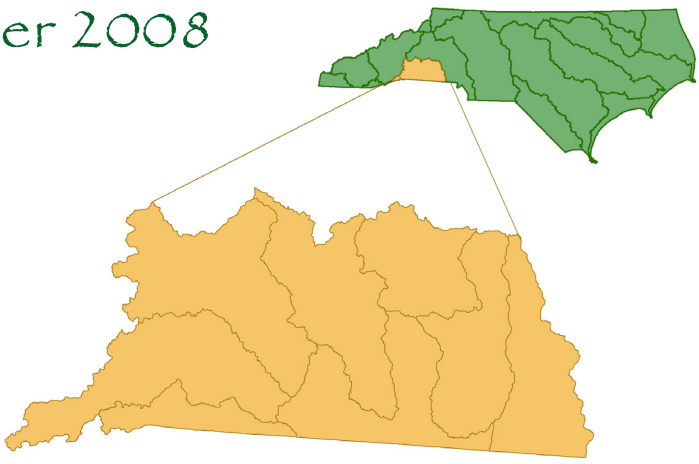
Broad River

Basinwide Water Quality Plan

December 2008



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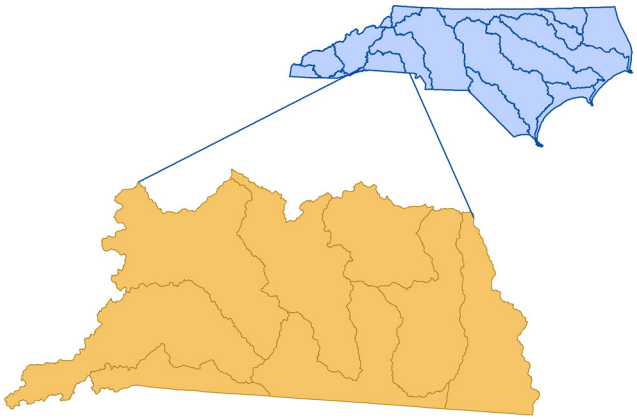
DWQ

Broad River Basin Plan 2008



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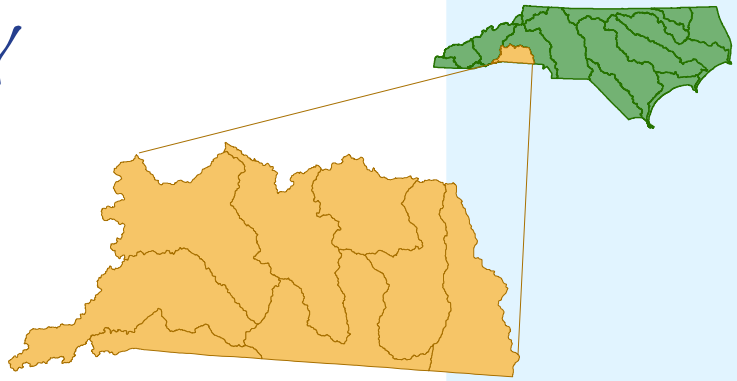
Broad River Basin Summary

HUC 03050105

2008



River Basin Description

The Broad River basin encompasses 5,419 square miles within North and South Carolina. The North Carolina portion covers 1,513 square miles - nearly 28 percent of the entire watershed. The headwaters and major tributaries in the Broad River basin begin in the Blue Ridge Mountains of western North Carolina. The river continues to flow south-southeast through the foothills and southern piedmont into Cherokee County, South Carolina where it eventually joins the Congaree and Santee Rivers and then the Atlantic Ocean.

The geography of the Broad River basin itself contributes to its ecological significance. The basin drains a section of the Blue Ridge escarpment, but the area is primarily within the piedmont. This provides a wide range of habitat types. The Broad River basin is home to 15 rare aquatic and wetland-dwelling animal and plant species and includes a considerable portion of the South Mountains – a biologically rich area that is considered of national importance for its ecological assemblage. Five Natural Heritage Program (NHP) Priority Areas are found in the basin: the Rollins/South Mountains Natural Area, Hickory Nut Gorge, the Green River Gorge, the Pacolet River Gorge, and Pinnacle Mountain. Chimney Rock State Park and a portion of Crowders Mountain State Park are also located in the basin.

It also contains 1,508 miles of freshwater streams. The average drainage area is 0.98 square miles per stream mile, but the average is much smaller in the western portion of the basin where there is mountainous terrain. Areas with high drainage density (total length of streams divided by total drainage basin) are associated with high flood peaks, high sediment production, relatively low suitability for traditional agriculture, and high development costs for the construction of buildings and the installation of roads and bridges.

Population & Land Cover Data

Population distribution and land cover patterns are highly variable in the Broad River basin. Land use varies from generally undisturbed areas in the headwater tributaries to relatively urban areas around the Towns of Spindale, Forest City, Rutherfordton, and the City of Shelby. As seen in this basin, converting land from an undisturbed forested area to an urban commercial/residential community can have significant impacts on local waterways.

River Basin at a Glance

Counties

Buncombe, Cleveland, Gaston, Henderson, Lincoln, McDowell, Polk, Rutherford

Municipalities

Belwood, Boiling Springs, Bostic, Casar, Cherryville, Chimney Rock Village, Columbus, Earl, Ellensboro, Fallston, Forest City, Grover, Kings Mountain, Kingstown, Lake Lure, Lattimore, Lawndale, Mooresboro, Patterson Springs, Polkville, Ruth, Rutherfordton, Saluda, Shelby, Spindale, Tryon, Waco

Permitted Facilities

NPDES WWTP
- Major: 14
- Minor: 30

NPDES Nondischarge: 7

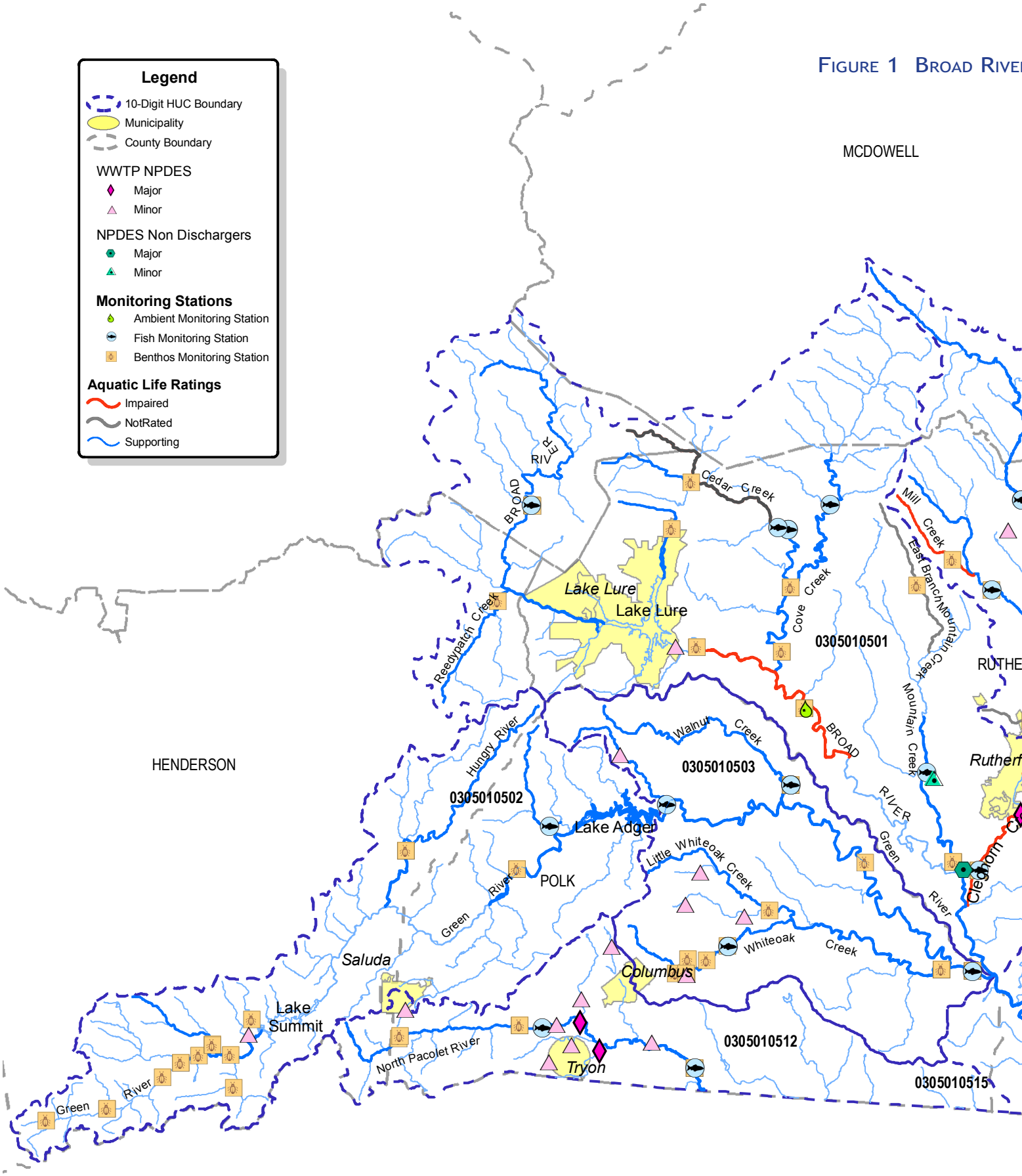
NPDES Stormwater
- General: 90
- Individual: 2

Animal Operations: 20

Monitored Stream Miles (Aquatic Life)

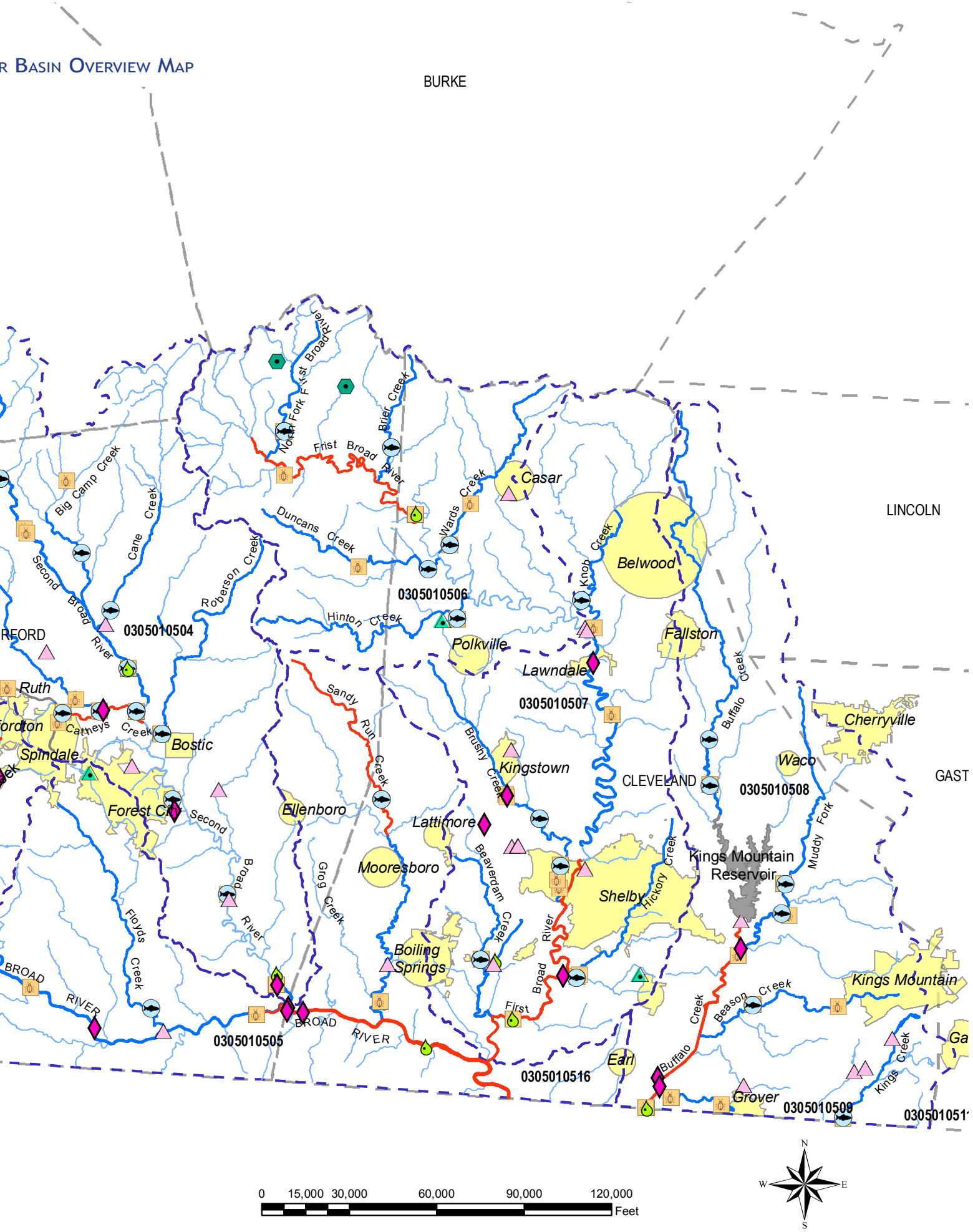
Total Stream Miles ..... 1,500 mi
Monitored: ..... 570 mi
Total Supporting: ..... 463 mi
Total Impaired: ..... 85 mi
Total Not Rated: ..... 22 mi

FIGURE 1 BROAD RIVER



North Carolina Department of Environment and Natural Resources,
Division of Water Quality, Planning Section,
Basinwide Planning Unit
October 28, 2008

R BASIN OVERVIEW MAP



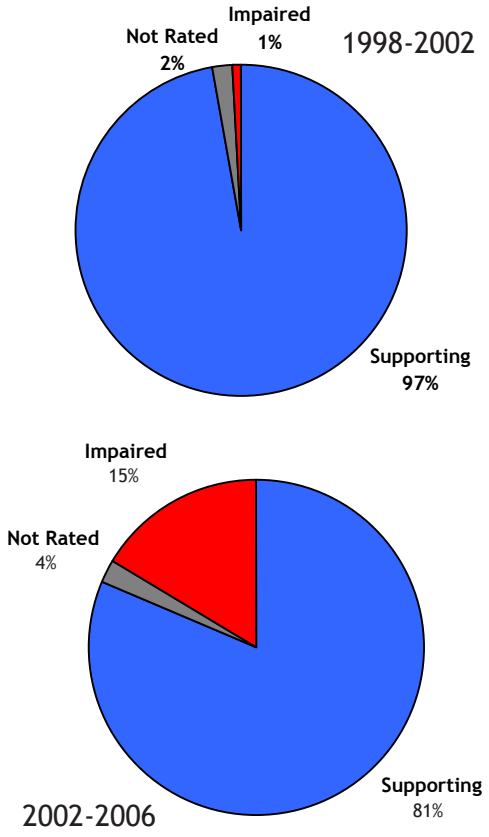
According to 2001 NRI Land Cover data, nearly 66 percent of the land in the basin is forested, and approximately 23 percent is agricultural. Nine percent is developed. All or portions of eight counties are located in the Broad River basin, and there are 27 municipalities. Much of the population can be found around the Towns of Spindale, Rutherfordton, Forest City, and the City of Shelby.

For more information, follow the link to the ***Population & Land Cover in the Broad River Basin*** chapter.

Current Water Quality Status

Of the 1,508 stream miles in the Broad River Basin, 570 miles were monitored by DWQ. Impaired stream segments are shown in Figure 1 as red lines. Table 1 provides descriptions of impaired streams in the basin along with reason for impairment. Twelve stream segments within the Broad River basin were found to be impaired due to turbidity or biological integrity.

Figure 2
Aquatic Life Use Support Category (Monitored Streams)



Ambient Sampling

During this assessment period, chemical and physical measurements were obtained by DWQ from eight ambient monitoring stations located throughout the basin. Two basinwide patterns of interest emerged: declining specific conductance and declining pH. Both of these parameters generally appear to have an inverse relationship with water flow when compared to flow data available from two USGS gaging stations. Between August 2003 and May 2004, however, pH deviated from this pattern and dropped significantly lower at five of the eight stations. No stressor has been identified to explain this observation.

Approximately 570 stream miles were assessed for aquatic life (37.8 percent). The number of impaired stream miles jumped from 4.7 miles in 2002 to 85 miles in 2006 (Figure 2). This increase is attributed to exceedences in water quality standards mostly due to nonpoint source pollution. Standards were exceeded for turbidity in several stream segments throughout the basin.

There are nearly 61 stream miles classified for primary recreation (Class B) in the Broad River basin. No waters are impaired in the recreation use support category; however, 29.5 miles are Not Rated. Fecal coliform bacteria in these segments exceeded 400 colonies/100 milliliter (mL) in greater than 20 percent of the samples collected.

There are nearly 480 stream miles currently classified for water supply in the Broad River basin. No waters are impaired in the water supply use support category.

No site-specific fish consumption advisories have been issued in the Broad River basin; however, there is a statewide advisory for several fresh water fish species. Site-specific and statewide advisories can be found on the ***NC Department of Health and Human Services (DHHS)*** web site.

Biological Sampling

In the Broad River basin, a total of 80 benthic and fish sites were evaluated during the assessment period. Sixty of those sites were sampled during the basinwide monitoring cycle, and 20 additional sites were sampled as part of special studies throughout the entire river basin. Thirteen sites were sampled for the first time in 2005, thus increasing the sampling efforts by 25 percent.

Benthos

Thirty-two benthic sites were sampled in the Broad River Basin between January 2002 and December 2006. An additional 15 sites were sampled as part of a special study. Nine sites rated Excellent, a significant improvement from the five that were identified as Excellent

in 2000. Most of this improvement is represented in Good sites moving to Excellent, but one site on Hinton Creek improved dramatically from Good-Fair to Excellent. Other benthic sites remained static.

