMDL) must be developed. TMDLs are not required for waters Impaired by pollution.

The Integrated Report includes descriptions of monitoring programs, the use support methodology, and the Impaired waters list. New guidance from EPA places all waterbody assessment units into one unique assessment category (EPA, 2001b). Although EPA specifies five unique assessment categories, North Carolina elects to use seven categories. Each category is described in detail below:

> **Category 1: Attaining the water quality standard and no use is threatened**. This category consists of those waterbody assessment units where all applicable use support categories are rated " Supporting". Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained.
>
> **Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened**. This category consists of those waterbody assessment units where at least one of the applicable use support categories are rated " Supporting" and the other use support categories are rated "Not Rated" or “No Data”. Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption, are rated "Supporting"; the remaining applicable use support categories, except Fish Consumption, are rated "Not Rated"; and the Fish Consumption category is rated "Impaired-Evaluated". Data and information are available to support a

determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there are insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information were previously insufficient to make a determination.

Category 3: Insufficient or no data and information to determine if any designated use is attained. This category consists of those waterbody assessment units where all applicable use support categories, except Fish Consumption, are rated "Not Rated", and the Fish Consumption category is rated "Impaired-Evaluated". Measured data or information to support an attainment determination for any use are not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status.

Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. This category contains three distinct sub-categories:

> **Category 4a: TMDL has been completed**. This category consists of those waterbody assessment units for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be considered before moving an assessment unit from Category 4a to Categories 1 or 2.
>
> **Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future**. This category consists of those waterbody assessment units for which TMDLs will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, etc.) are expected to attain water quality standards within a reasonable amount of time. Future monitoring will be used to verify that the water quality standard is attained as expected.
>
> **Category 4c: Impairment is not caused by a pollutant**. This category consists of assessment units that are Impaired by pollution, not by a pollutant. EPA defines pollution as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water." EPA staff have verbally stated that this category is intended to be used for impairments related to water control structures (i.e., dams). Future monitoring will be used to confirm that there continues to be an absence of pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Category 5: Impaired for one or more designated uses by a pollutant(s) and requires a TMDL. This category consists of those waterbody assessment units that are Impaired by a pollutant and the proper technical conditions exist to develop TMDLs. As defined by the EPA, the term pollutant means "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water." When more than one pollutant is associated with the impairment of a single waterbody assessment unit in this category, the assessment unit will remain in Category 5 until TMDLs for all listed pollutants have been completed and approved by the EPA.

Category 6: Impaired based on biological data. This category consists of waterbody assessment units historically referred to as "Biologically Impaired" waterbodies; these assessment units have no identified cause(s) of impairment although aquatic life impacts have been documented. The waterbody assessment unit will remain in Category 6 until TMDLs have been completed and approved by the EPA.

Category 7: Impaired, but the proper technical conditions do not yet exist to develop a TMDL. As described in the Federal Register, "proper technical conditions" refer to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662, December 28, 1978). These are assessment units that would otherwise be in Category 5 of the integrated list. As previously noted, EPA has recognized that in some specific situations the data, analyses or models are not available to establish a TMDL. North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. Open water and ocean hydrology fecal coliform Impaired shellfishing waters are included in this category.

For this integrated list, Categories 1 and 2 are considered fully supporting any assessed uses. This portion of the integrated list is extensive (thousands of segments); thus, a printed copy is not provided. A table of waters on Categories 1 through 3 is available for downloading on the DWQ website (http://h2o.enr.state.nc.us/tmdl/General_303d.htm). **Categories 5, 6 and 7 constitute the 2004 North Carolina 303(d) List for the State of North Carolina**.

Delisting Waters

In general, waters will move from Categories 5, 6 or 7 when data show that uses are fully supported or when a TMDL has been approved by EPA. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved Impaired waters list will be moved to Categories 1, 2, 3 or 4 under the following circumstances:

- An updated 305(b) use support rating of Supporting, as described in the basinwide management plans.
- Applicable water quality standards are being met (i.e., no longer Impaired for a given pollutant) as described in either basinwide management plans or in technical memoranda.
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as Impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or *National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing Decisions*. Robert Wayland, III, Director. Office of Wetlands, Oceans and Watersheds. Aug 27, 1997).
- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories or modification of fish eating advice.
- Typographic listing mistakes (i.e., the wrong water was identified).
- EPA has approved a TMDL.

Scheduling TMDLs

Category 5 waters, those for which a TMDL is needed, are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement. Others need to have a technical strategy budgeted, funded and scheduled. Some are ready for EPA submittal.

