Chapter 1
Watauga River Subbasin 04-02-01

Including the: Watauga River, Boone Fork, Laurel Fork, Cove Creek, Beaverdam Creek, Beech Creek, Elk River and Cranberry Creek

1.1 Subbasin Overview

Subbasin 04-02-01 at a Glance

Land and Water Area

Total area:	205 mi²
Land area:	203 mi²
Water area:	<2 mi²

Population (County)

2000 Est. Pop.:	23,675 people
Pop. Density:	115 persons/mi²

Land Cover (percent)

Forest/Wetland:	87%
Water:	<1%
Urban:	<1%
Cultivated Crop:	<1%
Pasture/ Managed Herbaceous:	13%

Counties

Avery and Watauga

Municipalities

Beech Mountain, Banner Elk, Seven Devils, Elk Park, Sugar Mountain, and (Western) Boone

Aquatic Life Monitored Streams Summary

Total Streams:	90.0 mi
Total Supporting:	79.4 mi
Total Impaired:	5.9 mi
Total Not Rated:	4.7 mi

The entire North Carolina portion of the Watauga River basin is contained within the boundaries of subbasin 04-02-01. This includes both the Watauga and Elk River watersheds. Much of the land is mountainous with elevations ranging from 2,100 feet at the Tennessee state line to over 5,900 feet at Calloway Peak on Grandfather Mountain.

Nearly 87 percent of the land is forested; however, some of these forested areas are being rapidly developed with seasonal or second homes and recreational areas (i.e., golf courses and campgrounds). Development in or near stream corridors and on steep slopes has the potential to impact water quality throughout the subbasin with nonpoint source runoff and numerous small point source dischargers. The population in urban areas around the Town of Boone is increasing. Between 1990 and 2002, population increased by 4 percent. Refer to Appendix I for more information about population growth and trends. Refer to Appendix III for information regarding changes in land use.

There are 29 individual NPDES wastewater discharge permits in this subbasin with a total permitted flow of 3.92 MGD. The two largest facilities are the Valley Creek and Sugar Mountain wastewater treatment plants (WWTP). The Sugar Mountain and Beech Mountain (Pond Creek) WWTPs are required by permit to monitor their whole effluent toxicity (WET). Both facilities are currently in compliance. Refer to Appendix VI for the listing of NPDES permit holders.

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 3. Table 3 contains a summary of assessment unit numbers (AU#) and lengths, streams monitored, monitoring data types, locations and results, along with use support

Figure 3 Watauga River Subbasin 04-02-01

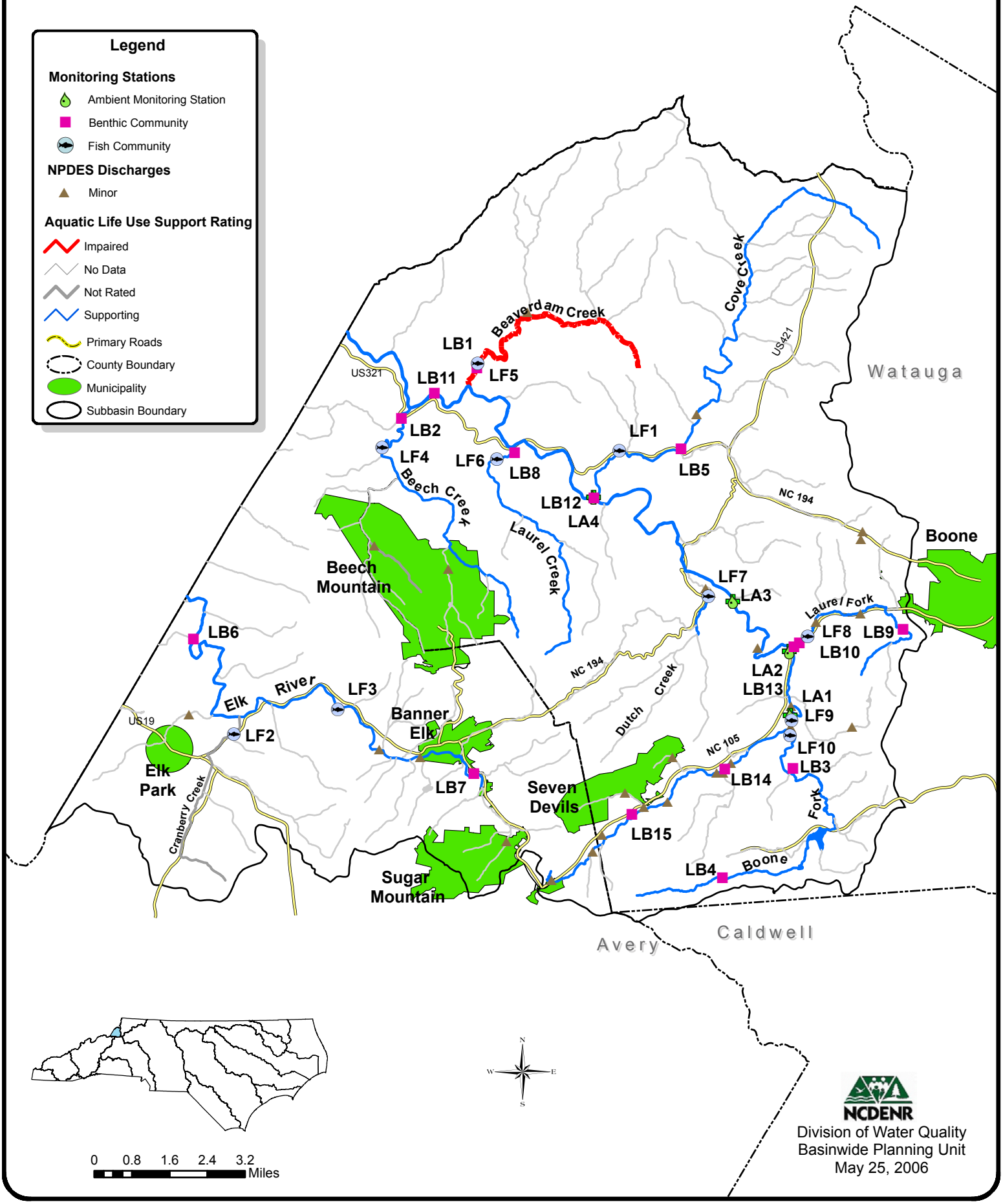

Table 3 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 04-02-01

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Beaverdam Creek													
8-19	C;Tr	5.9 FW Miles		I					ND			Habitat Degradation	Agriculture
	From source to Watauga River				LB1	G	2004					Habitat Degradation	Pasture
					LF5	P	2004						
Beech Creek													
8-20	C;Tr	7.6 FW Miles		S					ND			Habitat Degradation	Impervious Surfac
	From source to Watauga River				LB2	E	2004						
					LF4	NR	2004						
Boone Fork (Price Lake)													
8-7	C;Tr,ORW	8.4 FW Miles		S					ND			Habitat Degradation	Impervious Surfac
	From source to Watauga River				LF10	G	2004						
					LB4	E	2004						
					LB3	E	2004						
Cove Creek													
8-15	C	12.8 FW Miles		S					ND			Habitat Degradation	Construction
	From source to Watauga River				LF1	GF	2004					Habitat Degradation	Pasture
					LB5	G	2004						
Cranberry Creek													
8-22-16	C;Tr	4.7 FW Miles		NR					ND			Habitat Degradation	Unknown
	From source to Elk River				LF2	NR	2004						
Dutch Creek													
8-12-(1.5)	C;Tr	0.9 FW Miles		S					ND			Habitat Degradation	Unknown
	From Clark Creek to Watauga County SR 1112				LF7	GF	2004						
Elk River													
8-22-(14.5)	B;Tr	8.1 FW Miles		S					ND			Nutrient Impacts	Unknown
	From Peavine Branch to North Carolina-Tennessee State Line				LB6	G	2004					Habitat Degradation	Impervious Surfac
					LF3	NR	2004						
Elk River (Mill Pond)													
8-22-(3)	C;Tr	4.2 FW Miles		S					ND			Habitat Degradation	Impervious Surfac
	From Sugar Creek to Peavine Creek				LB7	GF	2004						