Fish Community

Twenty-eight fish community basinwide sites were sampled. Thirteen of these sites were sampled for the first time during this monitoring cycle. An additional five sites were sampled as part of a special study. Three sites saw an increase in rating (i.e., Good-Fair to Good); eleven sites did not change; and one site in Sandy Run Creek decreased from Good to Fair. The dramatic decline may be the result of lingering impacts from drought conditions during the previous assessment period followed by extremely high flow events in the fall of 2004.

Water Quality Stressors

In most cases, habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upstream portions of the watershed and may include runoff from impervious surface, sedimentation, and erosion from construction, general agricultural practices, or other land disturbing activities. Naturally erodible soils in the Broad River basin make streams highly vulnerable to these stressors. Habitat degradation (as indicated by impaired biological integrity and high turbidity) was identified as a stressor for nearly 270 miles of streams in the Broad River basin. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in the Broad River basin. However, it appears that violations are highest in urban transition and agricultural areas. Violations are lowest in the upper part of the basin where land use is predominantly forested. This trend demonstrates the importance of protection and conserving stream buffers and natural areas.

Fecal coliform bacteria and low pH are also stressors identified in the Broad River basin. Even though no waters in the basin were Impaired for fecal coliform bacteria, concentrations were above the 400 colonies/100 milliliter (mL) water quality guideline in more than 20% of samples at four of the eight ambient monitoring stations. The presence of fecal coliform bacteria in the aquatic environment indicates that the water has been contaminated from the fecal material of humans or other warm-blooded animals. Low pH was noted in two stream segments: First Broad River and Sugar Branch. Normal pH levels for streams in the Broad River basin should be between 6.5 and 7.2. Values below 6.5 may indicate the effects of acid rain or other acidic inputs. Values above 7.5 are often indicative of an industrial discharge.

Recommendations

More specific recommendations for water quality stressors can be found in the 10-digit HUC watershed chapters.

Water Quality Stressors:

- **Turbidity:** (See Statewide Recommendations).
- **Fecal Coliform Bacteria:** Fence livestock out of stream corridors. Educate the general public about properly disposing of pet waste. Provide public pet waste containers in local parks and along greenways.
- **Nutrients:** Educate the general public and farmers on the impacts of over fertilization. Adopt and implement a stormwater control ordinance to reduce nutrients through appropriate BMPs.

Additional Studies and/or Monitoring:

- Red tent in the Second Broad River (See ***Chapter 3***).
- Loss of fish communities with multi age groups in Roberson and Brushy Creeks (See ***Chapter 3*** & ***Chapter 5***).
- Low pH problems in the First Broad River, Beaverdam Creek and Sugar Branch (See ***Chapter 4*** & ***Chapter 5***).
- Additional monitoring is needed to determine the main source of excess nutrients through out the basin.

- Watershed Management Plans are needed, where specified within watershed chapters, to address basinwide stressors and issues brought on by growth pressures.
- Impacts of growth on ORW and HQW designated waters (See ***map***).

Coordinated Efforts:

- Support stormwater and sediment and erosion control ordinances where specified within the watershed chapters.
- Work with the Division of Land Resources and the Division of Soil & Water Conservation to improve education and implementation of BMPs and buffer requirements for Trout Waters (See ***Trout Waters map***).
- Continue support of restoration projects on impaired streams

Lake Lure Dam:

Minimum flow and stage release requirements are needed for the dam at Lake Lure. Extreme periodic low and high flows are causing biological impairments in a portion of the Broad River directly below the dam. DWQ will work with the Division of Water Resources and other agencies to address this situation.

Statewide Recommendations:

- Target turbidity impairments with the implementation of BMPs, support the establishment of local Sediment & Erosion Control Programs, and Stormwater Ordinances and determine what cases may be attributed to natural base sediment loads because of highly erodable soils vs. human caused erosion.
- An increased collaboration between all agencies involved in sediment control, riparian buffers and stormwater management programs will be the focus of a statewide effort to address turbidity concerns throughout the state. This may lead to the determination for the need of a statewide stormwater program.

Local Initiatives

Local initiatives allow local people to make decisions that affect change in the community, protect natural resources, and combine professional and historical expertise to holistically understand the challenges and opportunities of tackling watershed protection. By working in coordination across jurisdictions and agency lines, more funding opportunities are available, and it is easier to generate necessary matching or leveraging funds. This could potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The more localized the project, the better the chances for success. During this assessment period, $29,690,439 were spent by federal, state and local agencies on restoration and protection of the Broad River basin.

For more information, follow the link to the ***Local Initiatives in the Broad River Basin*** chapter.

Table 1 can be seen on the following page.

Table 1: Impaired Waters in the Broad River Basin

Assessment Unit	Stream Name	Potential Stressors	Potential Sources
9-(22)b	Broad River	Habitat Degradation	Mine Drainage
9-(25.5)b	Broad River	Turbidity	
9-26b	Cleghorn Creek	Habitat Degradation; Nutrient Impacts	Stormwater Runoff; WWTP NPDES
9-41-13-(6)b	Catheys Creek	Habitat Degradation	Impervious Surface; Stormwater Runoff
9-41-13-3	Mill Creek	Habitat Degradation	Impoundment
9-41-13-7-(3)b	Hollands Creek	Habitat Degradation	Stormwater Runoff; Impervious Surface
9-46a	Sandy Run (headwaters)	Habitat Degradation	General Agriculture/Pasture
9-50-(1)	First Broad River	Low pH	--
9-50-(28)	First Broad River	Turbidity	--
9-53-(5)	Buffalo Creek	Turbidity	--

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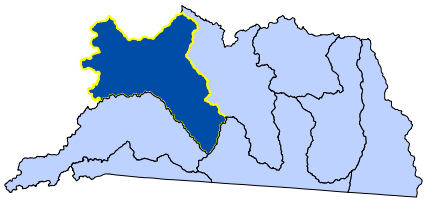


Broad River Headwaters Watershed

HUC 0305010501

Includes Buffalo Creek, Cove Creek, Mountain Creek, & Cleghorn Creek

General Watershed Description

Beginning in the mountains and flowing into the inner piedmont, the headwaters of the Broad River originates upstream of Lake Lure in Buncombe, Henderson, McDowell, and Rutherford Counties. The boulder-strewn section of the Broad River, between Bat Cave and Lake Lure, is locally referred to as the Rocky Broad River. Flat, Hickory, and Reedypatch Creeks are the largest tributaries above Lake Lure; Buffalo Creek forms a major arm of the lake; and Cove, Mountain, and Cleghorn Creeks are tributaries below the lake (Figure 1-2). Land cover is predominantly forested (Figure 1-1); however, property along portions of the Broad River and Lake Lure are being rapidly developed for second homes, vacation lodges, and recreational activities (i.e., golf courses and individual horse farms). Nonpoint source pollution from developmental actions such as these, in or near stream corridors and lake shorelines affects water quality and aquatic habitats.

Watershed at a Glance

Counties

Rutherford, Buncombe, Henderson, McDowell

Municipalities

Chimney Rock Village, Lake Lure, Rutherfordton, Spindale

Permitted Facilities

NPDES WWTP:	2
NPDES Nondischarge:	2
NPDES Stormwater:	5
Animal Operations:	2

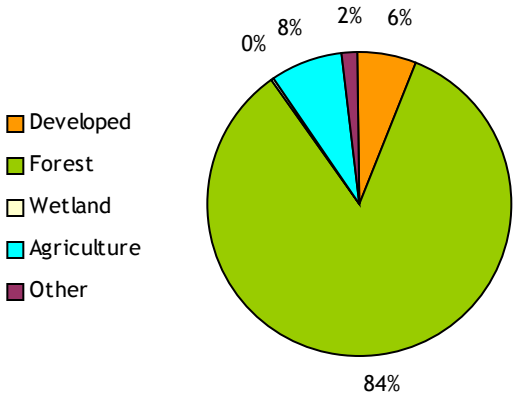
Monitored Stream Miles (AL)

Total Streams:	91.32 mi
Total Supporting:	62.12 mi
Total Impaired:	14.1 mi
Total Not Rated:	15.1 mi

Water Quality Overview

Of the 291 stream miles in the Broad River Headwaters watershed, 91 miles were monitored by DWQ. Of these monitored waters, 73 percent are Supporting for their designated uses* and 13 percent are Impaired*. Close to 33 percent of monitored waters in this watershed are either Impaired or impacted* due to habitat degradation related to general agriculture, natural conditions and mine drainage. Nutrient impacts from stormwater and wastewater treatment plants are the cause of 18 percent of these waters being impaired or impacted. (Table 1-1)

Figure 1-1: Broad River Headwaters Watershed Land Cover



NRI: National Land Cover Data, 2001

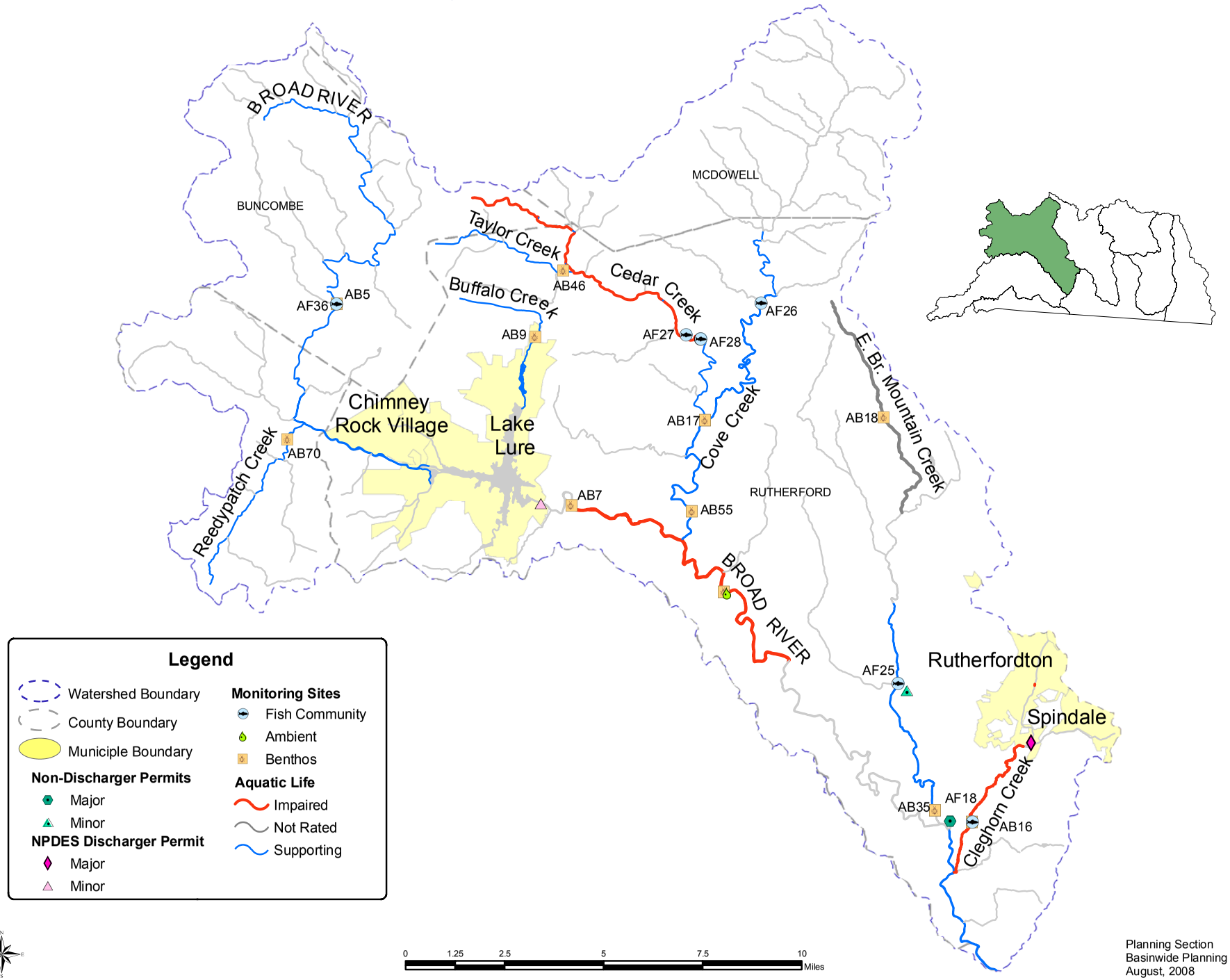
Biological monitoring was conducted at ten basinwide sites; four of these were sampled for the first time in 2005. Three additional biological sites were sampled as part of a special study. One ambient station was also monitored monthly in the Broad River Headwaters.

Overall, water quality is good in the Broad River Headwaters; however, DWQ biologists noted several streams with heavy sedimentation and streambank erosion.

Currently, there are one major and one minor NPDES permitted facilities in this watershed. The minor NPDES permit is the Lake Lure Wastewater Treatment Plant, which is permitted to discharge 1 million gallons per day into the Broad River below Lake Lure. The major NPDES permit is held by the City of Rutherfordton's Wastewater Treatment Plant, which is required to preform ***toxicity testing***. Since 2000, the City of Rutherfordton's WWTP has had 22 violations. Non-compliance issue for these facilities are discussed on ***page 5*** of this chapter.

* There terms are defined in the ***Glossary Chapter***.

Figure 1-2: Broad River Headwaters Watershed, HUC 0305010501



Planning Section
Basinwide Planning Unit
August, 2008

How to Read this Document

This document was written to correspond with our new ***Online Geographic Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. The uses for this tool will expand as the tool evolves. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes, in detail, water quality standards for each waterbody classification. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 1-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 1-B provides a summary of each ambient data monitoring station.
Appendix 1-C provides summaries of biological and fish assessment monitoring sites.

Table 1-1: Monitored Stream Segments in the Broad River Headwaters

Assessment Unit Number	Stream Name	Length (miles)	Class.	2008 IR Category*	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-(1)	BROAD RIVER	19.0	C;Tr	2	-	-		03-08-01
9-(22)b	BROAD RIVER	9.8	C	5	X	-	**Habitat Degradation** (Mine Drainage)	03-08-01
9-15	Reedypatch Creek	5.5	C;Tr	2	-	-		03-08-01
9-20	Buffalo Creek	4.1	C;Tr	2	-	-		03-08-01
9-23-(9)	Cove Creek	14.5	C	2	-	-		03-08-01
9-23-14-3	Taylor Creek	4.3	C;Tr	2	-	-		03-08-01
9-23-14a	Cedar Creek	8.5	C;Tr	3a	-	X	**Habitat Degradation** (Natural Conditions), **Nutrient Impact**	03-08-01
9-23-14b	Cedar Creek	3.6	C;Tr	2	-	-		03-08-01
9-25-(3.5)	Mountain Creek	6.9	WS-IV	2	-	X	**Habitat Degradation** (Natural Conditions & Mine Draining), **Nutrient Impact**	03-08-02
9-25-2	East Branch Mountain Creek	6.6	C	3a	-	X	**Habitat Degradation** (General Agriculture/ Pasture)	03-08-02
9-26b	Cleghorn Creek	4.3	C	5	X	-	**Habitat Degradation** (Stormwater Runoff, WWTP NPDES) **Nutrient Impact** (Stormwater Runoff, WWTP NPDES)	03-08-02

*The 2008 IR Categories definitions can be found on the first page of Appendix 1-A

Current Status of Impaired & Impacted Waters

Broad River AU#: 9-(1), 9-(22)b

Two benthic sites were sampled in the Broad River above (AB5) and below (AB4) Lake Lure. Site AB5 is located near the confluence with Flat Creek and is the most upstream site sampled in the Broad River Headwaters. To date, this site has maintained its Excellent rating and continues to support a pollution intolerant benthic and fish community. Overall, the instream habitat was favorable (habitat score 87 out of 100); however, the scarcity of pools, removal of riparian vegetation for agricultural use, and moderate streambank erosion lowered the score. Heavy rains during the time of sampling made the water turbid, an indication of potential land-disturbing activities upstream of the site. This segment of the Broad River is considered Supporting in the aquatic life category.

Located approximately six miles below the dam at Lake Lure, site AB4 received a Fair bioclassification, a significant drop from the Good rating it received in 2000. Encompassing approximately 190 square miles at this point, the overall habitat score (41 out of 100) was low due to inadequate instream habitat and minimal riparian area. The substrate was mostly sand (65 percent) with some gravel (25 percent) and rubble (10 percent). A sand dredging operation was observed just upstream on the right streambank. The 2005 benthic sample was collected in late September and previous samples were collected in July, during low flow conditions. Seasonal differences could influence the species present, but such an overall decline in species from 2000 to 2005 indicates a decline in water quality. This section of the Broad River is Impaired in the aquatic life category. This impairment and low bioclassification rating may be due to the lack of flow released from the Lake Lure dam. Site AA1 is also located here. No water quality standards were exceeded at this station.

Recommendations: Minimum flow and stage release requirements are needed for the Lake Lure dam. Extreme periodic low and high flows could be causing this biological impairment. DWQ will work with the Division of Water Resources and other agencies to address this situation. Restore vegetated areas along streambanks of these segments to help filter excess nutrients from farmlands and stabilize streambanks.

Buffalo Creek AU#: 9-20

Buffalo Creek was sampled at site AB9 as part of a special study requested by the DWQ Planning Section and the DWQ Regional Office Staff in Asheville. The request was made to evaluate the benthic community in response to increased development pressure in this section of Lake Lure. Site AB9 received a Good benthic bioclassification and numerous pollution intolerant species were collected. Considering the current bioclassification and types of species collected, Buffalo Creek is considered Supporting in the aquatic life category; however, biologists noted a visible increase in turbidity shortly after a rain event. Such an increase in turbidity indicates potential land-disturbing and/or construction activities upstream of the sampling site. Visual observations made throughout the Buffalo Creek watershed confirmed extensive pressure for residential development in and around the area surrounding Lake Lure.

Cove, Taylor & Cedar Creeks AU#: 9-23-(9), 9-23-14-3, 9-23-14a

Cove Creek and its tributaries drain northwestern Rutherford County, southwestern McDowell County, and the extreme southeastern corner of Buncombe County. Benthic (AB17) and fish sites (AF26, AF27, AF28) were sampled in Cove and Cedar Creeks. One benthic site (AF46) was also sampled in Taylors Creek as part of a special study in the Catheys Creek watershed. Taylors Creek and portions of Cove and Cedar Creeks are Supporting in the aquatic life category; however, the headwater of Cedar Creek is Impaired (Table 1-1).