North Carolina has prioritized TMDL development for waters Impaired due to bacteria or turbidity. The approach of prioritizing TMDL development based on pollutant has been successfully used in other states. Limited resources are used more effectively with a focus on a particular pollutant. Waters Impaired by other pollutants (i.e., not bacteria) are not excluded from the schedule. However, the majority of waters prioritized for the next few years are associated with bacterial contamination. Compliance with TMDL development schedules provided in the Integrated Report depends upon DWQ and EPA resources.

North Carolina uses biological data to place the majority of waterbody assessment units on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Category 6 is to be expected. It is important to understand that the identification of waters in Category 6 does not mean that they are low priority waters. The assessment of these waters is a high priority for the State of North Carolina. However, it may take significant resources and time to determine the environmental stressors and potentially a cause of impairment. Assigning waters to Category 6 is a declaration of the need for more data and time to adequately define the problems and whether pollution, pollutants or a combination affects waters.

According to EPA guidance (EPA 2004), prioritization of waterbody assessment units for TMDLs need not be reflected in a "high, medium or low" manner. Instead, prioritization can be reflected in the TMDL development schedule. Generally, North Carolina attempts to develop TMDLs within 10 years of the original pollutant listing. Other information for each assessment unit is also utilized to determine the priority in the TMDL development schedule. This information includes the following:

- Year listed. Assessment units that have been on the 303(d) list for the longest period of time will receive priority for TMDL development and/or stressor studies.
- Reason for listing. (Applicable to Category 5 AUs only) AUs with an impairment due to a standard violation will be prioritized based on which standard was violated. Standard violations due to bacteria or turbidity currently receive priority for TMDL development.
- Classification. AUs classified for primary recreation (Class B), water supply (Class WS-I through WS-V), trout (Tr), high quality waters (HQW), and outstanding resource waters (ORW) will continue to receive a higher priority for TMDL development and/or stressor studies.
- Basinwide Planning Schedule. (Applicable to Category 6 AUs only). The basinwide schedule is utilized to establish priority for stressor studies.

Revising TMDLs

Current federal regulations do not specify when TMDLs should be revised. However, there are several circumstances under which it would seem prudent to revisit existing TMDLs. The

TMDL analysis of targets and allocations is based upon the existing water quality standards, hydrology, water quality data (chemical and biological), and existing, active NPDES wastewater discharges. Conditions related to any of these factors could be used to justify a TMDL revision. Specific conditions that the Division will consider prior to revising an existing, approved TMDL include the following:

- A TMDL has been fully implemented and the water quality standards continue to be violated. If a TMDL has been implemented and water quality data indicate no improvement or a decline in overall water quality, the basis for the TMDL reduction or the allocation may need to be revised.
- A change of a water quality standard (e.g., fecal coliform to *Echerichia coli*). The Division will prioritize review of existing TMDLs and data to determine if a revision to TMDLs will be required.
- The addition or removal of hydraulic structures to a waterbody (e.g., dams). Substantial changes to waterbody hydrology and hydraulics have the potential to change many aspects of target setting, including the water quality standard upon which the TMDL was developed, the water quality data, and the water quality modeling.
- Incorrect assumptions were used to derive the TMDL allocations. This would include errors in calculations and omission of a permitted discharge.

Should a TMDL be revised due to needed changes in TMDL targets, the entire TMDL would be revised. This includes the TMDL target, source assessment, and load and wasteload allocations. However, the Division may elect to revise only specific portions of the TMDL. For example, changes may be justifiable to the load and wasteload allocation portions of a TMDL due to incorrect calculations or inequities. In these cases, revisions to the TMDL allocations would not necessarily include a revision of TMDL targets.