Table 3 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 04-02-01

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment				
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources
Laurel Creek													
8-17	C;Tr	6.1	FW Miles	S					ND			Habitat Degradation	Construction
From source to Watauga River					LB8	G	2004					Habitat Degradation	Impervious Surfac
					LF6	NR	2004						
Laurel Fork													
8-10	C;Tr	4.9	FW Miles	S					ND			Habitat Degradation	Stormwater Outfal
From source to Watauga River					LB10	GF	2004					Habitat Degradation	Impervious Surfac
					LB9	NI	2004						
					LF8	NR	2004						
WATAUGA RIVER													
8-(1)	B;Tr,HQW	19.5	FW Miles	S	LA1	NCE			S	LA1	NCE	Temperature	Impervious Surfac
					LA2	NCE				LA2	NCE	Habitat Degradation	Impervious Surfac
					LA3	NCE				LA3	NCE	Habitat Degradation	WWTP NPDES
					LA4	NCE				LA4	NCE		
From source to U.S. Hwy. 321 Bridge					LB15	E	2004						
					LB14	G	2004						
					LB13	E	2004						
					LB12	E	2004						
					LF9	GF	2004						
8-(16)	B;HQW	6.8	FW Miles	S					ND				
From U.S. Hwy. 321 to North Carolina-Tennessee State Line					LB11	E	2004						

Table 3 DWQ Assessment and Use Support Ratings Summary for Monitored Waters in Subbasin 04-02-01

AU Number	Classification	Length/Area Description	Aquatic Life Assessment					Recreation Assessment				
			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources

AL - Aquatic Life
REC - Recreation

LF - Fish Community Survey
LB - Benthic Community Survey
LA - Ambient Monitoring Site

Miles/Acres
FW- Fresh Water

E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired

S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment
Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded

Aquatic Life Rating Summary

S	m	79.4	FW Miles
NR	m	4.7	FW Miles
I	m	5.9	FW Miles
NR	e	1.6	FW Miles
ND		186.7	FW Miles

Recreation Rating Summary

S	m	19.5	FW Miles
NR	e	1.7	FW Miles
ND		257.0	FW Miles

Fish Consumption Rating Summary

I	e	278.1	FW Miles

ratings for waters in the subbasin. Refer to Appendix IX for the use support methodology applied to the Watauga River basin.

Waters in the following sections and in Table 3 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters, and to identify waters throughout the basinwide water quality plan. 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 assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

There were 13 benthic macroinvertebrate samples and 10 fish community samples collected during this assessment period. Data were also collected from four ambient monitoring stations. Overall, water quality in the subbasin is very good, with the majority of the sites receiving a bioclassification of Good or Excellent based on the macroinvertebrate data. Three sites in the basin improved in 2004 compared to the previous samples collected in 1999. These include two sites on the Watauga River (Section 1.4.7) and one on lower Boone Fork (Section 1.4.1). Two sites on the mainstem of the Elk River showed a decline in water quality (Section 1.4.9). The upstream site above the Town of Banner Elk declined from a Good in 1999 to a Good-Fair in 2004, and the downstream site near the state line declined from an Excellent in 1999 to a Good in 2004. The primary water quality problem is nonpoint source runoff (i.e., sediment and nutrients). Based on the macroinvertebrate data, nonpoint source runoff appeared to have some impacts (Good and Good-Fair ratings) on some segments of the Watauga River, Elk River, Cove Creek, Beaverdam Creek, Laurel Fork and Laurel Creek. Many of the sites that were sampled have roads that run parallel to the stream, leading to narrow riparian zones with frequent breaks and little shading.

All of the fish community sites in this subbasin were sampled by DWQ for the first time in 2004. The 2004 basinwide assessment will therefore serve as a baseline for fish communities sampled during the 2009 basinwide assessment period. The most commonly collected species were the central stoneroller and the northern hog sucker. Both were collected at all ten sampling sites. Brown trout and the blacknose dace were also very common species. With the exception of Cove Creek [AU# 8-15], all of the fish community sites are designated trout (Tr) waters by DWQ. The NC Wildlife Resources Commission (WRC) also manages portions of the basin as hatchery supported trout waters. Wild and stocked trout were collected at all of the 2004 fish community sites. Refer to the *2005 Watauga River Basinwide Assessment Report* at www.ncwaterquality.org/esb/Basinwide/WAT2005.pdf and Appendix IV for more information on DWQ monitoring.

Eleven sites are also monitored by the Volunteer Water Information Network (VWIN). Several of these sites correspond with DWQ sites and provide additional qualitative information. This program is managed by the University of North Carolina Asheville (UNCA) Environmental Quality Institute (EQI) and relies on volunteers to collect water samples monthly for chemical analysis. Parameters monitored include major nutrients, turbidity, suspended solids, pH, alkalinity, conductivity and heavy metals such as zinc, copper and lead (Patch, *et al*., February 2006). VWIN monitoring stations are listed in Appendix V.

1.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended or designated use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting the designated use. For aquatic life, an Excellent, Good, Good-Fair, Fair, or Poor bioclassification are assigned to a stream based on the biological data collected by DWQ. Aquatic life samples include benthic macroinvertebrates, fish community, and ambient monitoring. Methodologies related to assigning aquatic life bioclassifications and use support assessment are included in Appendices IV and IX, respectively. Appendix X provides definitions of the terms used throughout this basin plan.

Table 4 Summary of Use Support Ratings by Category in Subbasin 04-02-01

Use Support Rating	Aquatic Life	Recreation
Monitored Waters		
Supporting	79.4 mi (88.2%)	19.5 mi (100%)
Impaired*	5.9 mi (6.6%)	0
Not Rated	4.7 mi (5.2%)	0
Total	**90.0 mi**	**19.5 mi**
Unmonitored Waters		
Supporting	0	0
Impaired	0	0
Not Rated	1.6 mi	1.7 mi
No Data	186.7 mi	257.0 mi
Total	**188.3 mi**	**258.7 mi**
Totals		
All Waters**	**278.3 mi**	**278.2 mi**

* The noted percent Impaired is the percent of monitored miles/acres only.
** Total Monitored + Total Unmonitored = Total All Water.