Sites AF27 and AF28 are located in the Cedar Creek sub-watershed and were sampled based on a recommendation presented in the 2003 basin plan to document differences in the fish communities between two road crossings (SR 1008 and SR 1371). Within the 0.7-mile stretch the instream characteristics change from slow moving with sand and gravel runs (AF27) to high gradient, swift flows, boulder and bedrock shelves, plunge pools and riffles (AF28). The quality of instream habitats, substrates and the quantity and quality of the pools and riffles resulted in habitat scores of 61 out of 100 at site AF27 and 90 at site AF28.

Differences were also observed in the fish communities. Site AF27 rated Fair and site AF28 rated Good. The number of fish and diversity metrics were lower than expected at site AF27. The bluehead chub was the most abundant species present, indicating that nutrient enrichment from nonpoint sources may be impacting the stream. Even though the watershed has a drainage area of 21.3 square miles at site AF27, the stream may have naturally low fish diversity for a headwater stream. The stream has the supplemental classification of trout waters (Tr), but DWQ biologists did not find a reproducing trout populations (i.e., one with multiple age classes and sizes) at site AF27. The site slightly downstream (AF28), however, had a more balanced fish community. Two pollution intolerant species were present, and DWQ biologists found a reproducing population of naturalized, wild, rainbow trout.

In Cove Creek, fish and benthic samples resulted in Good (AF26) and Excellent (AB17) bioclassifications. Instream, riparian, and watershed characteristics were of exceptional quality at site AF26, resulting in a habitat score of 85 out of 100. Thirteen species of fish were collected with the bluehead chub being the dominant species (an indicator of nutrient enrichment).

Site AB17 is downstream of site AF26 and received an Excellent bioclassification. The substrate was almost entirely sand (70 percent) with infrequent pools and riffles, and riparian zones were narrow due to agricultural land use. DWQ biologists identified sedimentation and agricultural land use as habitat concerns for the Cove Creek watershed and noted that the substrate in 2000 was only 20 percent sand compared to the 70 percent seen in 2005.

In June 2003, Taylor Creek was sampled as a large stream control site for a special study in the Catheys and Hollands Creek watershed. Taylor Creek is a tributary to Cedar Creek with similar size, gradient, and temperature characteristics when compared to Catheys Creek; however, the Taylor Creek watershed contains more rocks with long sandy segments in the low gradient areas further downstream. Residential development was observed upstream of the sampling site (SR1314), but conservation measures were in place to protect the streambanks and residential property. Site AB46 rated Excellent. More information on the Catheys Creek watershed special study can be found ***here***.

Mountain Creek AU#: 9-25-(3.5)

Mountain Creek drains the west-central portion of Rutherford County, and like many streams throughout the basin, it carries heavy sand bedloads. Consequently, there is a sand-dipping operation just upstream of the fish community sample location. Fish (AF25) and benthic (AB35, AB18) sites were sampled in the Mountain Creek watershed. Sites AF25 and AB35 both received Good-Fair bioclassifications. In 2005, the diversity of fish met expectations, but the total number of fish collected (98) and the percentage of species with multiple age groups were well below expectations. Similar observations have been made in streams where the flow fluctuates dramatically from extremely low flows to extremely high flows. This may be the case for Mountain Creek. The bluehead chub was the most abundant species (55 percent) and is an indicator that nutrient enrichment from nonpoint sources may be impacting the stream. The benthic community (AB35) was sampled further downstream and had a representative mix of both moderately pollution tolerant and intolerant species. The substrate was almost entirely sand (80 percent), and the low habitat score (52) reflected the homogeneous substrate, narrow riparian zone on the left bank, and failing streambanks.

East Branch Mountain Creek (AU# 9-25-2) is a tributary to Mountain Creek. It was sampled in June 2003 as a benthic control site for a special study in the Catheys and Hollands Creek watershed. The site was selected to generate comparison data for other small streams in the special study area. Much of the headwater area is forested, but land cover immediately adjacent to the stream is agricultural (i.e., pasture and row crops). Site AB18 was assigned a bioclassification rating of Not Rated. This Not Rated bioclassification would have resulted in a Good if the drainage area was greater than three square miles. Because of the adjacent land cover, there were many breaks in the riparian zone, which often results in high sediment loads. Some streambank erosion was also observed. More information on the Catheys Creek watershed special study can be found in ***Chapter 9***.

Cleghorn Creek AU#: 9-26b

Cleghorn Creek drains the southwestern portion of Rutherford County and includes the Towns of Rutherfordton and Spindale. Much of the land cover in the headwaters of Cleghorn is dominated by residential and commercial use while the lower sections drain agricultural lands. Benthic (AB16) and fish (AF18) sites were sampled. Substrate was a mix of sand (60 percent) and gravel (30 percent) with a small amount of rubble (10 percent). Instream habitat was inadequate, and streambanks were eroding. Site AB16 received a Fair bioclassification, a decline from the Good-Fair it received during the previous assessment period. The decline is likely attributed to both point and nonpoint sources associated with the existing land cover. Site AF18 received a Good-Fair. Nearly two-thirds of all of the fish collected were bluehead chub, indicating nutrient enrichment from nonpoint source runoff could be impacting water quality. Cleghorn Creek is Impaired for biological integrity.

Recommendations: Streambank/vegetated area restoration is needed to stabilize streambanks and filter pollutants from stormwater runoff. Increase efforts to implement stormwater BMPs in residential and commercial areas.

Recommendations for this watershed can be found later in this chapter.

Significant Non-Compliance Issues

Enforcement action has been taken against the Town of Lake Lure's WWTP (permit NC0025381) for daily, weekly and

monthly exceedences in the permitted limit for total suspended solids (TSS), fecal coliform bacteria and ammonia. These exceedences may have been caused by the lack of flow being released from the Lake Lure dam just upstream. The town is working with DWQ to ensure that the effluent discharged from the facility is within the permitted water quality standards. Upon the most recent inspection (June 2007), the facility is in compliance with existing permit limits.

The Town of Rutherfordton WWTP (permit NC0025909) is located upstream of the sampling sites on Cleghorn Creek. In addition to daily monitoring, the facility is required to evaluate the whole effluent toxicity (WET). In 2000, the facility began to experience frequent failures of the WET limits. Evaluation of the facility's copper and zinc monitoring data indicated that the effluent had reasonable potential to produce levels that were above the Action Level Policy standards in Cleghorn Creek. Acting in response to DWQs Action Level Policy, the facility undertook toxicity identification evaluation studies to determine whether copper and/or zinc were contributing to the observed toxicity. These studies indicated that both metals were contributors to the standard exceedence. Per the Action Level Policy, limits for both metals were included in the facility's permit effective May 2004.

Several other violations are also on file for the Rutherfordton WWTP and include permit violations for fecal coliform bacteria, ammonia and chlorine. DWQ has been working with the facility through a special order of consent (SOC). A SOC is an agreement between the permit holder (the Town of Rutherfordton) and the NC Environmental Management Commission (EMC) that relaxes the limits set for particular parameters under the existing permit for a period of time until actions can be taken to reduce, eliminate or prevent water quality degradation. In the case of the Rutherfordton WWTP, the SOC relaxed limits on biological oxygen demand (BOD), total suspended solids (TSS), ammonia, and chronic toxicity from August 2005 through August 2007. Inspections conducted by DWQ indicate that the facility is on schedule with updating and repairing equipment. DWQ will continue to work with the Rutherfordton WWTP to ensure the facility stays on schedule and within its permit limits.

Local Initiatives

Upper Broad River Watershed Protection Program (UBRWPP)

The UPBRWPP is dedicated to protecting soil and water resources throughout the Broad River headwaters and provides assistance to numerous property owners and partners to reduce the impacts of erosion. The program began in 1999 when community members became concerned about sedimentation and flooding around the Town of Lake Lure. Through grants provided by the NC Clean Water Management Trust Fund (CWMTF), Section 319 Nonpoint Source Program, as well as Henderson, Buncombe and Rutherford Counties, the program has provided assistance for numerous projects. The program works on a voluntary basis and provides up to 90 percent of the cost of erosion control measures once they have been properly installed. Projects include technical assistance, grading contractor oversight and streambank restoration. **To date, 118 conservation plans have been written, 56 of which have been implemented. Under those 56 conservation plans, erosion control measures were established on approximately 50 acres and 63.3 acres of riparian corridors have been protected.** The UPBRWPP is continually working with voluntary landowners that have existing erosion and sediment problems that predate 2003. More information on the UPBRWPP can be found on the ***UPBRWPP website***.

Town of Lake Lure Comprehensive Plan

In June 2007, the Town of Lake Lure adopted a comprehensive plan to ensure that new development and future planning meets the goals of conservatively managing growth, developing a sustainable economy, promoting and preserving the Town's character, enhancing and preserving the natural environment, improving public infrastructure (e.g., transportation), and providing public services efficiently. The plan provides a long-term vision but will be reviewed annually and updated every five years to acknowledge changes in community goals and planning objectives. The North Carolina Sedimentation Control Commission can delegate authority to implement the Sedimentation Pollution Control Act to cities and counties that adopt a qualifying local erosion and sediment control ordinance in compliance with State requirements. The staff of the local program review erosion and sediment control plans and enforce compliance with the approved plan within their jurisdictions. The Town of Lake Lure is a delegated authority and has made great strides in addressing sediment and erosion control issues within the town's city limits. More information about erosion control can be found at the ***Town of Lake Lure's website***. A copy of the Town's comprehensive plan can also be found at the ***Town's website***.

Watershed Recommendations

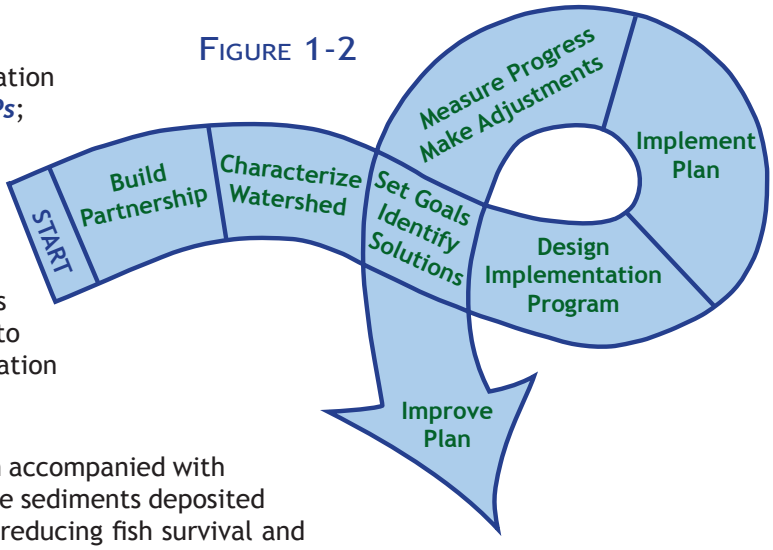
Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion

from construction, general agriculter, and other land disturbing activities.

Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 1-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

FIGURE 1-2



Turbidity

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), impair fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs (USEPA, 1999 and Waters, 1995). Sand and silt were noted in the stream substrate at many of the biological sample sites in the Broad River Headwaters.

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in the Broad River Headwaters. It appears, however, violations are highest near agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land cover is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***.

It is likely that a combination of human caused land disturbances and natural erosion are causing the majority of turbidity violations in this watershed, with human causes being the leading contributor. To appropriately address turbidity and sediment problems in the Broad River Headwaters, an assessment to determine the contribution of human accelerated erosion sources relative to natural processes should be undertaken. All reasonable efforts to reduce or eliminate human sources of erosion should be implemented immediately. These efforts can be organized by developing watershed restoration plans based on the process outlined in Figure 2. Plans are needed for each watershed with a turbidity stressor.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

Other

The Town of Lake Lure's comprehensive plan provides an introduction to existing infrastructure as well as steps to meet future development goals. Post-construction stormwater controls and policies should be established for new development activities required to submit an erosion and sediment control plan to the Town for approval. The impact of stormwater from new development may be mitigated by practices, which treat and store stormwater runoff before it affects downstream waterbodies. In addition, the Town can encourage low-impact development designs that reduce

the amount of impervious surface cover and the amount of stormwater that leaves a homeowner or commercial business site. More information about post-construction best management practices (BMPs) can be found ***here***. More information about low-impact development can be found ***here***.

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2008 Integrated Report Watershed- Headwaters Broad River

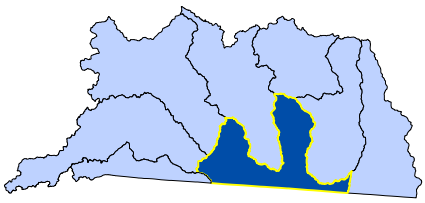
Broad River Basin | **WBD-10 Number 0305010503** | **Headwaters Broad River**

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
					WBD-12 Number 030501050301						**Headwaters Broad River**
9-(1)	**BROAD RIVER**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Pool Creek, including backwaters of Lake Lure below elevation 991											
C;Tr	03-08-01	19.0 FW Miles									
					WBD-12 Number 030501050302						**Hickory Creek-Broad River**
9-15	**Reedypatch Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2000		1
From source to Broad River											
C;Tr	03-08-01	5.5 FW Miles									
					WBD-12 Number 030501050303						**Lake Lure-Broad River**
9-20	**Buffalo Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Lake Lure, Broad River											
C;Tr	03-08-01	4.1 FW Miles									
					WBD-12 Number 030501050304						**Cedar Creek**
9-23-14-3	**Taylor Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
From source to Cedar Creek											
C;Tr	03-08-01	4.3 FW Miles									
9-23-14a	**Cedar Creek**		**3a**	**Habitat Degradation** Natural Conditions **Nutrient Impacts**	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2005		3a
From source to SR 1008											
C;Tr	03-08-01	8.5 FW Miles									
9-23-14b	**Cedar Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From SR 1008 to Cove Creek											
C;Tr	03-08-01	3.6 FW Miles									
					WBD-12 Number 030501050305						**Upper Cove Creek**
9-23-(9)	**Cove Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From Greasy Creek to Broad River											
C	03-08-01	14.5 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					WBD-12 Number 030501050307						**Mountain Creek**

Broad River Basin — *WBD-10 Number 0305010503* — *Headwaters Broad River*

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
9-25-(3.5)	**Mountain Creek**	**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From a point 0.5 mile downstream of U.S. Hwys. 64&74 to a point 0.4 mile upstream of mouth			Mine Drainage							
			Natural Conditions	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-IV	03-08-02 6.9 FW Miles		**Nutrient Impacts**							
9-25-2	**East Branch Mountain Creek**	**3a**	**Habitat Degradation**	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2003		3a
From source to Mountain Creek			General Agriculture/Pasture							
C	03-08-02 6.6 FW Miles									
			WBD-12 Number 030501050308							**Knob Creek-Broad River**
9-(22)b	**BROAD RIVER**	**5**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From US 64/74 to Rutherford County SR 1167			Mine Drainage							
				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2005	2008	5
C	03-08-01 9.8 FW Miles			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			WBD-12 Number 030501050309							**Cleghorn Creek-Broad River**
9-(25.5)a	**BROAD RIVER**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From a point 0.2 mile downstream of Rutherford County SR 1145 to Second Broad River										
WS-IV	03-08-02 19.9 FW Miles									
9-26b	**Cleghorn Creek**	**5**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From confluence with Stonecutter Creek to Broad River			Stormwater Runoff							
			WWTP NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2005	2008	5
C	03-08-02 4.3 FW Miles		**Nutrient Impacts**							
			Stormwater Runoff							
			WWTP NPDES							

Sandy Run-Broad River Watersheds



HUC's 0305010505 and 0305010516

Includes Broad River, Floyds Creek, Richardson Creek & Sandy Run Creek

General Watershed Description

The Sandy Run Creek-Broad River and Broad River watersheds are located in southern Rutherford County and the far southwest corner of Cleveland County. Found in the Southern Outer Piedmont, elevations are less than 1,000 feet, and land cover is predominantly forested. Urban areas can be found along Interstate-85 corridor, and agricultural lands are scattered throughout the watershed. Along with the lower portion of the Broad River, major tributaries include Floyds Creek, Richardson Creek and Sandy Run Creek (Figure 2-2). There are seven municipalities in this watershed; however, Mooresboro is the only municipality located completely with in the watershed. In 2005, census data reports the total population of the seven municipalities was 16,657, which had only grown 2.6 percent since 2000. Land cover as of 2001 indicates less than one percent of this watershed is urban development (Figure 2-1).

Watershed at a Glance

Counties

Rutherford, Cleveland

Municipalities

Mooresboro, and portions of Boiling Springs, Earl, Ellenboro, Lattimore, Spindale and Forest City

Permitted Facilities

NPDES WWTP:	3
NPDES Nondischarge:	1
NPDES Stormwater:	16
Animal Operations:	3

Monitored Stream Miles (AL)

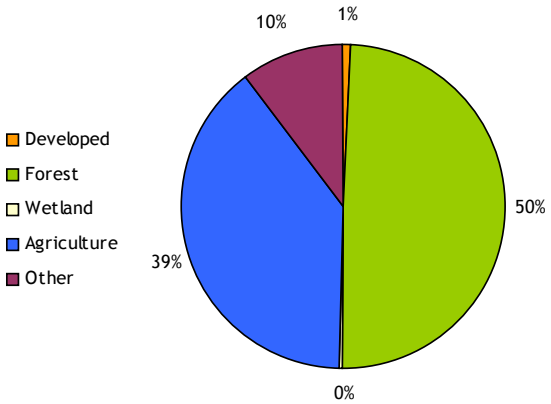
Total Streams:	63.08 mi
Total Supporting:	40.28 mi
Total Impaired:	22.8 mi
Total Not Rated:	0 mi

Water Quality Overview

Of the 168 stream miles in the Sandy Run-Broad River watershed, 63 miles were monitored by DWQ. Of these monitored streams, currently 63 percent are Supporting their designated uses, and 36 percent are Impaired. Habitat degradation, fecal coliform bacteria and turbidity are the leading causes of aquatic life impairments in this watershed. More specific information about these impairments are discussed later in this chapter.