Appendix V

Catawba River Basin Workshop Summaries

Issues Associated with Specific Waters of the Catawba River Basin

Water or Area	Subbasin	Issue	Workshop
Hidden Creek	03-08-30	Sand Removal and Odor at River Road WWTP	Hickory
Muddy Creek	03-08-30	Bank Erosion	Hickory
Lower Creek	03-08-31	Cattle in Creek - Impervious Surface	Hickory
McDowell	03-08-33	Erosion	Dallas
Beaver Dam	03-08-32	Erosion	Dallas
Tributaries to Lake Wylie	03-08-33 03-08-34 03-08-36 03-08-37	Erosion	Dallas
South Prong Stanly Creek	03-08-33	Erosion	Dallas
Dutchmans Creek	03-08-33	Erosion	Dallas
Lakes	All	Package Plants	Dallas
Lake James	03-08-30	Development and Associated erosion	Dallas
South Fork Catawba River	03-08-35 03-08-36	Color and Sediment	Dallas
Crowders Creek	03-08-37	Sediment and Fecal Coliform Bacteria	Dallas
Little Toe River	03-08-30	Food Dye, Fertilization and Algae	Dallas
Lakes Norman and Lookout Shoals	03-08-32	Aquatic Weeds	Dallas
Stanly Creek	03-08-33	Erosion	Dallas
Lake Hickory and Rhodhiss	03-08-31 03-08-32	Public Access	Newton
Lakes Hickory and James	03-08-30 03-08-32	Aquatic Weeds	Newton
Lake Hickory and Rhodhiss	03-08-31 03-08-32	Nutrients and Algal Blooms	Newton
Lower Creek	03-08-31	Sediment and Nutrients	Newton
Clark Creek	03-08-35	Sediment and Nutrients	Newton
Silver Creek	03-08-31	Sediment and Nutrients	Newton
Snow Creek	03-08-32	Sediment and Nutrients	Newton
Waxhaw Creek	03-08-38	Sediment	Newton

Issues Related to Enforcement, Permitting, Rule Making and Monitoring

Specific Issue	Recommendation	Workshop
Sewer Overflows	Investigate locations and permit review.	Hickory
Development	Land use ordinances.	Hickory
Aquatic Weeds	Develop management plan.	Hickory
Stormwater	Monitor stormwater quality, compile list of local ordinances.	Hickory
Stormwater	Require BMPs at all parking lots.	Dallas
Abandoned Industrial Sites	Ensure proper clean up.	Hickory
Straight Piping	Fund removal.	Hickory
General Enforcement	Enforce laws as written, focus on large corporations and landowners.	Hickory
General Enforcement	Focus on large corporations and landowners.	Dallas
Sediment Control	State should provide money for maintenance and enforcement.	Hickory
Sediment Control	Close one-acre lot size loophole.	Newton
Buffers	Expand buffer width. Provide local incentive to make stronger rules.	Dallas
Package Plants	Plants should be combined into regional system.	Dallas
Road Construction	DOT must restrict runoff.	Newton
Shoreline Development	Restrict Growth.	Newton

Issues Related to Funding Sources and Education

Specific Issue	Recommendation	Workshop
Fertilizer Application	Educate lawn care and residential users on application process.	All
Stormwater/Urban Runoff	Educate citizens/homeowners on the benefits of BMPs.	All
Riparian Buffers	Educate landowners.	All
Low Impact Development	Educate citizens and local governments on benefits.	All
Cattle in Streams	Provide more funding to cost share program.	Dallas, Newton
Septic Systems	Educate public.	Newton
Implement Long-Term Planning		Dallas
Fines	Fine revenue should go directly to enforcement fund, not general fund.	Dallas
Funding for Enforcement	Provide more.	Hickory
Tourism	Educate leaders on value of pristine environments and fund their protection.	Hickory
Optimize Spending	Increase in water quality should be proportional to spending.	Hickory

Appendix VI

Catawba River Basin Nonpoint Source Program Description and Contacts

Statewide Nonpoint Source Management Program Description

The North Carolina Nonpoint Source Management Program consists of a broad framework of federal, state and local resource and land management agencies. More than 2,000 individuals administer programs that are directly related to nonpoint source pollution management within the state. A range of responsibilities have been delegated to county or municipal programs including the authority to inspect and permit land clearing projects or septic system performance. In the field of agriculture, a well established network of state and federal agricultural conservationists provide technical assistance and program support to individual farmers.

Staff in the DWQ Water Quality Section's Planning Branch lead the Nonpoint Source Management Program, working with various agencies to insure that program goals are incorporated into individual agencies' management plans. The goals include:

1. Coordinate implementation of state and federal initiatives addressing watershed protection and restoration.
2. Continue to target geographic areas and waterbodies for protection based upon best available information.
3. Strengthen and improve existing nonpoint source management programs.
4. Develop new programs that control nonpoint sources of pollution not addressed by existing programs.
5. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico National Estuary Program).
6. Monitor the effectiveness of BMPs and management strategies, both for surface water and groundwater quality.

Coordination between state agencies is achieved through reports in the *North Carolina Nonpoint Source Management Program Update*. Reports are intended to keep the program document current and develop a comprehensive assessment identifying the needs of each agency to meet the state nonpoint source program goals. Annual reports are developed to describe individual program priorities, accomplishments, significant challenges, issues yet to be addressed, and resource needs. A copy of the latest Annual Report is available online at http://h2o.enr.state.nc.us/nps/nps_mp.htm.

