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 mi²
Land area:	516 mi²
Water area:	10 mi²

Population

2000 Est. Pop.:	57,046 people
Pop. Density:	108 persons/mi²

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 Mackey Creek below a metal plating discharge whose permit was rescinded in June 2001 showed the greatest change in water quality, its bioclassification improving from Poor to Good.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

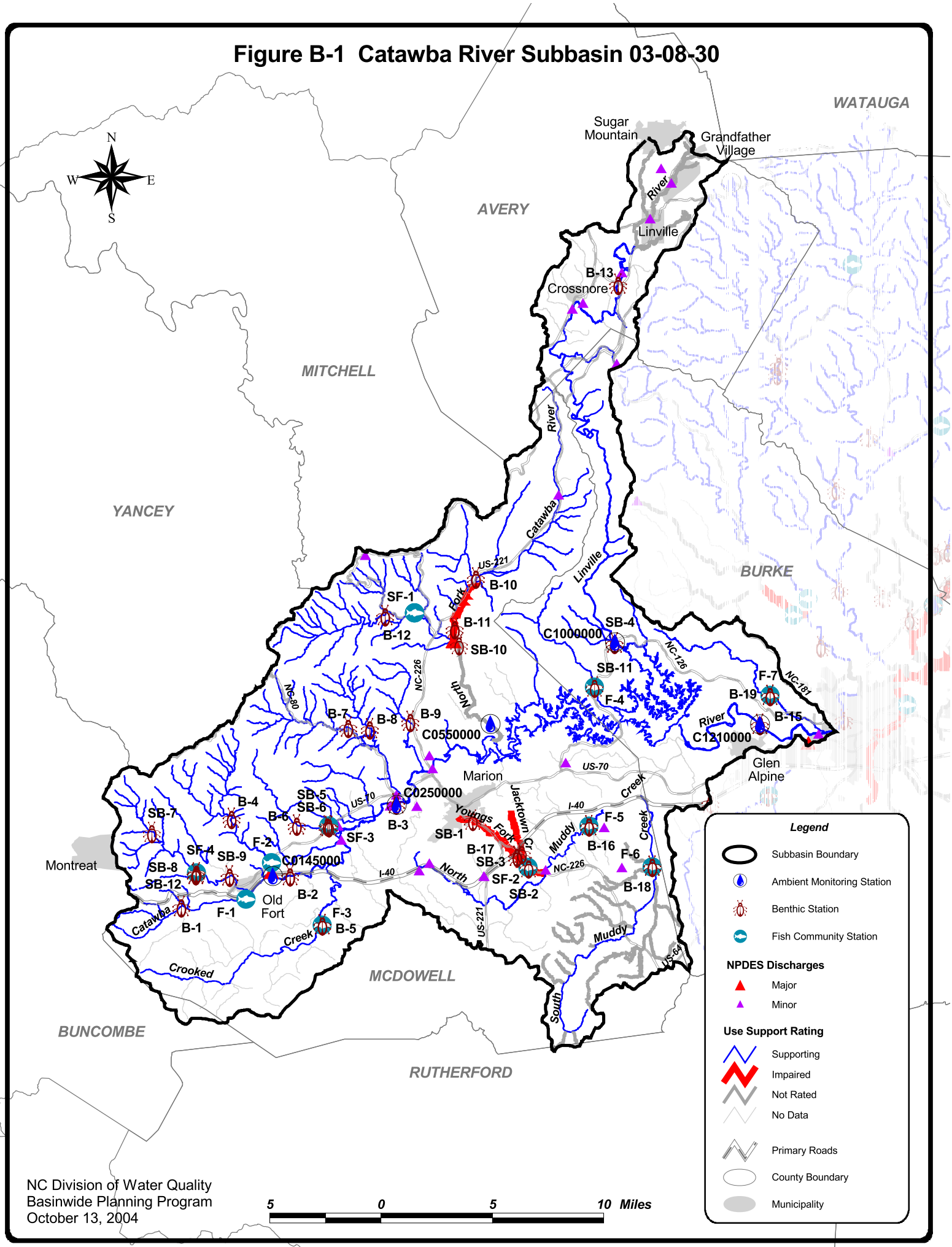

Table B-1 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 03-08-30

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			Use Support Rating	
					Biological	Ambient	Other	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 NI - Not Impaired
G - Good NR - Not Rated
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

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.