In subbasin 04-02-01, use support was assigned for the aquatic life, recreation, fish consumption and water supply categories. Waters are Supporting, Impaired, Not Rated, and No Data in the aquatic life and recreation categories on a monitored or evaluated basis. Waters are Impaired in the fish consumption category on an evaluated basis based on fish consumption advice issued by the Department of Health and Human Services (DHHS). All waters are Supporting in the water supply category on an evaluated basis based on reports from Division of Environmental Health (DEH) regional water treatment plant consultants.

Table 3 identifies those waters monitored during this assessment period. The table includes assessments for aquatic life and recreation, along with the identified stressors and sources. Table 4 provides a summary of use support ratings and includes total miles for Supporting, Impaired, Not Rated, and No Data waters.

1.3 Status and Recommendations of Previously and Newly Impaired Waters

No streams were identified as Impaired in the previous basin plan (2002). However, the following waters are newly Impaired based on recent biological and/or ambient data and will likely be placed on the 2008 303(d) list. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Information regarding 303(d) listing and reporting methodology is included in Appendix VII.

1.3.1 Beaverdam Creek [AU# 8-19]

2002 Recommendations
Based on the benthic macroinvertebrate data, nonpoint source runoff appeared to have some impacts on the habitat in Beaverdam Creek. Voluntary implementation of BMPs was encouraged and continued monitoring was recommended.

Current Status
Beaverdam Creek, from source to the Watauga River (5.9 miles), is Impaired in the aquatic life category due to a Poor fish bioclassification at site LF5. The number of fish collected and the total number of species were the lowest of any of the fish sites sampled in the subbasin. The numerically dominant species collected was an omnivorous river chub. Two wild rainbow trout were also collected, along with a number of omnivore and herbivore species. Very few insectivore species were collected. Based on the number and types of fish species collected, Beaverdam Creek is exhibiting an unbalanced ecological system.

Benthic macroinvertebrates were also collected in Beaverdam Creek. The benthic community received a Good bioclassification at site LB1. The species abundance and richness decreased from the previous assessment period and contained a mix of intolerant and tolerant species.

Overall, the instream habitat was good during the time of sampling and consisted primarily of riffles with high gradient plunge pools. Within the sampling reach, riparian zones were wide and intact, the streambanks were stable, and there was adequate shading. Just upstream, however, land use consisted of scattered residential development, pastureland and rowcrops. Cattle had direct, easy access to the stream, and the riparian corridor was narrow. One minor discharge (<1 MGD) is located two miles upstream of the sampling site; however, no violations have been reported for this facility.

2007 Recommendations
Based on the current aquatic life use support, DWQ recommends that Beaverdam Creek be listed on the 2008 303(d) list. DWQ will continue to monitor water quality in Beaverdam Creek and work with local agencies to encourage appropriate agricultural (e.g., livestock exclusion fencing, watering tanks, riparian buffer) and residential stormwater BMPs. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff.

Water Quality Initiatives
In 2005, the Watauga County Soil and Water Conservation District (SWCD) worked with a local landowner to construct a chicken litter storage area. Funding was provided by the NC Agricultural Cost Share Program (ACSP). The Watauga County SWCD plans to work with additional landowners to install appropriate agricultural and residential stormwater BMPs throughout this watershed.

1.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQ's most recent use support methodologies, the surface waters discussed in this section are Supporting their designated uses. However, notable water quality problems and

concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and to locate sources of water quality protection funding. Education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix VIII.

1.4.1 Boone Fork [AU# 8-7]

Current Status
Boone Fork, from source to the Watauga River (8.4 miles), is Supporting in the aquatic life category due to Excellent benthic bioclassifications at sites LB3 and LB4 and a Good fish bioclassification at site LF10. Boone Fork is a designated trout (Tr) and outstanding resource water (ORW) by DWQ.

Upstream, Boone Fork is a relatively small stream. Substrate is a good mix of bolder, rubble and cobble. Many intolerant benthic species were collected at site LB4. These species support the ORW designation, overall excellent water quality and favorable habitat conditions. Downstream, Boone Fork (below Price Lake) is 13 meters wide with a rocky substrate and has the potential to be impacted by Price Lake (i.e., flow regime and temperature). The benthic bioclassification improved from a Good (1999) to an Excellent (2004) during this assessment period.

The fish sample (LF10) was collected just upstream of the confluence with the Watauga River. The instream riparian and watershed characteristics were of exceptional high quality. A private fishing club known for its stocked trophy trout manages this reach of Boone Fork. Seven very large stocked rainbow trout, a stocked "golden trout" and one wild young-of-year rainbow trout were collected and released.

2004 Hurricane Damage
Several tributaries throughout the Boone Fork watershed were impacted by the hurricanes of 2004. One tributary that was impacted was Cold Prong (AU# 8-7-1). The excessive amount of rain and consequent heavy stream flows during the hurricanes severely damaged a dam on Appalachian Crest Lake, a privately owned 40-acre impoundment. Stormwater and sediments entered Boone Fork and Price Lake in the Julian Price Memorial Park.

Working with the local resource agency staff, the Blue Ridge Parkway and the Division of Land Resources (DLR) Safe Dam Program, the dam was breached and a 600-foot conveyance was placed through the dam. Large stone and vegetation was used to stabilize the breached section, and currently, there are no plans to reconstruct the dam. If the dam were to be reconstructed however, design plans would need to be reviewed by DLR and the Safe Dam Program, and Watauga County would be responsible for reviewing and approving any sediment and erosion control plan associated with dam reconstruction.

2007 Recommendations
Information and data collected during post-hurricane surveys was collected outside of the assessment period and was not used for use support determination. Information collected post-hurricane will be used during the next assessment period (September 2004 through August 2009). DWQ will work with DLR should the dam at Appalachian Crest Lake be reconstructed. Because Boone Fork is designated ORW and Tr by DWQ, extra precautions need to be taken to protect the excellent water quality in the watershed.

1.4.2 Laurel Fork [AU# 8-10]

2002 Recommendations
Although supporting its designated use, habitat degradation was noted throughout the Laurel Fork watershed. Sedimentation, narrow riparian zones and stormwater runoff from residential and commercial properties were identified as stressors to water quality. DWQ recommended that appropriate BMPs be installed to stabilize streambanks and reduce sediment loads.

Current Status
Laurel Fork, from source to the Watauga River (4.9 miles), is Supporting in the aquatic life category due to a Good-Fair benthic bioclassification at site LB10. The sampling site was located 0.5 mile upstream of the confluence with the Watauga River. Instream habitats were good, consisting of high gradient plunge pools, chutes and rocks.

Laurel Fork also received a Not Rated fish bioclassification at site LF8 because trout stream-specific criteria and metrics have not been developed. Ten species were collected from Laurel Fork, but the numbers were low and many were herbivorous species indicating an unbalanced ecological system. Conductivity was elevated at the time of sampling for both benthic and fish (135 µmhos/cm and 109 µmhos/cm). Conductivity is an indicator of nonpoint source and point source runoff in a stream segment.

In addition to DWQ biological sampling, VWIN has sampled water chemistry in Laurel Fork for two years (2003 – 2005). Laurel Fork is below average when compared to other VWIN sampling sites. Readings for median turbidity and suspended solids are elevated, and sediment is more frequent and higher during rain events when compared to other sites in the basin. Conductivity and nutrients (nitrate/nitrite-nitrogen) are also higher. Sediment, conductivity and nutrients are often indications of existing and continued land disturbing activities in a watershed (Patch, *et al*., February 2006).