The nature of nonpoint source pollution is such that involvement at the local level is imperative. Basinwide water quality plans identify watersheds that are impaired by nonpoint sources of pollution. Identification, status reports and recommendations are intended to provide the best available information to local groups and agencies interested in improving water quality. The plans also make available information regarding federal, state and local water quality initiatives aimed at reducing or preventing nonpoint source pollution.

The following table is a comprehensive guide to contacts within the state's Nonpoint Source Management Program. For more information, contact Alan Clark at (919) 733-5083, ext. 570. Most employees of the Department of Environment and Natural Resources, including the Division of Water Quality, Division of Land Resources and Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

Agriculture

USDA Natural Resources Conservation Service:

Part of the US Department of Agriculture, formerly the Soil Conservation Service. Technical specialists certify waste management plans for animal operations; provide certification training for swine waste applicators; work with landowners on private lands to conserve natural resources, helping farmers and ranchers develop conservation systems unique to their land and needs; administer several federal agricultural cost share and incentive programs; provide assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems; conduct soil surveys; offer planning assistance for local landowners to install best management practices; and offer farmers technical assistance on wetlands identification.

Area 1 Conserv.	Carol S. Litchfield	828-456-6341	589 Raccoon Road, Suite 246, Waynesville 28786-3217
Area 2 Conserv.	Mike Sugg	704-637-2400	530 West Innes Street, Salisbury 28144

County	Contact Person	Phone	Address
Alexander	James Propst	828-632-2708	Box 10, Taylorsville 28681
Avery	David Tucker	828-264-3857	971 West King Street, Boone 28607
Burke	Russell Lyday	828-439-9727	130 Ammons Drive, Suite 3, Morganton 28655
Caldwell	Russell Lyday	828-439-9727	130 Ammons Drive, Suite 3, Morganton 28655
Catawba	Richard Grant	828-464-1382	1175 Sourth Brady Avenue, Newton 28658
Gaston	Shawn Smith	704-922-3956	1303 Cherryville Hwy, Dallas 28034
Iredell	James Summers	704-873-6761	Ag. Resource Center, 444 Bristol Drive, Statesville 28677
Lincoln	Elton Barber	704-736-8501	115 Main Street, Lincolnton 28092
McDowell	Albert Moore	828-287-4220	121 Laurel Drive, Rutherfordton 28139-2952
Mecklenburg	Matthew Kinane	704-792-0400	715 Cabarrus Avenue West, Concord 28027
Union	Mark Ferguson	704-289-3212	604 Lancaster Avenue, Monroe 28112

Soil & Water Conservation Districts:

Boards and staff under the administration of the NC Soil and Water Conservation Commission (SWCC). Districts are responsible for: administering the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* at the county level; identifying areas needing soil and/or water conservation treatment; allocating cost share resources; signing cost share contracts with landowners; providing technical assistance for the planning and implementation of BMPs; and encouraging the use of appropriate BMPs to protect water quality.

County	Board Chairman	Phone	Address
Alexander	Larry Payne	828-632-2708	255 Liledoun Road, Taylorsville 28681
Avery	Edward Storey	828-733-2291	PO Box 190, Newland 28657
Burke	Don Abernethy	828-439-9727	130 Ammons Drive, Morganton 28655
Caldwell	Boyd Wilson	828-758-1111	120 Hospital Avenue NE, Suite #2, Lenoir 28645
Catawba	Charles Wike	828-464-1382	PO Box 389, Newton 28658
Gaston	William Craig	704-922-3956	1303 Cherryville Hwy, Dallas 28034
Iredell	Wade Carrigan	704-873-6761	444 Bristol Drive, Statesville 28677-2942
Lincoln	Blair Goodson	704-736-8501	115 Main Street, Citizen Center, Lincolnton 28092
McDowell	C. A. Buckner	828-652-4434	15 North Garden Street, Marion 28752
Mecklenburg	Owen Furuseth	704-336-6265	700 North Tryon Street, Charlotte 28202
Union	Warren Case	704-289-3212	604 Lancaster Avenue, Monroe 28112

Division of Soil and Water Conservation:

State agency that administers the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* (ACSP). Allocates ACSP funds to the Soil and Water Conservation Districts, and provides administrative and technical assistance related to soil science and engineering. Distributes Wetlands Inventory maps for a small fee.