Biological monitoring was conducted at five basinwide sites. One ambient station was also monitored in the Sandy Run-Broad River watershed. Based on biological monitoring, a portion of Sandy Run Creek is Impaired in the aquatic life category. In addition, ambient monitoring shows that a portion of the Broad River is also Impaired due to a water quality standards violation for turbidity (Table 2-1).

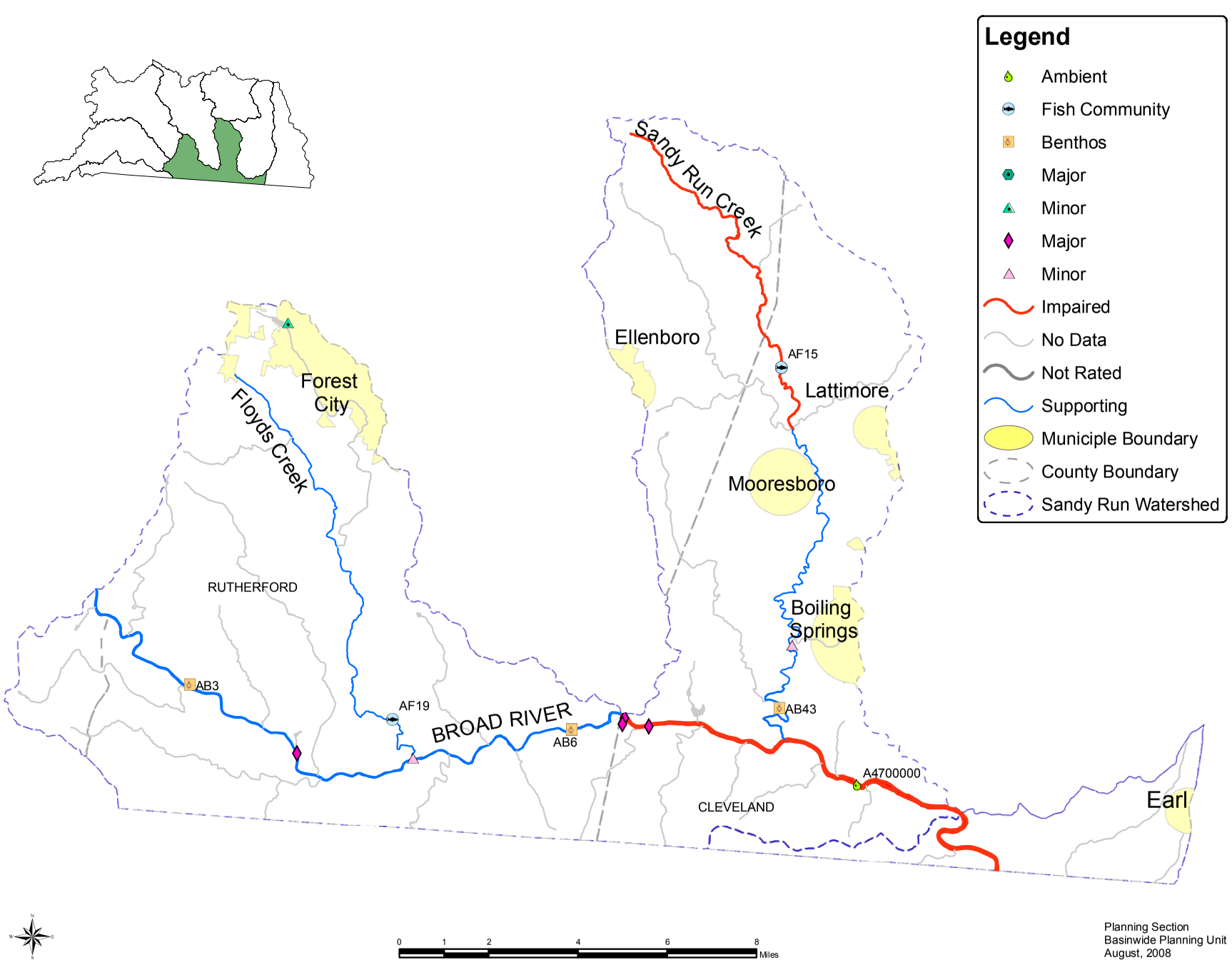
Figure 2-1: Sandy Run-Broad River Watershed Land Cover



* NRI: National Land Cover Data, 2001

Currently, there are one minor and two major NPDES permits in this watershed. The Harris Industrial and Commercial Plant (NC0083275) had one violation since 2000. This facility is no long in operation as of December 2006. The Duke Energy-Cliffside Steam Station (NC0005088) reported a fish kill caused by low flow of the river and high ambient temperatures in 2006. Flooding in 2005 caused damage to the Broad River with 5,000,000 gallons of untreated wastewater with a minimal amount untreated sewage. Plant employees worked nonstop to make temporary repairs to eliminate unwanted discharges and keep the facility operational. The other permit, Boiling Springs WWTP (NC0071943) had no violations. There are also 16 NPDES General Stormwater Permits, one NPDES Nondischarge Permit and three Animal Operations Permits in the Sandy Run-Broad River watershed.

Figure 2-2: Sandy Run Creek-Broad River & Broad River Watersheds, HUC 030501050505 & 030501050516



How to Read this Document

This document was written to correspond with our new ***Geographic Online Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 2-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 2-B provides a summary of each ambient data monitoring station.
Appendix 2-C provides summaries of biological and fish assessment monitoring sites.

Table 2-1: Monitored Stream Segments in Sandy Run-Broad River Watershed

Assessment Unit Number	Stream Name	Length (miles)	Class.	2008 IR Category	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-(25.5)a	BROAD RIVER	15.68	WS-IV	2	-	-		03-08-02
9-(25.5)b	BROAD RIVER	12.4	WS-IV	5	X	-	**Fecal Coliform Bacteria** **Turbidity** (Mining Operations)	03-08-02
9-37	Floyds Creek	12.5	C	2	-	-		03-08-02
9-46a	Sandy Run Creek	10.4	C	5	X	-	**Habitat Degradation** (General Agriculture/ Pasture, Natural Causes)	03-08-04
9-46b	Sandy Run Creek	12.1	C	2	-	-		03-08-04

*The 2008 IR Categories definitions can be found on the first page of Appendix 2-A

Current Status Impaired & Impacted Waters

Sandy Run Creek AU#: 9-46a

One fish (AF15) and one benthic (AB43) site were sampled in Sandy Run Creek. Site AF15 is located in the headwaters, and the habitat score (39 out of 100) was the lowest of any of the fish community sites sampled in the basin. The site received a Fair rating, dropping from the Good it received in 2000. This was also the greatest decline in rating of any of the fish community sites collected in the Broad River basin (nearly 80 percent). Only eight species were collected and the most abundant species was the bluehead chub (60 percent), an indicator of nutrient enrichment. The abundance of periphyton (algae attached to substrate like rocks) growth also suggests excess nutrient are entering the system. In 2000 and 2005, DWQ biologists noted that cattle had direct and easy access to the stream. Animal access is likely contributing excess nutrients and fecal coliform bacteria and impacting streambank stability. Recent hydrologic events, including drought (1998-2002) and flooding (2004 hurricane season), may have also contributed to the decline in this fish community. Sandy Run Creek, from its source to Mayne Creek, is Impaired in the aquatic life category.

Located approximately 10.5 miles downstream from site AF15, site AB43 was rated Good, matching the rating it received in 2000. Biological data collected since 1995 indicates that water quality in this downstream reach is steadily improving. Since the last assessment period, equipment and treatment upgrades to the Boiling Springs WWTP have been completed

and may be contributing to water quality improvements. This downstream portion of Sandy Run Creek is Supporting in the aquatic life category.

Recommendations: Restore vegetated areas along streambanks to filter excess nutrients from agricultural and pasture lands. Install fencing along this segment with animal operations. Fencing will prevent farm animals from eroding streambanks and depositing harmful bacteria into the surface water. DWQ will work to install a new ambient monitoring station within this segment to begin tracking turbidity.

Broad River AU#: 9-(25.5)b

Two benthic sites (AB3 and AB6) and one ambient monitoring station (AA4) were evaluated in the Broad River. Site AB3 has consistently received a Good-Fair rating (1995, 2000 and 2005). During the last assessment (2000), a new bridge was being constructed and flows were significantly reduced. Consequently, the benthic community included many species that can survive under very low flow conditions. Sampling in 2005, however, showed that the change in species was not permanent and most of the species absent in 2000 were collected again in 2005. Substrate was mostly sand (80 percent) with a small amount of boulder and rubble (10 percent each). The drainage area at site AB3 is approximately 539 square miles.

Site AB6 near the Cliffside Steam Station, is the most downstream benthic site that is sampled on the Broad River. This benthic community was rated Good-Fair. Site AB6 has been sampled nine times since 1983. Seven of the nine samples resulted in a Good-Fair rating with the exception of a Fair in 1983 and a Good in 2000. Substrate was mostly rubble (35 percent) and gravel (40 percent) with smaller amounts of sand and silt (20 and 35 percent). The habitat score (51 out of 100) was slightly higher than the upstream site at AB3 (habitat score 44 out of 100). Site AB6 experiences considerable diurnal flow fluctuations from power plant operations (Duke Power) located upstream, and the current here can be very swift and dangerous. The drainage area at this point is approximately 609 square miles.

Site AA4 near Boiling Springs is the most downstream ambient station monitored on the Broad River. The water quality standard for turbidity was exceeded in 12.1 percent of the samples that were collected from January 2002 through December 2006. Therefore, this section of the Broad River is Impaired for aquatic life due to exceedences in the water quality standard for turbidity.

In addition, 26 percent of the samples collected exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resource become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. No portion of the Broad River is classified for primary recreation (Class B); therefore, it was not prioritized for additional sampling during this assessment period. Potential sources of elevated bacteria levels include failing septic systems, straight pipes, and nonpoint source runoff from pasture and forestlands. This section of the Broad River is Not Rated for recreation.

Recommendations: Urban and agricultural BMPs should be carefully installed and maintained throughout the watershed because of the moderate to steep slopes and the high erosion potential of soils. Install fencing along this segment with animal operations. Fencing will prevent farm animals from eroding streambanks and depositing harmful bacteria and excess nutrients into the surface water. DWQ will work with Duke Power to stabilize flow released from the dam.

Recommendations for this watershed can be found later in this chapter.

Significant Non-Compliance Issues

No significant non-compliance issues were identified in the Sandy Run-Broad River or the Broad River watersheds.

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps owners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination.

The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields
- Sediment/Nutrient Delivery Reduction from Fields
- Stream Protection from Animals
- Proper Animal Waste Management
- Agricultural Chemical (agrichemical) Pollution Prevention

Table 2-2: BMPs Installed through NCACSP

Purpose of BMP	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	159.16 acres	$28,903
Sediment/Nutrient Delivery Reduction from Fields	-- --	-- --
Stream Protection from Animals	11 units 975 linear feet	$19,544 --
Proper Animal Waste Management	-- --	-- --
Agricultural Chemical Pollution Prevention	--	--
Total Costs		**$48,447**
Benefits	0305010505 - 16	
Total Soil Saved (tons)	922	
Total Nitrogen (N) Saved (lb.)	2,206	
Total Phosphorus (P) Saved (lb.)	326	
Total Waste-N Saved (lb.)	--	
Total Waste-P Saved (lb.)	--	

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $48,447 was provided for BMPs in the Second Broad River watershed. Table 2-2 summaries the cost and total BMPs implemented.

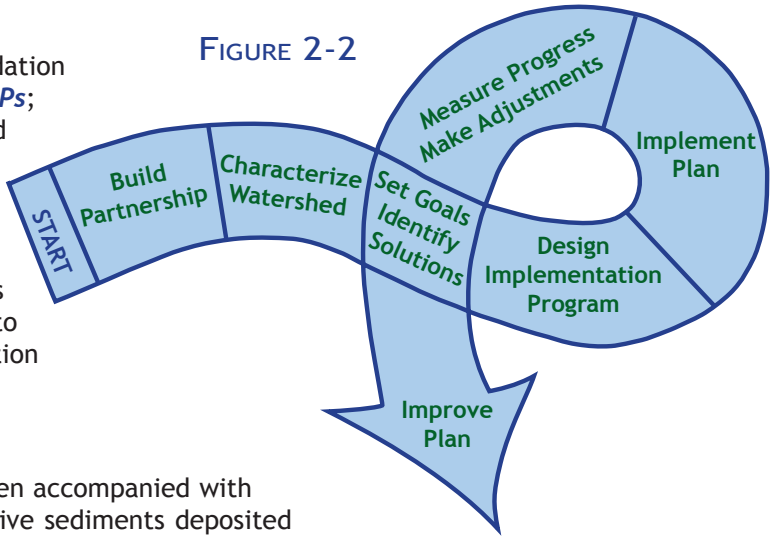
Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 2-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 2-2



Turbidity

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited

on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), impair fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs (USEPA, 1999 and Waters, 1995).

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in this watershed. It appears, however, violations are highest near agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land cover is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***. Information about starting a Sediment and Erosion Control Local Program can be found on the ***Division of Land Quality's*** web page.

Fecal Coliform Bacteria

The fecal coliform standard for freshwater is 200 colonies per 100 milliliters (ml) of water based on at least five consecutive samples taken during a 30-day period, not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. There are no waters Impaired for fecal coliform bacteria in the Sandy Run-Broad River watershed. However, fecal coliform bacteria concentrations were above the 400 colonies/100 milliliter (mL) water quality guideline in more than 20 % of at least one ambient monitoring stations in this watershed.

The presence of fecal coliform bacteria in the aquatic environment indicates that the water has been contaminated from the fecal material of humans or other warm-blooded animals. Elevated fecal coliform bacteria numbers can indicate contamination by harmful pathogens or disease causing bacteria or viruses that also exists in fecal material. Livestock and family pets are large contributors to this problem. As seen in Table 2-1, the Agriculture Cost Share Program has installed close to 1,000 linear feet of fencing along streams to help keep livestock out of the streams. This will significantly decrease the amount of fecal coliform bacteria contaminating the streams. Many municipalities have been placing pet waste bag and trash bins in public parks and along green ways to encourage and educate the public on the importance of keeping the waste out of the streams.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

References & Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin*. ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

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Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.

2008 Integrated Report Watershed- Sandy Run-Broad River

Broad River Basin

WBD-10 Number 0305010505

Sandy Run-Broad River

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501050502											**Floyds Creek**
9-37	**Floyds Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Broad River											
C	03-08-02	12.5 FW Miles									
WBD-12 Number 030501050504											**Upper Sandy Run**
9-46a	**Sandy Run Creek**		**5**	**Habitat Degradation** General Agriculture/Pasture Natural Conditions	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2005	2008	5
From source to Mayne Creek											
C	03-08-04	10.4 FW Miles									
9-46b	**Sandy Run Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From Mayne Creek to Broad River											
C	03-08-04	12.1 FW Miles									
WBD-12 Number 030501050506											**Suck Creek-Broad River**
9-(25.5)b	**BROAD RIVER**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Second Broad to North Carolina-South Carolina State Line				**Turbidity**	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
WS-IV	03-08-02	12.4 FW Miles			Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1

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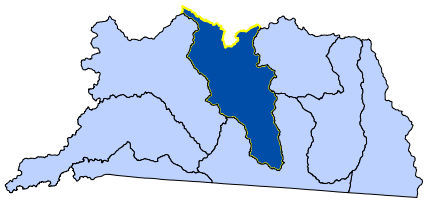


Second Broad River Watershed

HUC 0305010504

Includes Big Camp Creek, Catheys Creek, Roberson Creek & Second Broad River

Genreal Watershed Discription

The Second Broad River begins in the southern McDowell County mountains and ends at its confluence with the Broad River in the Rutherford County piedmont region. Most of the land is forested; however, large urbanized areas of Rutherfordton, Spindale and Forest City are also located in the watershed (Figure 3-1). Tributaries include Big Camp Creek, Cane Creek, Catheys Creek, Roberson Creek, Puzzle Creek, Webbs Creek and Hills Creek (Figure 3-2). Many are low gradient streams that are either extremely sandy or rocky depending on the local geology.

Watershed at a Glance

Counties

McDowell, Rutherford

Municipalities

Rutherforton, Ruth, Spindale, Forest City, Bostic, Alexander Mills

Permitted Facilities

NPDES WWTP:	8
NPDES Nondischarge:	0
NPDES Stormwater:	18
Animal Operations:	6

Monitored Stream Miles (AL)

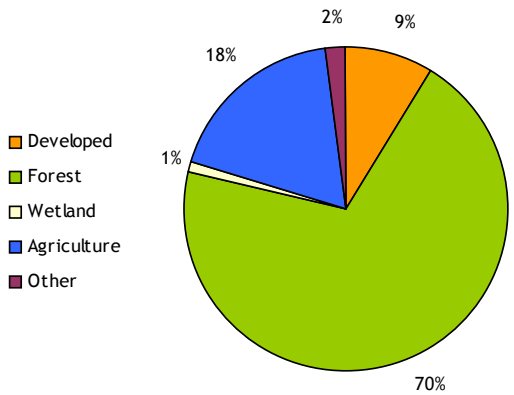
Total Streams:	84.5 mi
Total Supporting:	70.1 mi
Total Impaired:	8.6 mi
Total Not Rated:	5.9 mi

Water Quality Overview

Of the 237 stream miles in the Second Broad River watershed, 84.5 miles were monitored by DWQ. This watershed is mostly (83 percent) rated as Supporting for aquatic life. Only 10 percent of these monitored waters are rated as Impaired and 7 percent are Not Rated. Of the Impaired or impacted streams, 72 percent had a habitat degradation stressor, 21 percent had a fecal coliform stressor, and 16 percent had a nutrient impact stressor.