Special Studies
Laurel Fork receives nonpoint source and stormwater runoff from heavily urbanized areas of western Boone. Laurel Fork also receives runoff from several permitted stormwater facilities. For the past several years, local citizens and resource agency staff have noted periods when water clarity is reduced and the stream runs either “milky white” or “cloudy”. The periods are episodic and duration varies. Several complaints are on file with DWQ.

DWQ regional staff in conjunction with the NC (Watauga County) Cooperative Extension Service (CES), the Watauga County Planning Department, and the NC Department of Transportation (DOT) began an extensive investigation into the source of the “milky” substance.

As part of the investigation, the DWQ Winston-Salem Regional Office (WSRO) requested that a special study be conducted in the Laurel Fork watershed during the 2004 basinwide sampling cycle. In addition to the benthic sample collected at site LB10 (below the permitted stormwater dischargers), there was a sample collected upstream at site LB9. Site LB9 is 1.5 miles upstream of site LB10, and there are many land use changes between the two sites, including the stormwater discharges and several commercial and residential properties. Due to its small size and narrow stream width, site LB9 was given a Not Impaired benthic bioclassification. Several intolerant species were collected at site LB9, which indicates that the overall water quality is good in this upstream sampling reach.

Between 2004 and 2005, DWQ regional staff conducted several stormwater compliance inspections for Vulcan Quarry (Permit NCG020251), Chandler Concrete (Permit NCG140101) and Maymead Materials (Permit NCG160141). DWQ found that BMPs were properly installed and maintained and stormwater records were in order for Vulcan Quarry and Maymead Materials. A compliance evaluation inspection for Chandler Concrete in July 2005, however, revealed that three storm drains on Chandler's property were acting as stormwater conveyances. The storm drains were located in the main drive and parking areas of the property. The investigation by DWQ and the Department of Transportation (DOT) concluded that the storm drains were allowing stormwater to leave the property undetected, discharging directly into Laurel Fork. The facility is designed to capture most of the stormwater on site. Stormwater in ponded areas should be pumped to holding basins and used for concrete mixing operations.

In August 2005, DWQ issued a Notice of Violation (NOV) to Chandler Concrete. The NOV included several recommendations for preventing stormwater from leaving the property. These included closing the three storm drains and installing berms to deflect flow from the drains. Concrete curbs were also recommended and installed on Chandler's property to aid in the capture of stormwater. Back-up generators have also been installed to ensure stormwater is pumped to the holding basins.

Although an NOV has not been issued to Vulcan Quarry, DWQ regional staff is working closely with the foreman and managers of the facility to monitor stormwater runoff. Nearly 99 percent of the stormwater runoff and wash water used on site is captured and recycled. Vulcan Quarry has installed back-up generators on pumping stations, and employees are trained and reminded on a regular basis to turn on sump pumps in the truck washing area. The sump pumps capture the wash water and pump it to holding basins for later use in another area of the facility.

DOT has also been active in the Laurel Fork watershed and recently cleaned a culvert that had been blocked with rocks and runoff material. Much of the material was from Vulcan Quarry. Fine particulate material trapped in the culvert was likely resuspended during each rain event and therefore contributing to the "milky white" and "cloudy" appearance of the stream.

Cooperative efforts in the Laurel Fork watershed allowed for DWQ, DOT and local resource agencies to identify potential sources of the "milky white" substance and work with stormwater discharges to install appropriate measures to limit impacts to the stream. The Watauga River Conservation Partners (WRCP) have also played a crucial role in this watershed by educating local citizens on water quality concerns and practices that can be implemented to protect water quality. DWQ will continue to work with the permitted facilities to ensure compliance.

Land Cover and Average Slope Evaluation
To determine the effects of land use and slope on areas monitored by VWIN, the UNCA Environmental Quality Institute (EQI) evaluated land cover and average slope using ArcGIS 9.0 and land cover classifications from the USGS 2001 Land Cover Database. This evaluation was part of a special project initiated by EQI to determine the vulnerability of streams to erosion and runoff during heavy rain events. Laurel Fork had one of the highest percentages of land categorized as rural/semi-rural (non-forested) or urban/suburban (25.2 percent and 5.9 percent, respectively). The average slope is 30 percent upstream of the VWIN monitoring site making Laurel Fork a highly vulnerable area for flash flood damage during heavy rain events (Patch, *et al*., February 2006). Future planning and restoration activities should incorporate measures to protect streams and human welfare during heavy rain and flash flood events.

2007 Recommendations
DWQ will continue to monitor Laurel Fork and work with local agencies to encourage urban stormwater BMPs. DWQ will also continue stormwater inspections and work with permitted facilities to ensure compliance. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. Because Laurel Fork is designated Tr by DWQ, extra precautions (i.e., buffer requirements and temperature controls) need to be taken to protect the fisheries in the watershed.

1.4.3 Dutch Creek [AU# 8-12-(1.5)]

Current Status
Dutch Creek, from Clark Creek to State Route 1112 (0.9 miles), is Supporting in the aquatic life category due to a Good-Fair fish bioclassification at site LF7. The sample site is located approximately one mile above the confluence with the Watauga River in Valle Crucis. Instream habitat is good with riffles, runs and pools. Substrate consisted mostly of cobble and gravel.

Of all of the fish community samples collected in this subbasin, Dutch Creek contained the highest number of species (19) and total number of fish (775). The NC Wildlife Resources Commission (WRC) annually stocks Dutch Creek with 800 brook, rainbow and brown trout from March to June. Multiple age groups of wild brown trout, including young-of-year, indicated a natural reproducing population in addition to the stock trout.

2007 Recommendations
DWQ will continue to monitor Dutch Creek and work with local agencies to encourage appropriate agricultural and residential stormwater BMPs. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. Because Dutch Creek is designated Tr by DWQ, extra precautions (i.e., buffer requirements and temperature controls) need to be taken to protect the fisheries in the watershed.

1.4.4 Cove Creek [AU# 8-15]

Current Status
Cove Creek, from source to the Watauga River (12.8 miles), is Supporting in the aquatic life category due to a Good benthic bioclassification at site LB5 and a Good-Fair fish

bioclassification at site LF1. The sample site is located along the US 321 corridor, about one mile above the confluence with the Watauga River. The watershed encompasses approximately 33 square miles and contains a mix of rural residential and agricultural land use. Historic and current agricultural use (pasturelands) has created extremely narrow riparian zones, streambank instability and sedimentation throughout the watershed. Instream habitats were poor, consisting of sandy runs, riffles and chutes. New residential development was noted in the upper portion of the watershed, and elevated conductivity measurements were noted during the time of biological sampling (116 µmhos/cm and 95 µmhos/cm).

In addition to DWQ biological sampling, VWIN has sampled water chemistry in Cove Creek for two years (2003 – 2005). Cove Creek is below average when compared to other VWIN sampling sites. Conductivity and nutrients (nitrate/nitrite-nitrogen) are higher than other sites sampled in the basin. Conductivity and nutrients are often indications of existing and continued land disturbing activities in a watershed (Patch, *et al*., February 2006).