Central Office	David Williams	919-715-6103	5th Floor Archdale Bldg, 512 N. Salisbury St., Raleigh 27626
Asheville*	David Ferguson	828-251-6208	59 Woodfin Place, Asheville 28801
Mooresville**	Ralston James	704-663-1699	919 North Main Street, Mooresville 28115

Agriculture (con't)			

NCDA Regional Agronomists:

The NC Department of Agriculture technical specialists: certify waste management plans for animal operations; provide certification training for swine waste applicators; track, monitor, and account for use of nutrients on agricultural lands; operate the state *Pesticide Disposal Program,* and enforce the state pesticide handling and application laws with farmers.

Central Office	Richard Reich	919-733-2655	1040 Mail Service Center, Raleigh 27699-1040
Region 12	Lynn Howard	828-313-9982	604 Pine Mountain Road, Hudson 28638
Region 14	Steven Dillon	704-742-9933	242 at East Acres Farm Road, Ellenboro 28040

Education

NC Cooperative Extension Service:

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

County	Contact Person	Phone	Address
Alexander	Lenny Rogers	828-632-4451	621 Liledoun Road, Taylorsville 28681
Avery	Michael Pitman	828-733-8270	PO Box 280, Newland 28657
Burke	Spring Williams	828-439-4460	130 Ammons Drive, Morganton 28655
Caldwell	Allen Caldwell	828-757-1290	120 Hospital Avenue NE , Suite 1, Lenoir 28645
Catawba	Fred Miller	828-465-8240	1175 South Brady Avenue, Newton 28658
Gaston	David Fogarty	704-922-0301	PO Box 1578, Gastonia 28053
Iredell	Kenneth Vaughn	704-873-0507	PO Box 311, Statesville 28677
Lincoln	Kevin Starr	704-736-8458	115 West Main Street, Lincolnton 28092
McDowell	Daniel Smith	828-652-7121	10 East Court Street, Marion 28752
Mecklenburg	Deborah Myatt	704-336-2561	700 North Tryon Street, Charlotte 28202
Union	Jerry Simpson	704-283-3801	500 North Main Street, Room 506, Monroe 28112

Forestry

Division of Forest Resources:

Develop, protect, and manage the multiple resources of North Carolina's forests through professional stewardship, enhancing the quality of our citizens while ensuring the continuity of these vital resources.

Districts 12	Howard Williams	704-827-7576	1933 Mountain Island Hwy, Mount Holly 28120
Central Office	Moreland Gueth	919-733-2162	1616 Mail Service Center, Raleigh 27699-1616

Construction/Mining

DENR Division of Land Resources:

Administers the NC Erosion and Sedimentation Control Program for construction and mining operations. Conducts land surveys and studies, produces maps, and protects the state's land and mineral resources.

Central Office	Mel Nevills	919-733-4574	512 North Salisbury Street, Raleigh 27626
Asheville*	Richard Phillips	828-251-6208	59 Woodfin Place, Asheville 28801
Mooresville**	Doug Miller	704-663-6040	919 North Main Street, Mooresville 28115

Local Erosion and Sedimentation Control Ordinances:

Several local governments in the basin have qualified to administer their own erosion and sedimentation control ordinances.

Avery County	Tommy Burelson	828-733-8204	PO Box 596, Newland 28657
Cabarrus County	Tony Johnson	704-920-2835 ext. 2835	PO Box 707, Concord 28026
Mecklenburg County	Kia Whittlesey	704-336-7783	700 North Tryon Street, Charlotte 28202