Biological monitoring was conducted at seven basinwide sites. Eleven biological samples were also collected as part of a special study in the Catheys Creek (Hollands Creek) watershed. More information on the special study can be found in the Catheys Creek watershed ***Chapter***. Two ambient stations are also monitored in the Second Broad River watershed.

Figure 3-1: Second Broad River Watershed Land Cover

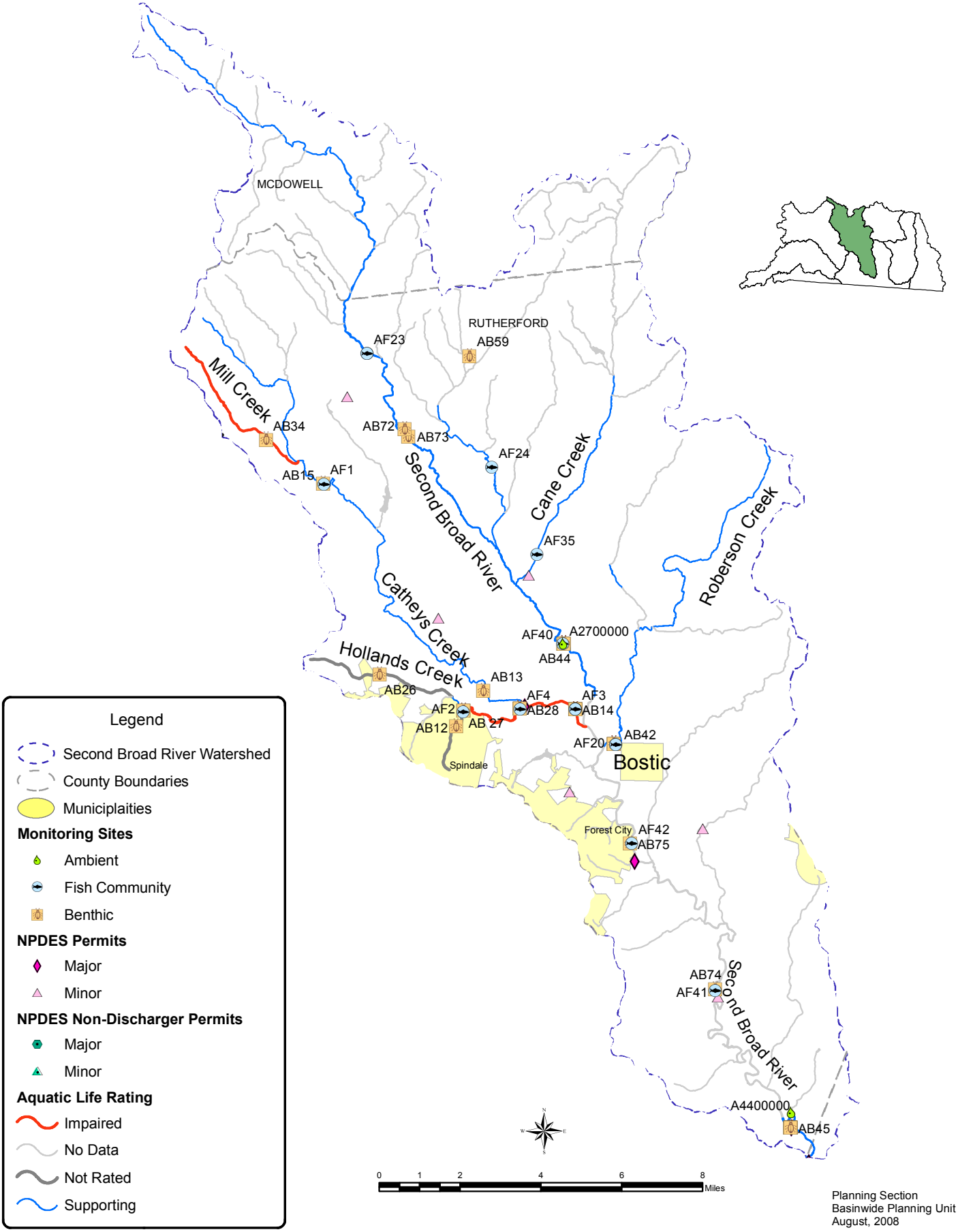


NRI: National Land Cover Data, 2001

No significant water quality changes were identified in the Second Broad River; however, several streams are impacted, and Catheys Creek, Hollands Creek and Mill Creek are Impaired (Table 3-1).

There are three major and five minor NPDES Discharger Permits within the Second Broad River watershed. None of these facilities had significant compliance issuse during this planning period. There are six Animal Operations Permits located mostly in the northern headwaters of this watershed.

Figure 3-2: Second Broad River Watershed, HUC 0305010504



How to Read this Document

This document was written to correspond with our new ***Geographic Online Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 3-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 3-B provides a summary of each ambient data monitoring station.
Appendix 3-C provides summaries of biological and fish assessment monitoring sites.

Table 3-1: Monitored Stream Segments In The Second Broad River Watershed

AU Number	Stream Name	Length (miles)	Class.	2008 IR Cat.*	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-41-(0.5)	Second Broad River	15.8	WS-V	2	-	-		03-08-02
9-41-(10.5)	Second Broad River	9.9	WS-IV	2	-	-	**Habitat Degradation**	03-08-02
9-41-(24.7)	Second Broad River	2.2	WS-IV	2	-	-	**Habitat Degradation**	03-08-02
9-41-11-(2.5)	Big Camp Creek	5.1	WS-IV	2	-	-	**Habitat Degradation**	03-08-02
9-41-12-(5.5)	Cane Creek	6.3	WS-IV	2	-	-		03-08-02
9-41-13-(0.5)	Catheys Creek	15.2	WS-V	2	-	-	**Fecal Coliform Bacteria** (Animal Operations) **Habitat Degradation** (General Agriculture/ Pasture, Stormwarer Runoff)	03-08-02
9-41-13-(6)a	Catheys Creek	1.9	C	2	-	-	**Habitat Degradation** (General Agriculture/ Pasture, Impervious Surface)	03-08-02
9-41-13-(6)b	Catheys Creek	1.9	C	5	X	-	**Fecal Coliform Bacteria** **Habitat Degradation** (General Agriculture/ Pasture, Stormwarer Runoff)	03-08-02
9-41-13-3	Mill Creek	4.5	WS-V	5	X	-	**Habitat Degradation** (Impoundment)	03-08-02
9-41-13-7-(1)	Hollands Creek	3.9	WS-V	3a	-	-	**Habitat Degradation** (Impervious Surface)	03-08-02
9-41-13-7-(3)a	Hollands Creek	0.7	C	2	-	-	**Fecal Coliform Bacteria** **Habitat Degradation** (Impervious Surface, Natural Conditions, Stormwarer Runoff) **Natural Impacts** (Stormwater Runoff)	03-08-02

*The 2008 IR Categories definitions can be found on the first page of Appendix 3-A

AU Number	Stream Name	Length (miles)	Class.	2008 IR Cat.*	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-41-13-7-(3)b	Hollands Creek	2.2	C	5	X	-	**Habitat Degradation** (Impervious Surface, Stormwarer Runoff)	03-08-02
9-41-13-7-4	Case Branch (Cox Branch)	1.9	C	3a	-	-		03-08-02
9-41-14	Roberson Creek (Robinson Creek)	12.9	WS-V	2	-	-	**Habitat Degradation** **Natural Impacts**	03-08-02
*The 2008 IR Categories definitions can be found on the first page of Appendix 3-A								

Current Status of Impaired & Impacted Waters

Second Broad River AU#: 9-41-(0.5), 9-41-(10.5), 9-41-(24.7)

DWQ collected data from five stations on the Second Broad River – one fish site (AF23), two benthic sites (AB44 and AB45) and two ambient monitoring stations (AA2 and AA3). Site AF23 is the most upstream sampling location and receives runoff from rural residential areas located in southern McDowell County and a small portion of northern Rutherford County. It is a regional reference site for fish community sampling and has rated Good for the last two assessments (2000 and 2005) with no substantial changes.

Sites AB44 and AA2 are co-located approximately 10 miles downstream of site AF23 near the Town of Logan. Site AB44 has consistently rated Good-Fair (1995, 2000 and 2005) and includes a mix of both pollution tolerant and intolerant species. The substrate is mostly sand (70 percent) with small amounts of rubble (5 percent), gravel (15 percent) and silt (10 percent). Heavy sedimentation has destroyed riffles and lead to a low habitat score (51 out of 100). DWQ biologists also noted severe streambank erosion. No water quality standards were exceeded at site AA2.

Sites AB45 and AA3 are co-located near the Cliffside Steam Station, just upstream of the Cliffside Sanitary District WWTP (Permit NC0004405). Site AB45 has been sampled eight times since 1983, and over time, water quality has improved but not above a Good-Fair rating. The substrate is a mix of rubble (55 percent), gravel (20 percent), sand (10 percent), boulder (10 percent) and silt (5 percent). Infrequent pools, streambank erosion and a narrow riparian zone lowered the habitat score (72). Conductivity was extremely high at the time of sampling (226μmhos/cm) and the water was tinted red. At this time, there is no indication of the causes of the high conductivity or the red tint. No water quality standards were exceeded at site AA3.

The monitored segments of the Second Broad River are Supporting in the aquatic life category; however, due to their Good-Fair bioclassifications, they are considered waters with noted impacts. Stormwater runoff from agricultural, commercial and residential properties is most likely impacting the aquatic habitats in the Second Broad River and the surrounding watersheds.

Big Camp Creek AU#: 9-41-11-(2.5)

Big Camp Creek drains rural northern Rutherford County. Site AF24 was sampled for the first time in 2005 and received a Good-Fair. The total number of species (including darters, sunfish, bass and trout) and the number of pollution intolerant species were lower than expected. Sedimentation is a concern for this watershed despite its rural characteristics. Big Camp Creek is Supporting in the aquatic life category; however, due to the Good-Fair bioclassification, it is considered a stream with noted impacts.

Catheys Creek (Hollands Creek) AU#: 9-41-13-(0.5), 9-41-13-(6)a, 9-41-13-(6)b, 9-41-13-7-(1), 9-41-13-7-(3)a; 9-41-13-7-(3)b

One basinwide site (AB14) and several benthic, fish and ambient sites were sampled in Catheys Creek watershed as part of a special study for the Ecosystem Enhancement Program (EEP). DWQ biologists noted that habitat quality varied from very good to very poor depending on land cover, geology, slopes, soils and streamflow. Most low gradient streams around Spindale and Rutherfordton are extremely sandy, often lacking aquatic habitat areas. Higher gradients streams, or those in the more forested areas of the watershed, have a rocky substrate. Sedimentation, point source pollution, stormwater runoff and historic mining activities were identified as the primary factors affecting watershed function in the Catheys Creek watershed.

Several of the streams in the Catheys Creek watershed are Supporting in the aquatic life category; however, portions of both Catheys and Hollands Creeks are Impaired. Mill Creek is also Impaired in the aquatic life category. More information on the Catheys Creek watershed can be found in ***Chapter 9***.

Recommendations for Hollands Creek (AU# 9-41-13-7-(3)b: Continue to implement the *Catheys Creek Watershed Management Plan*. Replace hard stream stabilization structures with natural stabilization methods. Increase the area of vegetation (with trees and shrubs) along residential portions of this segment to filter stormwater runoff. Encourage homeowners not to mow all the way down to the stream and to plant native vegetation along streambanks.

Mills Creek AU#: 9-41-13-3

Site AB34 was sampled for the first time during this assessment period. It was sampled in efforts to locate an area of good water quality in the upper portion of the Catheys Creek segment. The site received a Fair bioclassification. This is most likely due to an upstream impoundment causing increased water temperatures. More detailed information can be found in Chapter 9.

Recommendations: Continue to implement the *Catheys Creek Watershed Management Plan*. Increase shaded area around the upstream pond by planting trees and shrubs to lower water temperatures.

Roberson Creek AU#: 9-41-14

Roberson Creek is a tributary to the Second Broad River and drains east central Rutherford County. Benthic (AB42) and fish (AF20) samples were collected in 2005. Like many of the other streams in the basin, the substrate is mostly sand (50 percent) with some gravel (40 percent) and silt (10 percent). Site AB42 received a Good-Fair. This site has remained unchanged since 1995; however, overall declines in species abundance and richness indicate that the biological integrity is decreasing.

Site AF20 received a Good; however, the total number of fish collected and the number of species with multiple age groups decreased substantially between 2000 and 2005. This resulted in a 75 percent decline in the number of fish collected. Of the 21 species known from the site, abundance declined in 17 species, and four species were not collected. The bluehead chub (an indicator of nutrient enrichment) was the most abundant species. DWQ biologists noted that the decline in abundance and the loss of age classes has been observed at other sites where the flow has fluctuated dramatically (i.e., from extremely low flows to extremely high flows). This may have happened in Roberson Creek; however, future investigation is needed to determine the cause of the decline. The total drainage area at the sampling sites is 26 square miles.

Roberson Creek is Supporting in the aquatic life category; however, due to the Good-Fair benthic bioclassification, it is considered a stream with noted impacts.

Recommendations for this watershed can be found later in the chapter.

Significant Non-Compliance Issues

No significant non-compliance issues were identified for the permitted facilities in the Second Broad River watershed. Notice of violation (NOV) letters were sent to three NPDES WWTP facilities during the last two years of the assessment period; however, with recommended operational changes, all are in full compliance with permit limits. Two of these facilities are located in the Catheys Creek watershed. More information on these facilities can be found in ***Chapter 9***.

Local Initiatives

USDA – NRCS Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides assistance to farmers and ranchers who face threats to soil, water, air and related natural resources on their land. Through EQIP, the Natural Resources Conservation Service (NRCS) provides assistance to agricultural producers in a manner that will promote agricultural production and environmental quality as compatible goals, optimize environmental benefits, and help farmers and ranchers meet federal, state, tribal and local environmental requirements. Program priorities include reducing point and nonpoint sources of pollution; reducing groundwater contamination; conserving ground and surface water resources; reducing emissions; reducing soil erosion and sedimentation; and promoting species habitat conservation.

In 2001, areas north and east of the Broad River in Rutherford County were identified as an EQIP priority area. This includes all or part of the Mountain Creek, Cleghorn Creek, McKinney Creek, Floyds Creek, Catheys Creek, Second Broad River, Cane Creek, Camp Creek, Puzzle Creek, Roberson Creek, Hills Creek and Big Horse Creek watersheds. The priority area covers approximately 220,800 acres (345 square miles) of privately owned land. Primary resource concerns included streambank stabilization, sedimentation, livestock exclusion and establishment of resource management systems on pasturelands.

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps landowners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination. The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields
- Sediment/Nutrient Delivery Reduction from Fields
- Stream Protection from Animals
- Proper Animal Waste Management
- Agricultural Chemical (agrichemical) Pollution Prevention

Table 3-2: BMPs Installed through NCACSP

Purpose of BMP	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	20.8 acres	$5,378
Sediment/Nutrient Delivery Reduction from Fields	-- --	-- --
Stream Protection from Animals	11 units 2,518 linear feet	$18,666 --
Proper Animal Waste Management	1 unit --	$17,771 --
Agricultural Chemical Pollution Prevention	--	--
Total Costs	--	$41,815
Benefits	**0305010504**	
Total Soil Saved (tons)	331	
Total Nitrogen (N) Saved (lb.)	3,686	
Total Phosphorus (P) Saved (lb.)	1,827	
Total Waste-N Saved (lb.)	1,008	
Total Waste-P Saved (lb.)	619	

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $41,815 was provided for BMPs in the Second Broad River watershed. Table 3-2 summaries the cost and total BMPs implemented.

Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

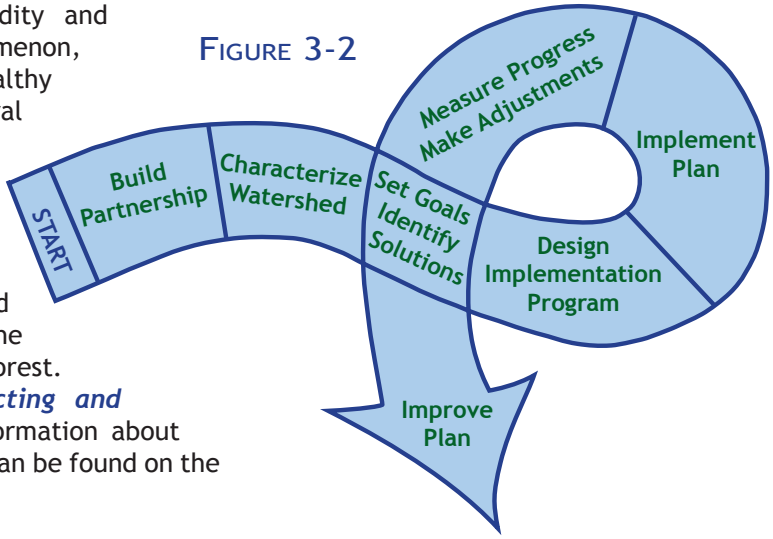
Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 3-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Turbidity

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), impair fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs (USEPA, 1999 and Waters, 1995).

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in this watershed. It appears, however, violations are highest near agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land cover is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***. Information about starting a Sediment and Erosion Control Local Program can be found on the ***Division of Land Quality's*** web page.

FIGURE 3-2



Fecal Coliform Bacteria

The fecal coliform standard for freshwater is 200 colonies per 100 milliliters (ml) of water based on at least five consecutive samples taken during a 30-day period, not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. There are no waters Impaired for fecal coliform bacteria in the Second Broad River watershed. However, fecal coliform bacteria concentrations were above the 400 colonies/100 milliliter (mL) water quality guideline in more than 20 % of at least one ambient monitoring stations in this watershed.