Post-Hurricane Special Study

During a three-week period in September 2004, the storm remnants of three hurricanes (Frances, Ivan and Jeanne) lead to widespread flooding throughout the central and northern mountains of western North Carolina. To assess the biological impacts of the hurricanes, DWQ staff requested a post-hurricane special study. Two sites were selected for sampling and included Cove Creek and the Watauga River near Sugar Grove (Section 1.4.7). The data collected during the post-hurricane surveys was collected outside of the assessment period and was not used for use support determination. Information collected during this special study will be used during the next assessment period (September 2004 through August 2009).

Samples collected post-hurricane showed very few physical or water quality differences. Flows were much greater post-hurricane (December 2004) than those collected during normal basinwide monitoring (August 2004). Conductivity was much lower in Cove Creek (91 µmhos/cm) post hurricane. This difference is largely due to the increased flow during the post-hurricane sampling.

Instream habitat for Cove Creek [AU# 8-15] included cobble and gravel riffles, runs and chutes, moderately embedded substrate, and infrequent pools. The streambanks were narrow, sparsely vegetated with an open canopy. The differences in habitat scores pre- and post-hurricane were slight. The benthic bioclassification dropped from Good to Good-Fair at site LB5. Fish diversity decreased slightly and the bioclassification dropped from Good-Fair to a Fair at site LF1. Both DWQ and local resource agency staff believe that the benthic and fish populations will rebound and return to pre-hurricane conditions.

Land Cover and Average Slope Evaluation

To determine the effects of land use and slope on areas monitored by VWIN, the UNCA EQI evaluated land cover and average slope using ArcGIS 9.0 and land cover classifications from the USGS 2001 Land Cover Database. This evaluation was part of a special project initiated by EQI to determine the vulnerability of streams to erosion and runoff during heavy rain events. Cove Creek had one of the highest percentages of land categorized as rural/semi-rural (non-forested) or urban/suburban (27.8 percent and 0.7 percent, respectively). The average slope is 24 percent upstream of the VWIN monitoring site making Cove Creek a vulnerable area for flash flood

damage during heavy rain events (Patch, *et al*., February 2006). Future planning and restoration activities should incorporate measures to protect streams and human welfare during heavy rain and flash flood events.

2007 Recommendations

DWQ will continue to monitor Cove Creek and work with local agencies to encourage appropriate agricultural and residential stormwater BMPs. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff.

1.4.5 Laurel Creek [AU# 8-17]

Current Status

Laurel Creek, from source to the Watauga River (6.1 miles), is Supporting in the aquatic life category due to a Good benthic bioclassification at site LB8. Laurel Creek is a small stream (five meters wide) with a drainage area of approximately seven square miles. The sampling site was located 0.5 mile above the confluence with the Watauga River. Overall, the habitat is good; however, the substrate was embedded and contained a high percentage of sand (25 percent). Land use in Laurel Creek has historically consisted of rural residential and agricultural lands; however, much of the agricultural land is being converted to residential properties.

Laurel Creek also received a Not Rated fish bioclassification at site LF6 because trout stream-specific criteria and metrics have not been developed. Very few species (4) and total number of fish (103) were collected. Six wild brown trout of multiple age groups were collected from Laurel Creek, including one young-of-year, indicating a reproducing population. The WRC manages this section of Laurel Creek as Hatchery Supported Trout waters and annually stocks 900 brook, rainbow and brown trout from March through June. Laurel Creek was the most natural of the high gradient trout streams that was sampled in the subbasin.

2007 Recommendations

DWQ will continue to monitor Laurel Creek and work with local agencies to encourage appropriate stormwater BMPs. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. Because Laurel Creek is designated Tr by DWQ, extra precautions (i.e., buffer requirements and temperature controls) need to be taken to protect the fisheries in the watershed.

1.4.6 Beech Creek [AU# 8-20]

Current Status

Beech Creek, from source to the Watauga River (7.6 miles), is Supporting in the aquatic life category due to an Excellent benthic bioclassification at site LB2. This sampling site is located approximately 0.5 mile above the confluence with the Watauga River and contains a substrate of boulders and rubble. Overall, the instream habitat is good; however, houses are located on either side of the stream, greatly reducing the width and the effectiveness of the riparian corridor. This benthic site is the only known North Carolina locality for the intolerant caddisfly, *Ceratopsyche walkeri*. The species is abundant in the high-current riffles found in Beech Creek. During this assessment period, Beech Creek and Boone Fork (Section 1.4.2) were the only tributaries to the Watauga River that received Excellent bioclassifications.

Even though the downstream segment received an Excellent bioclassification, Beech Creek also received a Not Rated fish bioclassification at site LF4. Beech Creek could not be rated for fish because trout stream-specific criteria and metrics have not been developed. The sampling site is located approximately 1.5 miles above the confluence with the Watauga River, upstream of site LB2. Overall, the instream habitat is good with riffles, fast chutes, fast runs, and plunge pools. The substrate primarily consists of cobbles and boulders; however, effects of severe flash flooding were evident with undercut streambanks and household debris scattered throughout the sampling reach. Eight species were collected for a total of 368 fish. The redbreast sunfish was the numerically dominant species (48 percent); however, the number is unnaturally high compared to other mountain streams. DWQ believes that the redbreast sunfish were once located in the Beech Mountain Reservoir. The reservoir is approximately 3 miles upstream of the sampling location. Migration or flooding likely caused the fish to move from the reservoir to the sampling location. Multiple age groups of two wild trout species were also collected, indicating reproducing populations. WRC manages this section of Beech Creek as Hatchery Supported Trout Waters and annually stocks 600 brook, rainbow and brown trout from March to May.

From the benthic sampling site, the watershed is approximately 20 square miles, contains a mix of forested, agricultural and residential area, and receives stormwater runoff from the Town of Beech Mountain. Two minor wastewater treatment facilities are also located in the watershed. The two facilities are the Pond Creek WWTP (Permit NC0069761) with a permitted discharge of 0.4 MGD and the Grassy Gap WWTP (Permit NC0022730) with a permitted discharge of 0.08 MGD. Both are managed by the Town of Beech Mountain.

2007 Recommendations

DWQ will continue to monitor Beech Creek and work with local agencies to encourage appropriate agricultural and residential stormwater BMPs. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. Because Beech Creek is designated Tr by DWQ, extra precautions (i.e., buffer requirements and temperature controls) need to be taken to protect the fisheries in the watershed.

1.4.7 Grassy Gap Creek [AU# 8-20-3-3]

Current Status

Grassy Gap Creek, from source to Buckeye Creek (1.6 miles), is Not Rated on an evaluated basis in the aquatic life category due to significant noncompliance issues with ammonia permit limits at the Grassy Gap WWTP (Permit NC0022730). To better meet discharge limits, the Grassy Gap WWTP discharge relocated to Buckeye Creek [AU# 8-20-3] in February 2004. The facility has completed a comprehensive wastewater systems analysis and is continually working to replace sewer lines and updating the collection system. In 2005, the Town of Beech Mountain received over $1.2 million from the NC Construction Grants and Loans Program (CG&L) to upgrade the town's WWTPs. To learn more about CG&L, refer to Section 10.3.3.