General Water Quality			
DWQ Water Quality Section:			
Coordinate the numerous nonpoint source programs carried out by many agencies; administer the Section 319 Grants Program statewide; conduct stormwater permitting; model water quality; conduct water quality monitoring; perform wetlands permitting; conduct animal operation permitting and enforcement; and conduct water quality classifications and standards activities.			
NPS Planning	Alan Clark	919-733-5083 x570	1617 Mail Service Center, Raleigh 27699-1617
Urban Stormwater	Bradley Bennett	919-733-5083 x525	1617 Mail Service Center, Raleigh 27699-1617
Modelling	Michelle Woolfolk	919-733-5083 x505	1617 Mail Service Center, Raleigh 27699-1617
Monitoring	Jimmie Overton	919-733-9960 x204	1621 Mail Service Center, Raleigh 27699-1621
Wetlands	John Dorney	919-733-1786	1621 Mail Service Center, Raleigh 27699-1621
Animal Operations	Kim Colson	919-733-5083 x540	1617 Mail Service Center, Raleigh 27699-1617
Classifications/Standards	Tom Reeder	919-733-5083 x557	1617 Mail Service Center, Raleigh 27699-1617
DWQ Regional Offices:			
Conduct permitting and enforcement field work on point sources, stormwater, wetlands, and animal operations, conduct enforcement on water quality violations of any kind, and perform ambient water quality monitoring.			
Asheville Region*	Forrest Westall	828-251-6208	59 Woodfin Place, Asheville 28801
Mooresville Region**	Rex Gleason	704-663-1699	919 North Main Street, Mooresville 28115
Wildlife Resources Commission:			
To manage, restore, develop, cultivate, conserve, protect, and regulate the wildlife resources of the state, and to administer the laws enacted by the General Assembly relating to game, game and non-game freshwater fishes, and other wildlife resources in a sound, constructive, comprehensive, continuing, and economical manner.			
Central Office	Frank McBride	919-733-7123	512 North Salisbury Street, Raleigh 27604
Central Office	David Cobb	919-733-7291	512 North Salisbury Street, Raleigh 27604
US Army Corps of Engineers:			
Responsible for: investigating, developing and maintaining the nation's water and related environmental resources; constructing and operating projects for navigation, flood control, major drainage, shore and beach restoration and protection; hydropower development; water supply; water quality control, fish and wildlife conservation and enhancement, and outdoor recreation; responding to emergency relief activities directed by other federal agencies; and administering laws for the protection and preservation of navigable waters, emergency flood control and shore protection. Responsible for wetlands and 404 Federal Permits.			
Asheville Field Office	Steve Chapin	828-271-4014	151 Patton Avenue, Room 143, Asheville 28801
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	PO Box 29578, Raleigh 27626-0578
Asheville*	Landon Davidson	828-251-6208	59 Woodfin Place, Asheville 28801
Mooresville**	Andrew Pitner	704-663-1699	919 North Main Street, Mooresville 28115

Solid Waste			
DENR Division of Waste Management:			
Management of solid waste in a way that protects public health and the environment. The Division includes three sections and one program -- Hazardous Waste, Solid Waste, Superfund, and the Resident Inspectors Program.			
Central Office	Brad Atkinson	919-733-0692	401 Oberlin Road, Suite 150, Raleigh 27605
Asheville*	Jesse Wells	828-251-6208	59 Woodfin Place, Asheville 28801
Mooresville**	Robert Krebs	704-663-1699	919 North Main Street, Mooresville 28115

On-Site Wastewater Treatment

Division of Environmental Health and County Health Departments:

Safeguard life, promote human health, and protect 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	Barbara Grimes	919-715-0141	2728 Capital Boulevard, Raleigh 27604
Asheville*	Joe Lynn	828-397-5152	59 Woodfin Place, Asheville 28801

County	Primary Contact	Phone	Address
Alexander	Doug Ferguson	828-632-9704	322 First Avenue, SW, Taylorsville 28681
Avery	Thomas Singleton	828-733-6031	PO Box 325, Newland 28657
Burke	David Rust, Jr.	828-438-5430	200 Avery Avenue, Morganton 28655
Caldwell	Douglas Urland	828-426-8579	1966-B Morganton Boulevard SW, Lenoir 28645
Catawba	Barry Blick	828-695-5800	3070 11th Avenue SE, Hickory 28602
Gaston	Coleen Bridger	704-853-5262	991 West Hudson Boulevard, Gastonia 28052
Iredell	Raymond Rabe	704-878-5303	318 Turnersburg Hwy, Statesville 28625
Lincoln	Margaret Dollar	704-736-8634	151 Sigmon Road, Lincolnton 28092
McDowell	Joyce Sluder	828-652-6811	140 Spaulding Road, Marion 28752
Mecklenburg	Peter Safer	704-336-3100	249 Billingsley Road, Charlotte 28211
Union	Lorey White, Jr.	704-296-4800	1224 West Roosevelt Boulevard, Monroe 28110

- **DENR Regional Offices involved**

  * **Asheville Region Office covers the following counties:**

  Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania and Yancey.

  ** **Mooresville Region Office covers the following counties:**

  Alexander, Cabarrus, Catawba, Cleveland, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Stanly and Union.