The presence of fecal coliform bacteria in the aquatic environment indicates that the water has been contaminated from the fecal material of humans or other warm-blooded animals. Elevated fecal coliform bacteria numbers can indicate contamination by harmful pathogens or disease causing bacteria or viruses that also exists in fecal material. Livestock and family pets are large contributors to this problem. As seen in Table 2-1, the Agriculture Cost Share Program has installed over 2,500 linear feet of fencing along streams to help keep livestock out of the streams. This will significantly decrease the amount of fecal coliform bacteria contaminating the streams. Many municipalities have been placing pet waste bag and trash bins in public parks and along green ways to encourage and educate the public on the importance of keeping the waste out of the streams.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

REFERENCES & SUPPORTING DOCUMENTATION

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin*. ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

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2008 Integrated Report Watershed- Second Broad River

Broad River Basin

WBD-10 Number 0305010504

Second Broad River

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
			WBD-12 Number 030501050401							**Big Camp Creek**
9-41-11-(2.5)	**Big Camp Creek (Camp Creek)**	**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From a point 0.5 mile upstream of mouth of Crawley Branch to Second Broad River										
WS-IV	03-08-02	5.1 FW Miles								
			WBD-12 Number 030501050402							**Cane Creek**
9-41-12-(5.5)	**Cane Creek**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2000		1
From mouth of Fork Creek to Second Broad River										
WS-IV	03-08-02	6.3 FW Miles								
			WBD-12 Number 030501050403							**Catheys Creek**
9-41-13-(0.5)	**Catheys Creek**	**2**	**Fecal Coliform Bacteria** Animals	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to 0.4 miles downstream of Rutherford County SR 1538			**Habitat Degradation** General Agriculture/Pasture Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
WS-V	03-08-02	15.2 FW Miles								
9-41-13-(6)a	**Catheys Creek**	**2**	**Habitat Degradation** General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
From 0.4 miles downstream of Rutherford County SR 1538 to confluence with Hollands Creek										
C	03-08-02	1.9 FW Miles								
9-41-13-(6)b	**Catheys Creek**	**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2004	1998	5
From confluence with Hollands Creek to S. Broad R.			**Habitat Degradation** Impervious Surface Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
C	03-08-02	1.9 FW Miles								
9-41-13-3	**Mill Creek**	**5**	**Habitat Degradation** Impoundment	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
From source to Catheys Creek										
WS-V	03-08-02	4.5 FW Miles								
9-41-13-7-(1)	**Hollands Creek**	**3a**	**Habitat Degradation** Impervious Surface	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2003		3a
From source to Duke Power Co. old Auxiliary Raw Water Supply Intake										
WS-V	03-08-02	3.9 FW Miles								

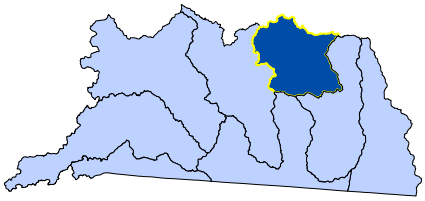
Broad River Basin — *WBD-10 Number 0305010504* — *Second Broad River*

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
9-41-13-7-(3)a	**Hollands Creek**		**2**	**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From Duke Power Co. old Auxiliary Raw Water Supply Intake to Case Branch				**Habitat Degradation** Impervious Surface Natural Conditions Stormwater Runoff **Nutrient Impacts** Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
C	03-08-02	0.7 FW Miles									
9-41-13-7-(3)b	**Hollands Creek**		**5**	**Habitat Degradation** Impervious Surface Stormwater Runoff	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2004	1998	5
From Case Branch to Catheys Creek					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
C	03-08-02	2.2 FW Miles									
9-41-13-7-4	**Case Branch (Cox Branch)**		**3a**		Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2003		3a
From source to Hollands Creek											
C	03-08-02	1.9 FW Miles									
				WBD-12 Number 030501050404 Headwaters Second Broad River							
9-41-(0.5)	**Second Broad River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to a point 0.4 mile downstream of Rutherford County SR 1504											
WS-V	03-08-02	15.8 FW Miles									
9-41-(10.5)	**Second Broad River**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.4 mile downstream of Rutherford County SR 1504 to a point 0.8 mile upstream of mouth of Catheys Creek					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-IV	03-08-02	9.9 FW Miles			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
				WBD-12 Number 030501050405 Roberson Creek							
9-41-14	**Roberson Creek (Robinson Creek)**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Second Broad River				**Nutrient Impacts**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-V	03-08-02	12.9 FW Miles									
				WBD-12 Number 030501050407 Hills Creek-Second Broad River							

Broad River Basin — *WBD-10 Number 0305010504* — *Second Broad River*

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
9-41-(24.7)	**Second Broad River**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Cone Mills Water Supply Intake to Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-IV	03-08-02	2.2 FW Miles			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1

First Broad River Headwaters Watershed



HUC 0305010506

Includes Brier Creek, Wards Creek, North Fork First Broad River & Hinton Creek

General Watershed Description

The First Broad River and its tributaries originate in Rutherford County and flow into the Broad River in Cleveland County just above the North Carolina-South Carolina state line. Tributaries to the First Broad River headwaters include the North Fork First Broad River, Brier Creek, Wards Creek, Hinton Creek and Duncans Creek (Figure 4-2). Portions of northeastern Rutherford County and northwestern Cleveland County contain large forested areas associated with the South Mountains and the South Mountains State Park. In addition, some agricultural (i.e., row crops, pastureland) and residential areas are located throughout the watershed. Land cover for this watershed is mostly forest and agriculture (Figure 4-1).

Watershed at a Glance

Counties

Rutherford, Cleveland

Municipalities

Casar, Polkville

Permitted Facilities

NPDES WWTP:	2
NPDES Nondischarge:	2
NPDES Stormwater:	1
Animal Operations:	4

Monitored Stream Miles (AL)

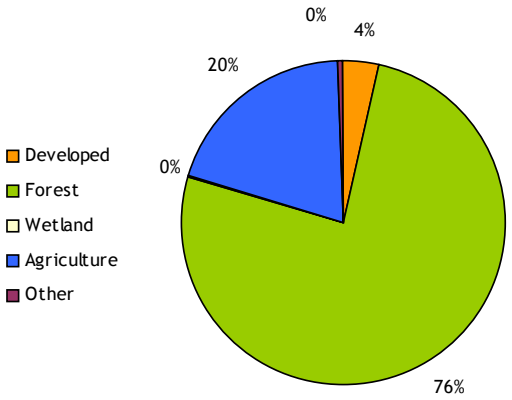
Total Streams:	62.6 mi
Total Supporting:	47.6 mi
Total Impaired:	15.0 mi
Total Not Rated:	0 mi

Water Quality Overview

Of the 186 stream miles in the First Broad River headwaters watershed, 62.6 miles were monitored by DWQ. This watershed is mostly (76 percent) rated as Supporting for aquatic life. The First Broad River is the only Impaired waterbody which accounts for 24 percent of monitored waters. It is Impaired due to a standards violation for low pH (Table 4-1).

Biological monitoring was conducted at eight basinwide sites, four of which were sampled for the first time in 2005. One ambient station is also located in this watershed.

Figure 4-1: First Broad River Headwaters Watershed Land Cover

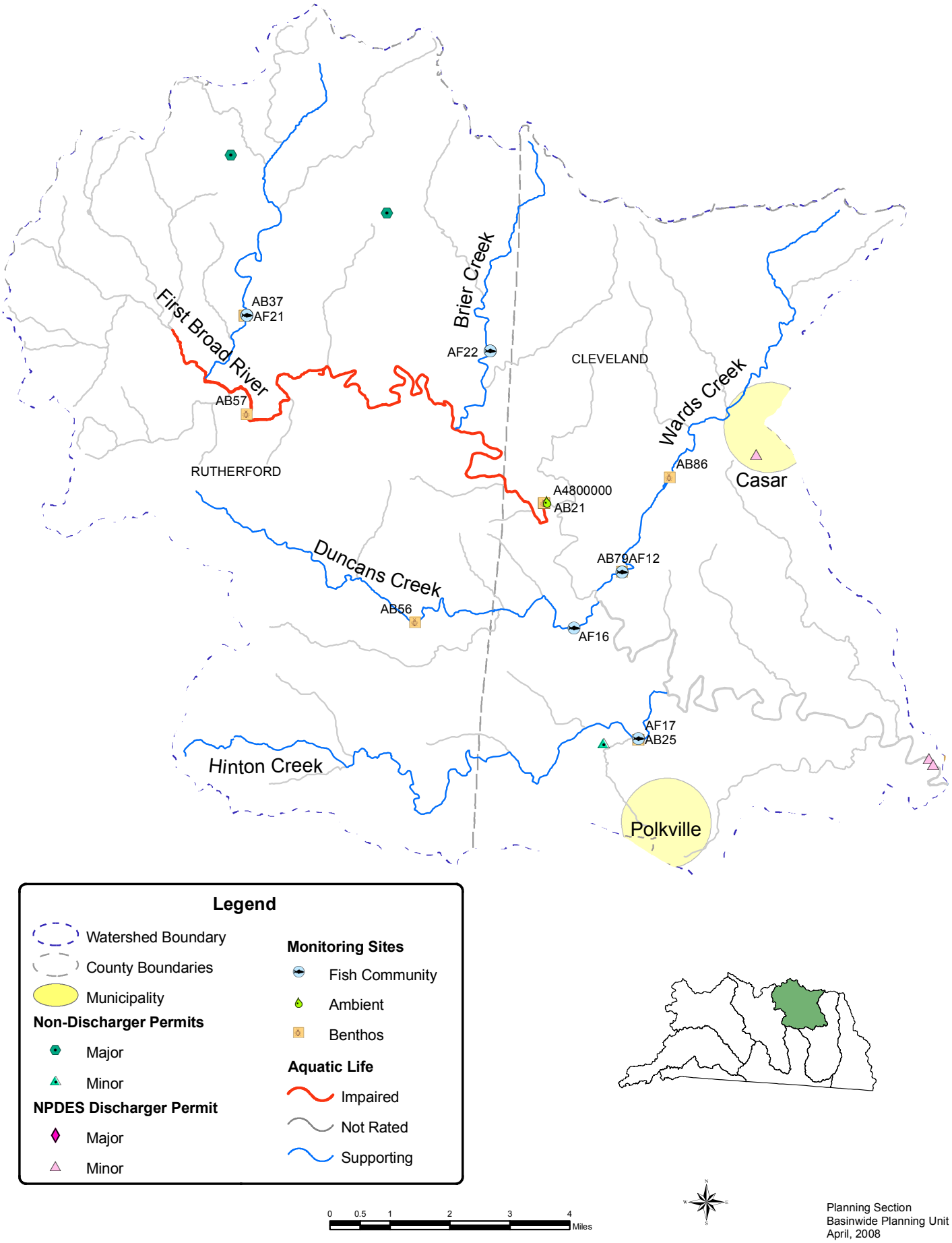


NRI: National Land Cover Data, 2001

No significant water quality changes were identified in the First Broad River headwaters and some biological monitoring sites even improved. Biologists note that the improvements to biological communities could possibly be the result of higher flows in 2005 versus those measured in 2000 (97 cubic feet per second (cfs) compared to 49 cfs). In protected catchments, such as the First Broad River and Hinton Creek, increased stream flow can result in better physical conditions instream (i.e., increased availability of wetted habitat, increased levels of dissolved oxygen). This can result in more favorable conditions for benthic colonization.

Three minor NPDES Discharge Permits are found in this watershed. Only one of these permits has significant non-compliance issues. For more information on the Cleveland County Wastewater Treatment Plant's compliance violations, see page 4.4. There are also four Animal Operations Permits within this watershed. These are mostly cattle operations.

Figure 4-2: First Broad River Headwaters Watershed, HUC 0305010506



How to Read this Document

This document was written to correspond with our new ***Geographic Online Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 4-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 4-B provides a summary of each ambient data monitoring station.
Appendix 4-C provides summaries of biological and fish assessment monitoring sites.

Table 4-1: Monitored Stream Segments In The First Broad River Headwaters Watershed

AU Number	Stream Name	Length (miles)	Class.*	2008 IR Categories	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-50-(1)	First Broad River	15.0	WS-V;Tr	5	X	-	**Low pH**	03-08-04
9-50-12	Wards Creek	10.2	C	2	-	-		03-08-04
9-50-13	Duncans Creek	10.1	C	2	-	-		03-08-04
9-50-15	Hinton Creek	13.2	C	2	-	-		03-08-04
9-50-4	North Fork First Broad River	7.5	C;Tr,ORW	2	-	-		03-08-04
9-50-8	Brier Creek	6.7	C;Tr	2	-	-		03-08-04

*The 2008 IR Categories definitions can be found on the first page of Appendix 4-A

Current Status of Impaired & Impacted Waters

North Fork First Broad River AU#: 9-50-4

The North Fork First Broad River is in the headwaters of the First Broad River and drains the northeastern corner of Rutherford County and the South Mountains. Benthic (AB37) and fish (AF21) sites were sampled in the North Fork First Broad River. Several pollution intolerant benthic species were collected at site AB37 resulting in an Excellent bioclassification. Substrate was an unembedded mix of boulder (10 percent), rubble (40 percent), gravel (30 percent) and sand (20 percent). The habitat score was 90.

Site AF21 also received an Excellent bioclassification. The percentage of pollution tolerant fish in the river has always been low (usually 1 to 2 percent) and is the lowest of any of the streams sampled in the basin. DWQ documented a reproducing population of rainbow trout, thus supporting the supplemental trout (Tr) classification. A reproducing population of smallmouth bass was also identified. Both species prefer cold to cool water with low turbidity. Due to excellent water quality and the benthic and fish habitats identified in this watershed, the North Fork First Broad River was given the supplemental classification of Outstanding Resource Water (ORW) in January 2005.

First Broad River (Headwaters) AU#: 9-50-(1)

Sites AA5 and AB21 are the most upstream sites sampled on the First Broad River. Site AB21 has been sampled six times since 1986 with all six samples resulting in a Good bioclassification. In 2005, the site improved to an Excellent rating, and several pollution intolerant species were collected for the first time. The substrate was a mix of boulder (10 percent), rubble (20 percent), gravel (40 percent) and sand (30 percent). No major habitat problems were noted along this reach of the First Broad River (habitat score 88).

Despite the Excellent benthic bioclassification, ambient monitoring at site AA5 shows that the water quality standard for pH (<6.0) was exceeded in 17.2 percent of the samples collected from January 2002 through December 2006. Therefore, this section of the First Broad River is Impaired for aquatic life due to exceedences of the water quality standard for pH.

Hinton Creek AU#: 9-50-15

Hinton Creek drains rural northeastern Rutherford County and a small area of northwestern Cleveland County. Benthic (AB25) and fish (AF17) sites were sampled in 2005. Site AB25 received an Excellent bioclassification. This is a dramatic improvement from the Good-Fair bioclassification it received in 1995 and 2000. Several pollution intolerant species were collected for the first time. The substrate was a mix of gravel (40 percent), sand (50 percent) and silt (10 percent). Overall, habitat quality was good (habitat score 70); however, well-developed pool habitats and boulder-rubble riffles were absent. The improvement is likely the result of higher flows in 2005 versus those measured in 2000 (97 cubic feet per second (cfs) compared to 49 cfs). In protected watersheds (such as in the First Broad River headwaters), increased streamflow can improve instream physical conditions (i.e., increase availability of wet habitat and increased dissolved oxygen levels), which often results in more favorable conditions for macroinvertebrate colonization.

Site AF17 received a Good bioclassification. Sixteen species were collected in 2005 and the dominant species was the bluehead chub (a nutrient indicator species). Hinton Creek was sampled as a new potential regional reference site; however, the habitat score (61) failed to qualify the site for regional reference. Physical effects from the extremely high flows during the 2004 hurricanes were evident throughout the sampling reach.

Significant Non-Compliance Issues

Several limit violations are on file for both chlorine and total suspended solids (TSS) from the Cleveland County Water Treatment Plant (WTP) (Permit NC0051918). Effluent from the WTP discharges into the First Broad River. Notes from the most recent inspection (January 2007) recommended that the WTP should consider adding additional lagoon storage space. The facility has historically had problems with storing the filter backwash. With more water being treated and distributed, the current lagoon capacity is likely inadequate. It is also recommended that the permit reflect the liquid sodium bisulfite dechlorination process that was recently installed as part of an authorization to construct permit (Permit 05198A01).

No significant non-compliance issues were identified at the Casar Elementary School WWTP (Permit NC0066397).

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps owners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination. The NCACSP is implemented by the Division of Soil and Water Conservation (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields
- Sediment/Nutrient Delivery Reduction from Fields
- Stream Protection from Animals
- Proper Animal Waste Management
- Agricultural Chemical (agrichemical) Pollution Prevention

Table 4-2: BMPs Installed through NCACSP

Purpose of BMP	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	151 linear feet	$9,830
Sediment/Nutrient Delivery Reduction from Fields	-- --	-- --
Stream Protection from Animals	4 units 1,200 linear feet	$7,435
Proper Animal Waste Management	--	--
Agricultural Chemical Pollution Prevention	--	--
Total Costs		$17,265
Benefits	0305010506	
Total Soil Saved (tons)	97	
Total Nitrogen (N) Saved (lb.)	191	
Total Phosphorus (P) Saved (lb.)	225	
Total Waste-N Saved (lb.)	--	
Total Waste-P Saved (lb.)	--	

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $17,265 was allocated for BMPs in the First Broad River headwaters watershed. Table 4-2 summaries the cost and total BMPs implemented.

References & Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin*. ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

NCDENR Division of Water Quality. February 2003. *Broad River Basinwide Water Quality Plan*. ***http://h2o.enr.state.nc.us/basinwide/Broad/2002/plan.htm***.