2007 Recommendations
DWQ will continue to work with the Grassy Gap WWTP to improve facility function and increase compliance. In addition, DWQ will work with local resource agencies to identify education and BMP opportunities throughout the Beech Creek watershed.

1.4.8 Watauga River [AU# 8-(1) and 8-(16)]

2002 Recommendations
The benthic sample collected near Foscoe decreased from an Excellent to a Good-Fair bioclassification. This decline in bioclassification indicates that impacts to water quality are present. Sedimentation, lack of pool habitat, narrow riparian corridors, and frequent breaks in the riparian corridor were all noted as habitat problems. Several new homes and commercial properties were constructed throughout the upper portion of the watershed. Residential and agricultural BMPs should be carefully installed and maintained.

Current Status
The Watauga River, from source to the North Carolina-Tennessee state line (26.3 miles), is Supporting in the aquatic life category due to Good and Excellent benthic bioclassifications at sites LB14 (Foscoe), LB13 (NC 105), LB12 (Sugar Grove) and LB11 (Peoria). The river also received a Good-Fair fish bioclassification at site LF9 (Shull Mills). Overall, instream habitat throughout the watershed is good; however, there is evidence of increased development activities throughout the entire area resulting in narrow riparian corridors, sediment, and periphyton growth along the river's edge.

In the upstream section near Foscoe (LB14), substrate is a good mix of bedrock, boulder and rubble. Located below a cluster of small permitted WWTP facilities, the river also receives runoff from agricultural and residential properties and areas under development in and around the Town of Seven Devils. The entire length of the Watauga River is given the supplemental classification for high quality waters (HQW). The HQW designation is assigned to those waters that are Excellent based on DWQ chemical and biological sampling. Since 1985, this site has fluctuated between Excellent and Good-Fair. The most recent Good bioclassification is an improvement from the Good-Fair rating in 1999; however, the Watauga River is not consistently meeting the criteria of an Excellent bioclassification for HQW.

Out of the ten fish samples monitored in the subbasin, site LF9 has the second highest number of species (16) and total number (469) collected, which resulted in a Good-Fair bioclassification. Wildlife Resources Commission (WRC) manages this section of the Watauga River as delayed harvest trout waters. From March to May, approximately 3,500 rainbow, brook and brown trout are stocked with 600 more added in July followed by another 2,200 in October and November. Despite the abundance of species and numbers, the river is not meeting the criteria of an Excellent bioclassification for HQW.

At site LB12 (Sugar Grove), the river is 17 meters wide, encompasses 92 square miles, and receives runoff from several forested, agricultural and residential areas as well as discharge from several minor NPDES facilities. The velocity of the river is also slower in this downstream section. Consequently, fine sediments tend to settle out near the streambanks. The habitat score

was slightly lower in this section of the river due to infrequent riffles, minimal shading and narrow riparian corridors. Conductivity was higher at site LB12 (100 µmhos/cm) indicating an increase in watershed disturbance (i.e., development and land clearing activities). Biologists noted heavy periphyton growth along the river's edge. Periphyton algal growth is often an indication of nutrient enrichment from both point and nonpoint sources.

In the recreational use support category, the Watauga River is Supporting due to no criteria exceeded for fecal coliform bacteria levels at sites LA1, LA2, LA3, and LA4. Physical and chemical parameters are also evaluated at these ambient sampling sites to assess potential water quality stressors and impacts to aquatic life. Data from these ambient stations indicate that temperature is a water quality stressor at sites LA1 (Shull Mills), LA3 (Valle Crucis) and LA4 (Sugar Grove). Narrow and sparsely vegetated riparian corridors offer little shade to these wide river sections. New development activities throughout the entire watershed increases the amount of impervious surface cover, potentially raising the temperature of stormwater entering tributaries that lead to the Watauga River.

Watauga River Special Study

To investigate water quality and watershed concerns, the uppermost segment of the Watauga River was part of a special study requested by the Winston-Salem Regional Office (WSRO) during the 2004 basinwide sampling cycle. The site (LB15) was selected a control site upstream of development around the Town of Seven Devils. Site LB14 served as the downstream comparison site, below development activities. Site LB15 received an Excellent benthic bioclassification. Site LB14 received a Good bioclassification (discussed above). Species richness and abundance were higher at site LB15 compared to site LB14; however, conductivity was higher upstream at site LB15 (91 µmhos/cm) than downstream at site LB14 (71 µmhos/cm) indicating more disturbances in the uppermost part of the watershed. Biologists noted that at the time of sampling, several small tributaries appeared to be contributing sediment to the Watauga River. Several of the collected specimens were coated with a reddish-orange silt and/or sediment. Despite these inputs, however, the uppermost part of the watershed near Seven Devils (LB15) supports a more pollution intolerant benthic community than the downstream Foscoe site (LB14).

Post-Hurricane Special Study

To assess the biological impacts of the September 2004 hurricanes, DWQ staff requested a post-hurricane special study. Two sites were selected for sampling and included the Watauga River near Sugar Grove and Cove Creek (Section 1.4.4). The data collected during the post-hurricane surveys was collected outside of the assessment period and was not used for use support determination. Information collected during this special study will be used during the next assessment period (September 2004 through August 2009).

Instream habitat in the Watauga River was still a good mix of boulders, rubble, sand, gravel, and silt. Post-hurricane sampling showed a substantial decline in species richness and diversity. Despite the decline, however, the benthic bioclassification only dropped from an Excellent (August 2004) to a Good (December 2004) at site LB12. Both DWQ and local resource agency staff believe that the benthic population will rebound and return to pre-hurricane conditions.

2007 Recommendations
DWQ will continue to monitor the Watauga River and work with local agencies to encourage appropriate agricultural and residential stormwater BMPs. Public education is needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. County, city and town councils should work to implement stormwater BMPs and reevaluate land use ordinances to incorporate low-impact development (LID) design criteria.

Because the Watauga River is designated HQW and Tr by DWQ, extra precautions need to be taken to protect the excellent water quality throughout the watershed. Precautions should also be taken to preserve the pollution intolerant benthic macroinvertebrate communities found throughout the Watauga River watershed. In addition, DWQ should reevaluate the HQW management strategies and identify ways to prevent degradation of these waters.

Water Quality Initiatives
Several restoration projects are underway throughout the entire watershed. One project is the Camp Yonahlossee Restoration project, which includes restoring 700 feet of stream channel, enhancing 0.5 acre of a mountain bog and planting a riparian corridor along the streambanks. Project partners include the Division of Water Resources, the NC Cooperative Extension Service Center, Watauga County, Watauga County SWCD, and the Yonaholosee Property Owners Association (POA) with the POA funding nearly one-third of the project total of $253,000. The Watauga County SWCD will oversee the project and provide technical support. The project will be a demonstration project for the surrounding mountain communities. It is estimated that over 400 tons of soil will be saved, reducing sediment loads in Lance Creek [AU# 8-8-(1) and 8-8-(2)], a tributary to the Watauga River.

With help from the U.S. Geological Survey (USGS), the NC Rural Economic Development Center, the High Country Council of Governments, and Appalachian State University (ASU) Geology Department, the Town of Seven Devils is conducting studies related to steep slope hazards. The study also includes an evaluation of water resources and the "carrying capacity" for population growth now and in the future. The results will aid the town and the county in land use decisions and projected water demand.