Appendix VII

Glossary
of
Terms and Acronyms

Glossary

§	Section.
30Q2	The minimum average flow for a period of 30 days that has an average recurrence of one in two years.
7Q10	The annual minimum 7-day consecutive low flow, which on average will be exceeded in 9 out of 10 years.
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing.
basin	The watershed of a major river system. There are 17 major river basins in North Carolina.
benthic macroinvertebrates	Aquatic organisms, visible to the naked eye (macro) and lacking a backbone (invertebrate), that live in or on the bottom of rivers and streams (benthic). Examples include, but are not limited to, aquatic insect larvae, mollusks and various types of worms. Some of these organisms, especially aquatic insect larvae, are used to assess water quality. See EPT index and bioclassification for more information.
benthos	A term for bottom-dwelling aquatic organisms.
best management practices	Techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point and nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Often, BMPs are applied as system of practices and not just one at a time.
bioclassification	A rating of water quality based on the outcome of benthic macroinvertebrate sampling of a stream. There are five levels: Poor, Fair, Good-Fair, Good and Excellent.
BMPs	See *best management practices*.
BOD	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed by the decomposition of biological matter or chemical reactions in the water column. Most NPDES discharge permits include a limit on the amount of BOD that may be discharged.
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.
channelization	The physical alteration of streams and rivers by widening, deepening or straightening of the channel, large-scale removal of natural obstructions, and/or lining the bed or banks with rock or other resistant materials.
chlorophyll *a*	A chemical constituent in plants that gives them their green color. High levels of chlorophyll *a* in a waterbody, most often in a pond, lake or estuary, usually indicate a large amount of algae resulting from nutrient overenrichment or eutrophication.
coastal counties	Twenty counties in eastern NC subject to requirements of the Coastal Area Management Act (CAMA). They include: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell and Washington.
Coastal Plain	One of three major physiographic regions in North Carolina. Encompasses the eastern two-fifths of state east of the *fall line* (approximated by Interstate I-95).
conductivitiy	A measure of the ability of water to conduct an electrical current. It is dependent on the concentration of dissolved ions such as sodium, chloride, nitrates, phosphates and metals in solution.
degradation	The lowering of the physical, chemical or biological quality of a waterbody caused by pollution or other sources of stress.

DENR	Department of Environment and Natural Resources.
DO	Dissolved oxygen.
drainage area	An alternate name for a watershed.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
dystrophic	Naturally acidic (low pH), "black-water" lakes which are rich in organic matter. Dystrophic lakes usually have low productivity because most fish and aquatic plants are stressed by low pH water. In North Carolina, dystrophic lakes are scattered throughout the Coastal Plain and Sandhills regions and are often located in marshy areas or overlying peat deposits. NCTSI scores are not appropriate for evaluating dystrophic lakes.
EEP	Ecosystem Enhancement Program (EEP)
effluent	The treated liquid discharged from a wastewater treatment plant.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
EPT Index	This index is used to judge water quality based on the abundance and variety of three orders of pollution sensitive aquatic insect larvae: Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).
eutrophic	Elevated biological productivity related to an abundance of available nutrients. Eutrophic lakes may be so productive that the potential for water quality problems such as algal blooms, nuisance aquatic plant growth and fish kills may occur.
eutrophication	The process of physical, chemical or biological changes in a lake associated with nutrient, organic matter and silt enrichment of a waterbody. The corresponding excessive algal growth can deplete dissolved oxygen and threaten certain forms of aquatic life, cause unsightly scums on the water surface and result in taste and odor problems.
fall line	A geologic landscape feature that defines the line between the piedmont and coastal plain regions. It is most evident as the last set of small rapids or rock outcroppings that occur on rivers flowing from the piedmont to the coast.
FS	Fully supporting. A rating given to a waterbody that fully supports its designated uses and generally has good or excellent water quality.
GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
habitat degradation	Identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.
headwaters	Small streams that converge to form a larger stream in a watershed.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
Hydrilla	The genus name of an aquatic plant - often considered an aquatic weed.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222 subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975 square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
hypereutrophic	Extremely elevated biological productivity related to excessive nutrient availability. Hypereutrophic lakes exhibit frequent algal blooms, episodes of low dissolved oxygen or periods when no oxygen is present in the water, fish kills and excessive aquatic plant growth.