2008 Integrated Report Watershed- Upper First Broad River

Broad River Basin

WBD-10 Number 0305010506

Upper First Broad River

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501050601											**Headwaters First Broad River**
9-50-(1)	**First Broad River**		**5**	**Low pH**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From source to Cleveland County SR 1530					Aquatic Life	Impaired	Standard Violation	Low pH	2006	2008	5
WS-V;Tr	03-08-04	15.0 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
9-50-4	**North Fork First Broad River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C;Tr,ORW	03-08-04	7.5 FW Miles									
WBD-12 Number 030501050602											**Brier Creek-First Broad River**
9-50-8	**Brier Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C;Tr	03-08-04	6.7 FW Miles									
WBD-12 Number 030501050603											**Wards Creek-First Broad River**
9-50-12	**Wards Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C	03-08-04	10.2 FW Miles									
9-50-13	**Duncans Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C	03-08-04	10.1 FW Miles									
WBD-12 Number 030501050604											**Hinton Creek**
9-50-15	**Hinton Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	13.2 FW Miles									
WBD-12 Number 030501050605											**Knob Creek**
9-50-19-(2.5)	**Knob Creek (Big Knob Creek)**		**2**	**Habitat Degradation** Natural Conditions **Nutrient Impacts** Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From a point 0.3 mile downstream of Adams Creek to a point 0.6 mile upstream of mouth											
WS-IV	03-08-04	8.3 FW Miles									

Broad River Basin — *WBD-10 Number 0305010506* — *Upper First Broad River*

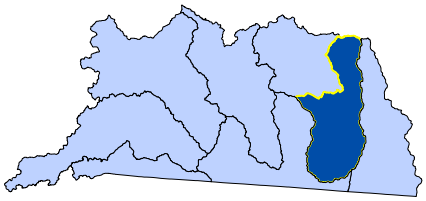
Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
9-50-19-(4)	**Knob Creek (Big Knob Creek)**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From a point 0.6 mile upstream of mouth to First Broad River											
WS-IV;CA	03-08-04	0.5 FW Miles									

2008 Integrated Report Watershed- Lower First Broad River

Broad River Basin | **WBD-10 Number 0305010507** | **Lower First Broad River**

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
				WBD-12 Number 030501050701							**Brushy Creek**
9-50-29	**Brushy Creek**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River				**Nutrient Impacts**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	14.7 FW Miles									
				WBD-12 Number 030501050702							**Magness Creek-First Broad River**
9-50-(19.5)	**First Broad River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From Cleveland County Sanitary District Raw Water Supply Intake (just below Knob Creek) to a point 1.0 mile upstream of Shelby downstream Raw Water Intake											
WS-IV	03-08-04	16.5 FW Miles									
9-50-(28)	**First Broad River**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Shelby Downstream Raw Water Intake to Broad River				**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	14.6 FW Miles		**Turbidity**	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
				WBD-12 Number 030501050703							**Hickory Creek-First Broad River**
9-50-30	**Hickory Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C	03-08-04	9.6 FW Miles									
				WBD-12 Number 030501050704							**Beaverdam Creek**
9-50-32	**Beaverdam Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	9.5 FW Miles									
9-50-32-3	**Sugar Branch**		**3a**	**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From source to Beaverdam Creek				Failing Septic Systems	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
C	03-08-04	2.5 FW Miles		Stormwater Runoff	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
				Low pH							

First Broad River Watershed



HUC's 0305010507 & parts of 0305010506

Includes Knob Creek, Brushy Creek, Hickory Creek & Beaverdam Creek

General Watershed Description

The First Broad River and its tributaries originate in Rutherford County (***the First Broad River headwaters***), flow through Cleveland County and join the Broad River just above the North Carolina-South Carolina state line. Tributaries in the First Broad River watershed include Knob Creek, Brushy Creek, Beaverdam Creek and Hickory Creek (Figure 5-2). Land cover is predominantly forested with agriculture, residential and commercials areas (Figure 5-1). Streams exhibit both mountain and piedmont characteristics due to their location within the basin; and geology, soils and streamflows vary.

Watershed at a Glance

Counties

Cleveland

Municipalities

Belwood, Casar, Fallston, Lawndale, Polkville, Kingstown, Lattimore, Shelby, Boiling Springs, Patterson Springs

Permitted Facilities

NPDES WWTP:	8
NPDES Nondischarge:	1
NPDES Stormwater:	16
Animal Operations:	2

Monitored Stream Miles (AL)

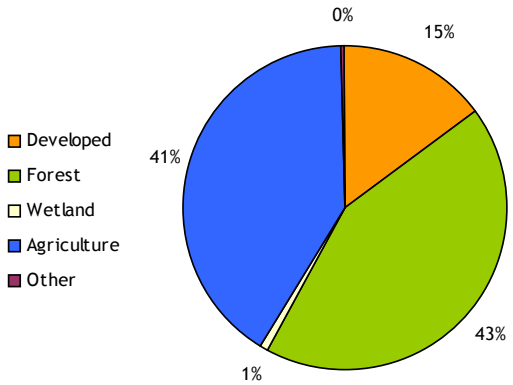
Total Streams:	76.2 mi
Total Supporting:	59.1 mi
Total Impaired:	14.6 mi
Total Not Rated:	2.5 mi

Water Quality Overview

Of the 151 stream miles in the First Broad River watershed, 76.2 were monitored by DWQ. Of these monitored waters, 78 percent are Impaired, 19 percent are Supporting and 3 percent are not rated for aquatic life. The majority of impairments and impacts are associated with fecal coliform bacteria, habitat degradation, turbidity and nutrient impacts.

Biological monitoring was conducted at nine basinwide sites. Two benthic sites improved (Brushy and Beaverdam Creeks), and biologists noted that the improvements are likely the result of higher flows in 2005 versus those measured in 2000 (97 cubic feet per second (cfs) compared to 49 cfs). In those watersheds primarily influenced by point source pollution (such as Brushy and Beaverdam Creeks), increased streamflow can dilute point source discharge and result in short-term improvements to aquatic communities. In protected watersheds (such as in the ***First Broad River headwaters***), increased streamflow can improve instream physical conditions (i.e., increase availability of wet habitat and increased dissolved oxygen levels), which often results in more favorable conditions for macroinvertebrate colonization. Two ambient stations are also located in this watershed.

Figure 5-1: First Broad River Watershed Land Cover

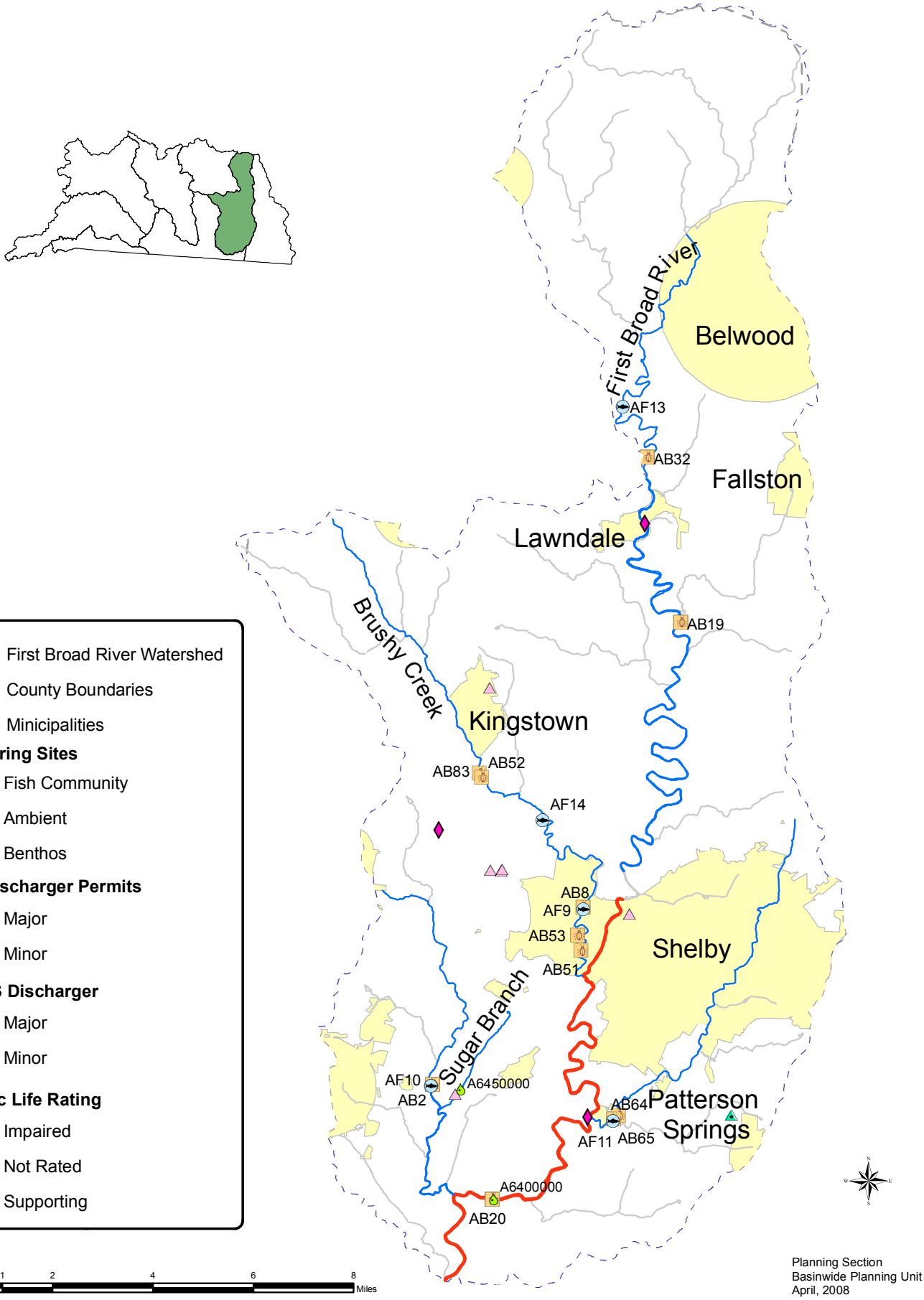


NRI: National Land Cover Data, 2001

Even though the aquatic communities are supporting throughout the watershed, a section of the First Broad River is impaired in the aquatic life category due to a water quality standard violation for turbidity. In addition, the First Broad River is Not Rated in the recreation category, and two streams are identified as streams with noted impacts (Table 5-1).

There are five minor and three major NPDES Discharge Permits within this watershed. Two of these facilities obtained compliance violations between 2002 and 2006.

Figure 5-2: First Broad River Watershed, HUC's 0305010507 & parts of 0305010506



How to Read this Document

This document was written to correspond with our new ***Geographic Online Document Distribution (OGDD)*** tool using Google Earth. If you are unable to use Google Earth, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 5-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 5-B provides a summary of each ambient data monitoring station.
Appendix 5-C provides summaries of biological and fish assessment monitoring sites.

Table 5-1: Monitored Stream Segments In The First Broad River Watershed

AU Number	Stream Name	Length (miles)	Class.	2008 IR Category*	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-50-(19.5)	First Broad River	16.5	WS-IV	2	-	-		03-08-04
9-50-(28)	First Broad River	14.6	C	5	X	-	**Fecal Coliform Bacteria** **Habitat Degradation** **Turbidity**	03-08-04
9-50-19-(2.5)	Knob Creek (Big Knob Creek)	8.3	WS-IV	2	-	-	**Nutrient Impacts** (Stormwater Runoff) **Habitat Degradation** (Natural Conditions)	03-08-04
9-50-19-(4)	Knob Creek (Big Knob Creek)	0.5	WS-IV; CA	2	-	-		03-08-04
9-50-29	Brushy Creek	14.7	C	2	-	-	**Nutrient Impacts** **Habitat Degradation**	03-08-04
9-50-30	Hickory Creek	9.6	C	2	-	-		03-08-04
9-50-32	Beaverdam Creek	9.5	C	2	-	-		03-08-04
9-50-32-3	Sugar Branch	2.5	C	3a	-	X	**Fecal Coliform Bacteria** (Stormwater Runoff, Failing Septic Systems) **Low pH**	03-08-04

*The 2008 IR Categories definitions can be found on the first page of Appendix 5-A

Current Status of Impaired and Impacted Waters

First Broad River AU#: 9-50-(19.5) 9-50-(28)

Two benthic sites (AB19 and AB20) and one ambient monitoring station (AA6) are located on the First Broad River in Cleveland County. Site AB19 received a Good bioclassification. The substrate was slightly embedded with a mix of bedrock (30 percent), rubble (10 percent), gravel (10 percent), sand (20 percent) and silt (20 percent). Habitat was good (habitat score 80); however, DWQ biologists noted eroding streambanks within the sampling reach. The site has

been sampled twice before (1995 and 2000), resulting in a Good bioclassification each time. The abundant presence of three pollution intolerant species and long-lived stoneflies suggests stable and favorable water quality conditions in this section of the river.

Sites AB20 and AA6 are the most downstream sites on the First Broad River; consequently, habitat and water quality is impacted by upstream water and land use. Site AB20 has been sampled seven times since 1983 resulting in a mix of Good-Fair and Fair bioclassifications. In 2005, the site received a Good bioclassification and several pollution intolerant species were collected for the first time. Substrate is mostly sand (80 percent) with some gravel (10 percent) and silt (10 percent). Primary habitat problems include eroding streambanks, frequent breaks in the riparian zone, and inadequate instream habitat.

Despite the Good bioclassification at site AB20, ambient monitoring at site AA6 shows that the water quality standard for turbidity (>50 NTU) was exceeded in 15.5 percent of the samples collected from January 2002 through December 2006. Therefore, this section of the First Broad River is impaired for aquatic life due to exceedences in the water quality standard. This section of the First Broad River is also Not Rated in the recreation category due to high levels of fecal coliform bacteria. Nearly 26 percent of the samples collected exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resources become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. No portion of the First Broad River is classified for primary recreation (Class B); therefore, it was not prioritized for additional sampling during this assessment period. Potential sources of elevated bacteria levels include failing septic systems, straight pipes and nonpoint source runoff from pasture and forestlands.

Recommendations: Restoration is needed to stabilize streambanks and reduce erosion. Installation of fencing along this segment with animal operations will prevent farm animals from eroding streambanks and depositing harmful bacteria and excess nutrients into the surface water. The Town of Shelby should implement a Sediment and Erosion Control Local Program to help control construction site sediment from entering surface waters. More information on local programs can be found on the Division of Land Resources web site.

Knob Creek AU#: 9-50-19-(2.5), 9-50-19-(4)

Knob Creek is located in north-central Cleveland County, where land use consists of agriculture, forest and some residential development. Site AF13 received a Good-Fair bioclassification. In 2005, the number of fish and the percentage of species with multiple age classes was less than those collected in 2000. The bluehead chub (a nutrient indicator species) was the dominant species. DWQ biologists noted that the change in the number and percentage of species was likely impacted by drought (2000) and subsequent high flow conditions experienced during the 2004 hurricane season.

Located approximately 2.5 miles downstream of site AF13, site AB32 received a Good bioclassification. Substrate is mostly sand (90 percent) with only a small amount of gravel (10 percent). Biologists noted several habitat problems, including severe streambank erosion, frequent breaks in the riparian zone and inadequate instream habitat (habitat score 50). Even though Knob Creek has received a Good bioclassification in 1995, 2000 and 2005, the most recent sampling in 2005 shows that the diversity of species is declining. Loss of diversity is often an indication of nonpoint source impacts and changes in habitat.

Brushy Creek AU#: 9-50-29

Brushy Creek is located in west-central Cleveland County. Fish (AF14 and AF9) and benthic (AB8) samples were collected in lower Brushy Creek. Site AF14 received a Good-Fair bioclassification. In 2005, eighteen species were collected with the bluehead chub (a nutrient indicator species) being the dominant species. DWQ biologists noted that the diversity of darters, sunfish, bass and trout were lower than expected.

Fish were also collected at site AF9 in 2004. This site is located 4.1 miles downstream of site AF14 and was selected as part of a fish community urbanization study by NC State University (*unpublished data*). Unlike site AF14, site AF9 rated Excellent. The difference in the ratings was due to the collection of sunfish, bass and trout. Differences were also found in the trophic structure and more species with multiple age groups were identified. The instream habitat, pools and canopy were of greater quality than that found upstream, and the bluehead chub constituted only 24 percent of total number of species downstream compared to 54 percent of the species upstream.

Site AB8 was co-located with site AF9 and received an Excellent bioclassification. Substrate was a mix of slightly embedded

rubble (10 percent), gravel (10 percent), sand (70 percent) and silt (10 percent). Primary habitat problems included poor instream habitat and moderate streambank erosion (habitat score 66). Despite the habitat problems, several pollution intolerant species were collected for the first time in 2005 and conductivity was much lower, suggesting water quality improvements.

Hickory Creek AU#: 9-50-30

Hickory Creek drains the eastern half of the Town of Shelby in south-central Cleveland County. Previous assessments describe the creek as "…generally typical of the basin – sandy substrate, shallow runs, infrequent and small side pools, shallow gravelly riffles." Despite the marginal instream habitat, the riparian zone is wide and intact. Site AF11 received a Good bioclassification. Twenty-four species were collected from the site. The bluehead chub (a nutrient indicator species) and the greenfin shiner were the two dominant species. Trash, including automotive tires and aluminum cans, continue to be an issue in the stream and BMPs are recommended to control sedimentation.

Beaverdam Creek AU#: 9-50-32

Beaverdam Creek drains southwestern Cleveland County. Land use is a mix of forest, agriculture, commercial and residential properties located along the US 74 corridor. Benthic (AB2) and fish (AF10) samples were collected in lower Beaverdam Creek. Site AB2 received an Excellent bioclassification for the first time in 2005. Even though the substrate was an uneven mix of sand (60 percent), gravel (30 percent) and rubble (10 percent), there were several pollution intolerant species present. Increased streamflows likely diluted impacts from the wastewater and stormwater outfalls upstream of the sampling site, and two facilities (Crest High School and Middle School) no longer discharge to Beaverdam Creek.

Site AF10 received a Good fish bioclassification. Twenty-three species were identified; however, the abundance of the bluehead chub (40 percent) and the elevated percentage of omnivore-herbivore species indicate nutrient enrichment from nonpoint sources of pollution. The number of intolerant species has also declined over time and instream habitat did not support predatory fish species.