1.4.9 Cranberry Creek [AU# 8-22-16]

Current Status
Cranberry Creek, from source to the Elk River (4.7 miles), is Not Rated in the aquatic life category due to a Not Rated fish bioclassification at site LF2. Cranberry Creek could not be rated for fish because trout stream-specific criteria and metrics have not been developed. The sampling site is located approximately 0.5 mile above its confluence with the Elk River. There are no permitted discharges in the watershed; however, conductivity was elevated (63 μmhos/cm) for this mountain stream. Overall instream habitat was moderate and consisted of cobble riffles, pools and runs. The number of fish species (6) and number of individuals (93) collected was low, but typical, for a high-gradient trout stream. Brown and rainbow trout were caught and both species has multiple age groups, including young-of-year, indicating reproducing populations.

Land use in the Cranberry Creek watershed is a mix of forest, agriculture and residential. It may be possible that the elevated conductivity levels noted on the day of sampling are associated with failing septic systems and/or straight pipes in the watershed. Within the sampling reach, one side of the stream had stable streambanks and a good riparian corridor; however, the other streambank was unstable, had poor riparian cover, and lawns were mowed down to the stream's edge.

2007 Recommendations
DWQ will continue to monitor Cranberry Creek and work with local agencies to encourage appropriate agricultural and residential stormwater BMPs. Public education is also needed to demonstrate the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. Septic systems should be maintained and straight pipes (if any) eliminated. DWQ will work with the NC Wastewater Discharge Elimination Program (WaDE) and the local health department to identify failing septic systems and straight pipes. Because Cranberry Creek is designated Tr by DWQ, extra precautions (i.e., buffer requirements and temperature controls) need to be taken to protect the fisheries in the watershed.

1.4.10 Elk River [AU# 8-22-(3) and AU# 8-22-(14.5)]

Current Status
The Elk River, from Sugar Creek to the North Carolina – Tennessee state line (12.3 miles), is Supporting in the aquatic life category due to a Good-Fair and Good benthic bioclassification at sites LB7 and LB6, respectively. Sampling at both basinwide sites, however, noted a decline in aquatic communities. Site LB7 received Good benthic bioclassifications in 1994 and 1999 but declined to a Good-Fair in 2004. Site LB6 received Excellent benthic bioclassifications in 1994 and 1999 but declined to a Good in 2004. Conductivity was also elevated at both locations (82 and 83 µmhos/cm, respectively) in 2004. The decline in the aquatic community is most likely associated with new construction activities throughout the Elk River watershed.

Site LB7 is located just upstream of the Town of Banner Elk. Here, the substrate is highly embedded, consists of a high amount of silt and sand (45 percent), and is not favorable to benthic colonization. Stormwater runoff from the surrounding residential and impervious land cover likely contributed to the decline in bioclassification.

Site LB6 is located 1.3 miles upstream of the state line, near the confluence with Mill Creek. Sand comprised nearly 30 percent of the substrate here, but there was less silt than at site LB7. The substrate was less embedded than the upstream sampling reach (LB7). Despite little shade and periphyton growth (indication of nutrient enrichment), there was a mix of tolerant and intolerant benthic macroinvertebrates collected at this site and several intolerant species were collected for the first time.

The Elk River also received a Not Rated fish bioclassification at site LF3 because trout stream-specific criteria and metrics have not been developed. The sampling location is located just downstream of the Town of Banner Elk. Three permitted NPDES discharge facilities are located upstream. None of these facilities have violated permit limits during the last two years of the assessment period. Substrate consisted mainly of cobble with some boulders and gravel.

Overall, instream habitat was good, consisting of runs and riffles. The riparian corridor was fairly open and was primarily grass cover. Even though two wild species of trout (rainbow and brown) were caught in this segment of the Elk River, this mountain stream no longer exhibits natural trout stream characteristics. Characteristics of Southern Appalachian type trout streams include the presence of plunge pools, low conductivity, elevation, clear and swift waters, and vegetated (shaded) riparian zones.

2007 Recommendations

DWQ will continue to monitor the Elk River and work with local agencies to encourage appropriate agricultural and residential stormwater BMPs. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation and impacts from stormwater runoff. Because the Elk River is designated Tr by DWQ, extra precautions (i.e., buffer requirements and temperature controls) need to be taken to protect the fisheries in the watershed.

Water Quality Initiatives

To protect water quality in the Town of Banner Elk, the town installed a stormwater collection system, which includes a 150,000-gallon underground detention/storage vault and treatment wetlands. The project was installed during 2001 and has become a demonstration project for many mountain communities. Stormwater from the 65-acre downtown area is collected and transported via the stormwater collection system (curb and gutters) to the underground detention vault where it is stored and cooled. Sediment and debris settle out in the vault before it is released to the wetlands at a controlled rate to prevent flooding. The treatment wetlands then trap additional sediment and pollutants before flowing into Shawneehaw Creek [AU# 8-22-7], a tributary to the Elk River. Funding for the Banner Elk stormwater collection system and wetlands was provided by the Blue Ridge Resource Conservation & Development (RC&D) Council, the Clean Water Management Trust Fund (CWMTF) and the Town of Banner Elk. Funding was also used to establish a 1.3-mile greenway along Shawneehee Creek.

The NC Ecosystem Enhancement Program (NCEEP) has implemented one stream mitigation project in the Elk River watershed. It is located on Hanging Rock Creek [AU# 8-22-5], a 2.6-mile tributary to the Elk River, just outside the Town of Banner Elk. The project consisted of approximately 2,800 feet of stream restoration and 1,000 feet of stream enhancement. NCEEP project is in the third year of post-construction monitoring. For more information about NCEEP water quality initiatives, see Section 10.3.1.

1.5 Additional Water Quality Issues within Subbasin 04-02-01

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

This section also discusses ideas, rules and practices in place to preserve and maintain the pristine waters of the Watauga River basin. This is particularly important since many of the waters are designated as high quality or outstanding resource waters (HQW and ORW, respectively). Special management strategies, or rules, are in place to better manage the

cumulative impact of pollutant discharges, and several landowners have voluntarily participated in land conservation, stabilization, and/or restoration projects.

1.5.1 Biological Assessments Post-Hurricane

During a three-week period in September 2004, the storm remnants of three hurricanes (Frances, Ivan and Jeanne) lead to widespread flooding throughout the central and northern mountains of western North Carolina. Rainfall estimates for the combined three storms totaled more than 20 to 30 inches in some watersheds. Runoff from the storms produced flash floods throughout the region with peak flows in the excess of 10,000 cubic feet per second (cfs) in the headwater streams. For many streams, this is approximately 500 times the average flow. Some of the rivers exceeded 50,000 cfs. Several of the peak stream flows were within the 25 to 50 year recurrence interval. Others were within the 200 to 500 year recurrence interval with a few even surpassing the 500-year recurrence interval. Many of the instream and riparian habitats were affected by flash floods and included:

- Scoured substrates;
- Displaced and/or removed sediment and silts;
- Eroded and denuded streambanks;
- Eroded gravel bars;
- Damaged instream and riparian vegetation; and
- Deposition of household debris.