impaired	Term that applies to a waterbody that has a use support rating of partially supporting (PS) or not supporting (NS) its uses.
impervious	Incapable of being penetrated by water; non-porous.
kg	Kilograms. To change kilograms to pounds multiply by 2.2046.
lbs	Pounds. To change pounds to kilograms multiply by 0.4536.
loading	Mass rate of addition of pollutants to a waterbody (e.g., kg/yr)
macroinvertebrates	Animals large enough to be seen by the naked eye (macro) and lacking backbones (invertebrate).
macrophyte	An aquatic plant large enough to be seen by the naked eye.
mesotrophic	Moderate biological productivity related to intermediate concentrations of available nutrients. Mesotrophic lakes show little, if any, signs of water quality degradation while supporting a good diversity of aquatic life.
MGD	Million gallons per day.
mg/l	Milligrams per liter (approximately 0.00013 oz/gal).
NCIBI	North Carolina Index of Biotic Integrity. A measure of the community health of a population of fish in a given waterbody.
NH_3-N	Ammonia nitrogen.
nonpoint source	A source of water pollution generally associated with rainfall runoff or snowmelt. The quality and rate of runoff of NPS pollution is strongly dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from forested lands will generally contain much less pollution and runoff more slowly than runoff from urban lands.
NPDES	National Pollutant Discharge Elimination System.
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NS	Not supporting. A rating given to a waterbody that does not support its designated uses and has poor water quality and severe water quality problems. Both PS and NS are called impaired.
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed).
NTU	Nephelometric Turbidity Units. The units used to quantify turbidity using a turbidimeter. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions.
oligotrophic	Low biological productivity related to very low concentrations of available nutrients. Oligotrophic lakes in North Carolina are generally found in the mountain region or in undisturbed (natural) watersheds and have very good water quality.
ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
pH	A measure of the concentration of free hydrogen ions on a scale ranging from 0 to 14. Values below 7 and approaching 0 indicate increasing acidity, whereas values above 7 and approaching 14 indicate a more basic solution.

phytoplankton	Aquatic microscopic plant life, such as algae, that are common in ponds, lakes, rivers and estuaries.
Piedmont	One of three major physiographic regions in the state. Encompasses most of central North Carolina from the Coastal Plain region (near I-95) to the eastern slope of the Blue Ridge Mountains region.
PS	Partially supporting. A rating given to a waterbody that only partially supports its designated uses and has fair water quality and severe water quality problems. Both PS and NS are called impaired.
riparian zone	Vegetated corridor immediately adjacent to a stream or river. See also SMZ.
river basin	The watershed of a major river system. North Carolina is divided into 17 major river basins: Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar-Pamlico, Watauga, White Oak and Yadkin River basins.
river system	The main body of a river, its tributary streams and surface water impoundments.
runoff	Rainfall that does not evaporate or infiltrate the ground, but instead flows across land and into waterbodies.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival.
sedimentation	The sinking and deposition of waterborne particles (e.g., eroded soil, algae and dead organisms).
silviculture	Care and cultivation of forest trees; forestry.
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOCs are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance).
streamside management zone (SMZ)	The area left along streams to protect streams from sediment and other pollutants, protect streambeds, and provide shade and woody debris for aquatic organisms.
subbasin	A designated subunit or subwatershed area of a major river basin. Subbasins typically encompass the watersheds of significant streams or lakes within a river basin. Every river basin is subdivided into subbasins ranging from one subbasin in the Watauga River basin to 24 subbasins in the Cape Fear River basin. There are 133 subbasins statewide. These subbasins are not a part of the national uniform hydrologic unit system that is sponsored by the Water Resources Council (see *hydrologic unit*).
Sw	Swamp Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are common in the Coastal Plain and are often naturally discolored giving rise to their nickname of “blackwater” streams.
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses and water quality standards.
TN	Total nitrogen.
TP	Total phosphorus.
tributary	A stream that flows into a larger stream, river or other waterbody.

trophic classification	Trophic classification is a relative description of a lake's biological productivity, which is the ability of the lake to support algal growth, fish populations and aquatic plants. The productivity of a lake is determined by a number of chemical and physical characteristics, including the availability of essential plant nutrients (nitrogen and phosphorus), algal growth and the depth of light penetration. Lakes are classified according to productivity: unproductive lakes are termed "oligotrophic"; moderately productive lakes are termed "mesotrophic"; and very productive lakes are termed "eutrophic".
TSS	Total Suspended Solids.
turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. All particles in the water that may scatter or absorb light are measured during this procedure. Suspended sediment, aquatic organisms and organic particles such as pieces of leaves contribute to instream turbidity.
UT	Unnamed tributary.
watershed	The region, or land area, draining into a body of water (such as a creek, stream, river, pond, lake, bay or sound). A watershed may vary in size from several acres for a small stream or pond to thousands of square miles for a major river system. The watershed of a major river system is referred to as a basin or river basin.
WET	Whole effluent toxicity. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WS	Class WS Water Supply Water Classification. This classification denotes freshwaters used as sources of water supply. There are five WS categories. These range from WS-I, which provides the highest level of protection, to WS-V, which provides no categorical restrictions on watershed development or wastewater discharges like WS-I through WS-IV.
WWTP	Wastewater treatment plant.