Flooding was particularly acute in the Watauga River near Valle Crucis. Even though the flooding inundated supply stores, petroleum storage facilities and wastewater treatment plants, there were no significant fish kills greater than 25 fish reported during or after the floods (DWQ, April 2005).

To assess the biological impacts of the hurricanes, DWQ staff requested a post-hurricane special study. Two sites were selected for sampling and included Cove Creek and the Watauga River near Sugar Grove. Both are basinwide sampling sites and are discussed in Sections 1.4.5 and 1.4.8, respectively. The data collected during the post-hurricane surveys was collected outside of the assessment period and was not used for use support determinations. Information collected during this special study will be used during the next assessment period (September 2004 through August 2009).

1.5.2 Emergency Watershed Protection (EWP) Projects

The Emergency Watershed Protection (EWP) Program is designed to remove threats to life and property in the nation's watershed in the aftermath of natural disasters such as floods, hurricanes, tornadoes, wildfires, drought, windstorms, and volcanic activities. The EWP Program is administered by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and provides technical and financial assistance to local sponsoring authorities (i.e., city, county, conservation district, state agency). Funds available through the EWP Program can cover up to 75 percent of the construction cost of emergency measures or up to 90 percent in limited resource areas. The remaining cost share must come from local sources and can be in the form of cash or in-kind services. Projects that can be addressed through EWP

include debris-clogged stream channels, undermined and unstable streambanks, damaged upland sites stripped of protective vegetative cover, and water control structures and public infrastructures that jeopardize the health and safety of downstream life and resources (USDA NRCS, December 2004). EWP projects in North Carolina have typically involved stream debris removal, streambank stabilization, revegetation, and stabilization of landslide areas where the impairment posed a threat to life and/or property.

The remnants of three hurricanes in September 2004 caused widespread damage throughout Avery and Watauga County. Avery County received a total of $3.2 million for EWP projects. A total of $720,000 was spent in the Elk River Watershed of the Watauga River basin. Several contiguous projects were along the Elk River while several smaller projects were along tributaries to the river. Repair included streambank stabilization, debris removal and plantings to replace lost vegetation. Watauga County received approximately $1.3 million for EWP projects. Repairs included debris removal, streambank stabilization, and landslide stabilization. For more information about the EWP Program, visit http://www.nrcs.usda.gov/programs/ewp/.

1.5.3 Management Strategies for Water Quality Protection

Municipalities and smaller outlying communities are continuing to expand. This can involve construction and land-disturbing activities in areas of pristine waters throughout the region. High Quality Water (HQW) and Outstanding Resource Water (ORW) are supplemental classifications to the primary freshwater classification(s) placed on a waterbody. Management strategies are associated with the supplemental HQW and ORW classifications that are intended to protect water quality. Below is a brief summary of these strategies and the administrative code under which the strategies are found. More detailed information can be found in the document entitled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, 2004). This document is available on-line at www.ncwaterquality.org/admin/rules/codes_statutes.htm. Definitions of the primary and supplemental classifications can be found in Chapter 2.

In waters classified as HQW, new discharges and expansions of existing discharges may, in general, be permitted provided that the required tertiary effluent limits are met. New discharges must be able to provide treatment for oxygen consuming wastes, total suspended solids, nutrients, and toxic substances. In addition, new facilities must have emergency systems in place. The total volume from all of the discharges in the receiving stream cannot exceed the total instream flow under summer low flow (7Q10) conditions. If there is an increase in permitted pollutant loading, expanding NPDES WWTP facilities must be able to provide the same treatment as new facilities. In some cases, more stringent limitations are set to ensure that the cumulative effects from all discharges with oxygen consuming wastes do not decrease dissolved oxygen and biochemical oxygen demand below background levels. Discharges from new single-family residential structures into surface waters are prohibited. When a discharge from an existing single-family home fails and no other treatment option is available, a septic tank, dual or recirculation sand filters, disinfection, and step aeration should be installed (15A NCAC 2B .0224). HQWs are rated as excellent based on biological and physical/chemical characteristics, designated by NC Wildlife Resources Commission (WRC) as native and special trout waters, or are classified as SA, WS-I or WS-II.

Like HQWs, ORWs are rated excellent based on biological and physical/chemical characteristics, but they also have an outstanding resource value (e.g., outstanding fish habitat and fisheries, unusually high levels of water-based recreation, special ecological or scientific significance). No new discharge or expansions on existing discharges are permitted in watersheds designated as ORW (15A NCAC 2B .0225).

In accordance with rules established by the NC Sedimentation Control Commission, any proposed construction projects disturbing more than one acre of land are required to submit a sediment/erosion control plan to the Division of Land Resources (DLR) Land Quality Section (LQS) or the locally administered sediment/erosion control program. When the project is near a waterbody, DLR notifies DWQ and more stringent development standards may be required as part of the sediment/erosion control plan approval process. To ensure the protection of HQW and ORW waters, projects are permitted under the following stormwater management options:

Low Density Option: This option is permitted when the built upon area is less than 12 percent of the total land area or the proposed development is for single-family residential homes on lots one acre or greater. Stormwater must be transported by vegetated conveyances and cannot lead to a discrete stormwater collection system (e.g., a constructed collection system such as a wet detention pond). Thirty-foot vegetated buffers must remain between the development activities and the stream.

High Density Option: The high density option is used when the built upon area is greater than 12 percent of the total land area or the proposed development is for single-family residential homes on lots less than one acre. Structural stormwater controls must be constructed (i.e., wet detention ponds, stormwater infiltration systems, innovative systems) and must be designed to control runoff from all surfaces affected by one inch of rainfall or more.

In addition, more stringent stormwater management measures may be required on a case-by-case basis where it is determined additional measures are needed to protect and maintain existing and anticipated uses of the water. When DWQ receives a request for a permit for a discharge from a new subdivision, construction of a new sewer line, or for a 401 certification, DWQ determines the stream classification and notifies the local government and the applicant of these requirements. Rules associated with stormwater management can be found in 15A NCAC 2H .1000.

1.5.4 Best Management Practices – Christmas Tree Conservation Cover

Christmas tree production in western North Carolina is an important industry generating nearly $100 million in yearly wholesale income. An estimated 2,000 Christmas tree growers are growing over 30,000 acres of Christmas trees. Most of the tree plantations in western North Carolina are above 3,000 feet in elevation and are often located on steep, highly erodible slopes (NCSU Cooperative Extension Service, April 2005).

To address sediment, pesticide and nutrient runoff, the NC Agriculture Cost Share Program (NCACSP) adopted a new best management practice (BMP) in March 2003. Under the Christmas Tree Conservation Cover BMP, grass, legumes or other approved plantings should be planted and maintained on fields with no previously established groundcover to reduce soil

erosion and improve water quality. Other improvements include reduced off-site sedimentation and pollution from dissolved and sediment-attached substances.

Between 2003 and 2006, 20.5 acres of Christmas Tree Conservation Cover were installed in the Watauga River basin. NCACSP funding totaled $2,230. For more information on the NCACSP, see Chapter 8. For more information related to Christmas tree production and BMPs, visit http://www.ces.ncsu.edu/fletcher/programs/xmas/.