Site AA7 is located in Sugar Branch, which is a tributary to Beaverdam Creek. Thirty-five percent of the samples collected exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resource become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. No streams in the Beaverdam Creek sub-watershed are classified for primary recreation (Class B); therefore, Sugar Branch was not prioritized for additional sampling during this assessment period. Potential sources of elevated bacteria levels include failing septic systems, straight pipes and nonpoint source runoff from pasture and forestlands. Sugar Branch is Not Rated for recreation. Although not a water quality standard violation, pH is also a noted concern in Sugar Branch. The pH was below the water quality standard of 6.0 in nearly nine percent of the samples collected.

Recommendations for this watershed can be found later in the chapter.

Significant Non-Compliance Issues

There are eight NPDES WWTP permitted in the First Broad River watershed. No significant non-compliance issues were identified for the majority of facilities; however, monitoring and/or operating violations have been issued to a few. Two such facilities are located in the Brushy Creek watershed and include PPG Industries (Permit NC0004685) and Ramseur Washerette (Permit NC0030481). PPG is a major industrial process and commercial wastewater facility with a permitted flow of 1.3 million gallons per day (MGD). In August 2002, PPG started a pilot project where up to 100 percent of their discharge was recovered, filtered and used in the non-contact cooling process. As a result, there has been a significant reduction in the volume of water discharged into Brushy Creek. The facility was last inspected in September 2006 and is in full compliance with its permit limits.

Ramseur Washerette is a minor industrial process and commercial wastewater facility with a permitted flow of 0.0056 MGD. The facility mostly treats wash water from washing machines and two one-stall bathrooms. Ramseur Washerette was last inspected in May 2005 when several violations were noted and included problems related to operations and maintenance, disinfection, lagoons and record keeping. Based on the most recent inspection, the owners were hoping to tie into sewer lines that were being laid throughout the area; however, the line was never laid to the facility. The

facility is identified as non-compliant and the owners are considering closing the facility. If the facility is closed, it is recommended that the permit be rescinded provided that the bathroom facilities are hooked onto a different treatment system (i.e., septic system).

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps owners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination. The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields
- Sediment/Nutrient Delivery Reduction from Fields
- Stream Protection from Animals
- Proper Animal Waste Management
- Agricultural Chemical (agrichemical) Pollution Prevention

Table 5-2: BMPs Installed through NCACSP

Purpose of BMP	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	264.7 ac. 50 linear feet	$46,320
Sediment/Nutrient Delivery Reduction from Fields	3 ac.; 1 unit 725 linear feet	$23,379
Stream Protection from Animals	54 units 15,156 linear feet	$93,323
Proper Animal Waste Management	1 unit	$7,680
Agricultural Chemical Pollution Prevention	--	--
Total Costs		$170,702
Benefits	**0305010507**	
Total Soil Saved (tons)	2,719	
Total Nitrogen (N) Saved (lb.)	2,853	
Total Phosphorus (P) Saved (lb.)	430	
Total Waste-N Saved (lb.)	36,885	
Total Waste-P Saved (lb.)	15,750	

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $170,702 was allocated for BMPs in the First Broad River watershed. Table 5-2 summaries the cost and total BMPs implemented.

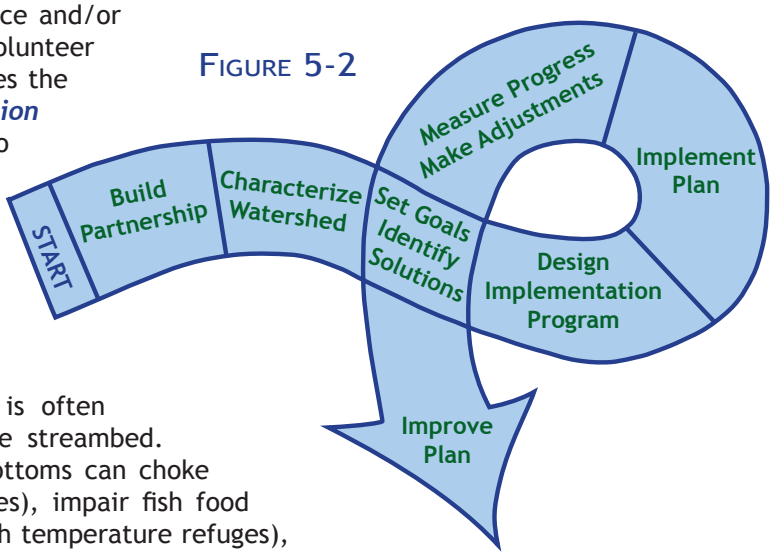
Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 5-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 5-2



Turbidity

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), impair fish food sources, fill in pools (reducing cover from prey and high temperature refuges),

and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs (USEPA, 1999 and Waters, 1995).

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in this watershed. It appears, however, violations are highest near agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land cover is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***. Information about starting a Sediment and Erosion Control Local Program can be found on the ***Division of Land Quality's*** web page.

Fecal Coliform Bacteria

The fecal coliform standard for freshwater is 200 colonies per 100 milliliters (ml) of water based on at least five consecutive samples taken during a 30-day period, not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. There are no waters Impaired for fecal coliform bacteria in the First Broad River watershed. However, fecal coliform bacteria concentrations were above the 400 colonies/100 milliliter (mL) water quality guideline in more than 20 % of at least one ambient monitoring stations in this watershed.

The presence of fecal coliform bacteria in the aquatic environment indicates that the water has been contaminated from the fecal material of humans or other warm-blooded animals. Elevated fecal coliform bacteria numbers can indicate contamination by harmful pathogens or disease causing bacteria or viruses that also exists in fecal material. Livestock and family pets are large contributors to this problem. As seen in Table 2-1, the Agriculture Cost Share Program has installed over 700 linear feet of fencing along streams to help keep livestock out of the streams. This will significantly decrease the amount of fecal coliform bacteria contaminating the streams. Many municipalities have been placing pet waste bag and trash bins in public parks and along green ways to encourage and educate the public on the importance of keeping the waste out of the streams.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

References & Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin.* ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

NCDENR Division of Water Quality. February 2003. *Broad River Basinwide Water Quality Plan.* ***http://h2o.enr.state.nc.us/basinwide/Broad/2002/plan.htm***.

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

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2008 Integrated Report Watershed- Upper First Broad River

Broad River Basin | **WBD-10 Number 0305010506** | **Upper First Broad River**

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501050601											**Headwaters First Broad River**
9-50-(1)	**First Broad River**		**5**	**Low pH**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From source to Cleveland County SR 1530					Aquatic Life	Impaired	Standard Violation	Low pH	2006	2008	5
WS-V;Tr	03-08-04	15.0 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
9-50-4	**North Fork First Broad River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C;Tr,ORW	03-08-04	7.5 FW Miles									
WBD-12 Number 030501050602											**Brier Creek-First Broad River**
9-50-8	**Brier Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C;Tr	03-08-04	6.7 FW Miles									
WBD-12 Number 030501050603											**Wards Creek-First Broad River**
9-50-12	**Wards Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C	03-08-04	10.2 FW Miles									
9-50-13	**Duncans Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C	03-08-04	10.1 FW Miles									
WBD-12 Number 030501050604											**Hinton Creek**
9-50-15	**Hinton Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	13.2 FW Miles									
WBD-12 Number 030501050605											**Knob Creek**
9-50-19-(2.5)	**Knob Creek (Big Knob Creek)**		**2**	**Habitat Degradation** Natural Conditions **Nutrient Impacts** Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From a point 0.3 mile downstream of Adams Creek to a point 0.6 mile upstream of mouth											
WS-IV	03-08-04	8.3 FW Miles									

Broad River Basin — *WBD-10 Number 0305010506* — *Upper First Broad River*

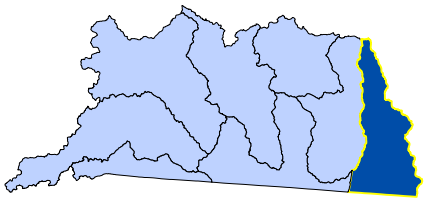
Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
9-50-19-(4)	**Knob Creek (Big Knob Creek)**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From a point 0.6 mile upstream of mouth to First Broad River											
WS-IV;CA	03-08-04	0.5 FW Miles									

2008 Integrated Report Watershed- Lower First Broad River

Broad River Basin | **WBD-10 Number 0305010507** | **Lower First Broad River**

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
				WBD-12 Number 030501050701							**Brushy Creek**
9-50-29	**Brushy Creek**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River				**Nutrient Impacts**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	14.7 FW Miles									
				WBD-12 Number 030501050702							**Magness Creek-First Broad River**
9-50-(19.5)	**First Broad River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From Cleveland County Sanitary District Raw Water Supply Intake (just below Knob Creek) to a point 1.0 mile upstream of Shelby downstream Raw Water Intake											
WS-IV	03-08-04	16.5 FW Miles									
9-50-(28)	**First Broad River**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Shelby Downstream Raw Water Intake to Broad River				**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	14.6 FW Miles		**Turbidity**	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
				WBD-12 Number 030501050703							**Hickory Creek-First Broad River**
9-50-30	**Hickory Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River											
C	03-08-04	9.6 FW Miles									
				WBD-12 Number 030501050704							**Beaverdam Creek**
9-50-32	**Beaverdam Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to First Broad River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-04	9.5 FW Miles									
9-50-32-3	**Sugar Branch**		**3a**	**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From source to Beaverdam Creek				Failing Septic Systems	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
C	03-08-04	2.5 FW Miles		Stormwater Runoff	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
				Low pH							

Buffalo, Kings & Bullock Creek Watershed



HUC's 0305010508, 0305010509 & 0305010511

Includes Muddy Fork, Potts Creek, Beason Creek & Lake York

General Watershed Description

This 10-digit set of HUC's drain to the far eastern side of Cleveland County and portions of Lincoln and Gaston Counties. The Buffalo Creek, Kings Creek and Bullock Creek watersheds contain habitat characteristics of the Northern Piedmont, the Southern Outer Piedmont, and Kings Mountain ecoregions. Major waterbodies draining these watersheds include Muddy Fork, Buffalo, and Beason Creeks. Nearly 50 percent of these watersheds are forested with another 40 percent containing pastureland (Figure 6-1). The City of Kings Mountain is the largest urbanized area (Figure 6-2).

Watershed at a Glance

Counties

Cleveland, Lincoln, Gaston

Municipalities

Kings Mountain, Cherryville, Belwood, Shelby, Waco, Gastonia, Earl, Grover

Permitted Facilities

NPDES WWTP:	7
NPDES Nondischarge:	0
NPDES Stormwater:	28
Animal Operations:	1

Monitored Stream Miles (AL)

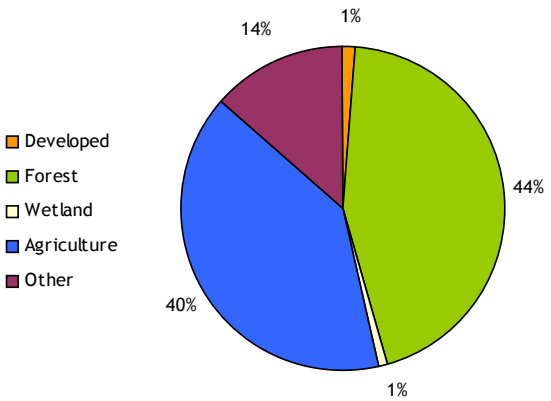
Total Streams:	64.3 mi
Total Supporting:	53.8 mi
Total Impaired:	9.7 mi
Total Not Rated:	0.8 mi

Water Quality Overview

Of the 140 stream miles in the Buffalo, Kings and Bullock Creek watershed, 63 stream miles were monitored by DWQ. Of these waters, 83 percent are Supporting, 16 percent are Impaired and one percent is not rated for aquatic life. The majority of impairments and impacts are associated with habitat degradation. Fecal coliform bacteria, nutrient impacts and turbidity were also issues in this watershed.

Biological monitoring was conducted at nine basinwide sites; two were sampled for the first time in 2005. One additional benthic site was sampled as part of a special study in Potts Creek to evaluate chemical contaminates from a former textile facility. One ambient monitoring station is located in Buffalo Creek near the state line.

Figure 6-1: Buffalo, Kings & Bullock Creek Watershed Land Cover

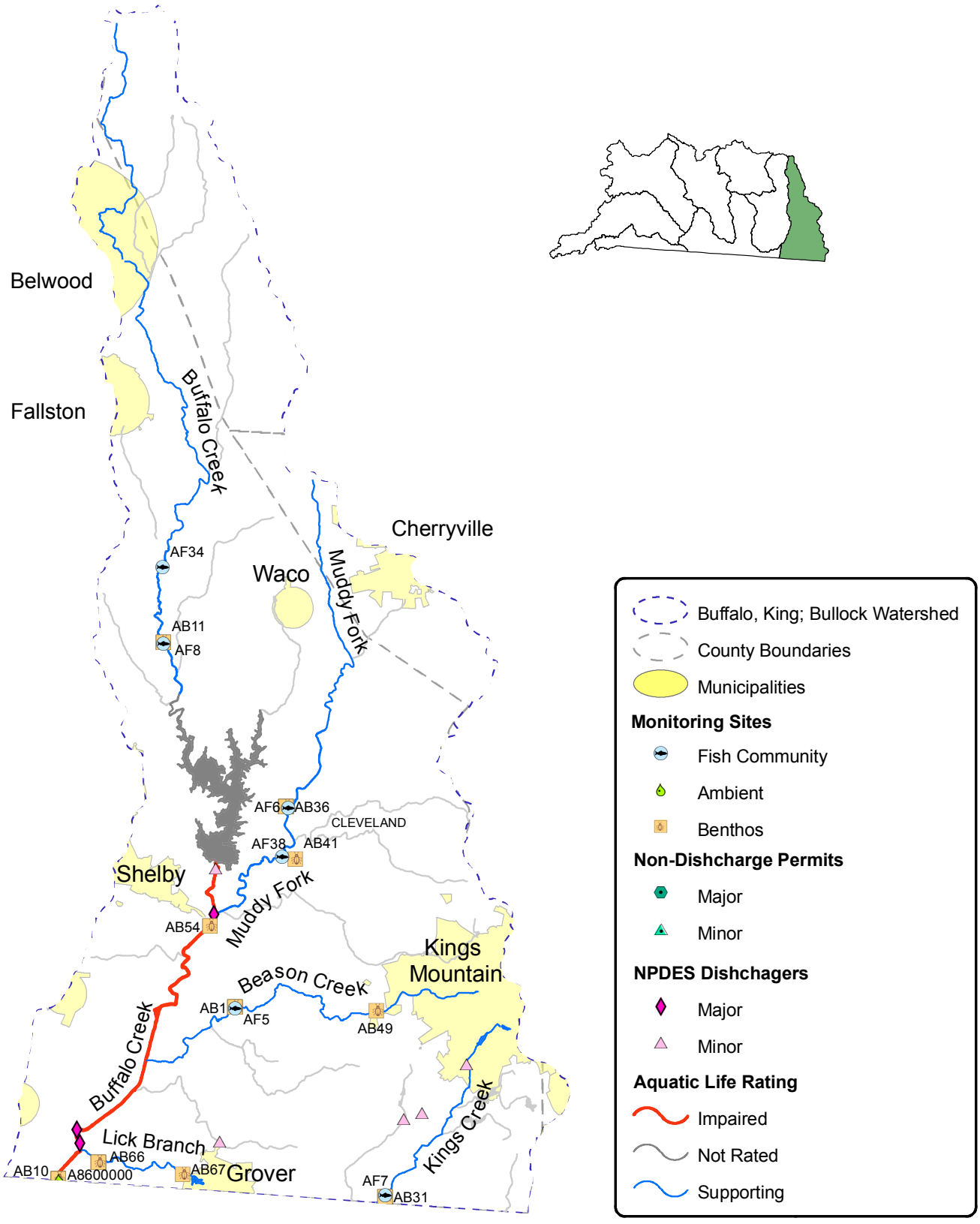


NRI: National Land Cover Data, 2001

Overall, three sites improved, three sites declined, two sites were sampled for the first time, and one remained unchanged. Sedimentation and habitat degradation were noted in several stream segments and a portion of Buffalo Creek below the reservoir is impaired in the aquatic life category due to a water quality standards violation for turbidity.

There are three major and four minor NPDES Discharger Permits within this watershed. The Pilot Creek Wastewater Treatment Plant received two minor color compliance violations. Currently, there is no standard for color. One Animal Operations Permit is issued for a cattle operation on Muddy Fork Creek. The majority of the Stormwater Permits can be found between the Town of Grover and the Town of Kings Mountain.

FIGURE 6-2: BUFFALO, KINGS & BULLOCK CREEKS WATERSHED, HUC'S 0305010508, HUC 0305010509 & 0305010511



Planning Section
Basinwide Planning Unit
April, 2008

How to Read this Document

This document was written to correspond with our new ***Online Geographic Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody classification. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 6-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 6-B provides a summary of each ambient data monitoring station.
Appendix 6-C provides summaries of biological and fish assessment monitoring sites.

Table 6-1: Monitored Stream Segments In The Buffalo, Kings & Bullock Creek Watersheds

AU Number	Stream Name	Length (miles)	Class.	2008 IR Category	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-53-(1)	Buffalo Creek	9.7	C	2	-	-		03-08-05
9-53-(2.9)	Buffalo Creek	0.8	WS-III; CA	3a	-	X		03-08-05
9-53-(5)	Buffalo Creek	20.8	WS-III	5	X	-	**Fecal Coliform Bacteria Habitat Degradation** (Impervious Surface, Stormwater Runoff), **Turbidity**	03-08-05
9-53-11	Lick Branch	3.3	C	2	-	-		03-08-05
9-53-6	Muddy Fork	13.9	C	2	-	-	**Habitat Degradation, Nutrient Impact** (Row Crop Agriculture, Stormwater Runoff)	03-08-05
9-53-8	Beason Creek	10.3	C	2	-	-		03-08-05
9-54	Kings Creek	5.5	C	2	-	-		03-08-05

*The 2008 IR Categories definitions can be found on the first page of Appendix 6-A

Current Status of Impaired & Impacted Waters

Buffalo Creek AU#: 9-53-(1), 9-53-(2.9), 9-53-(5)

Two benthic and one fish site were sampled on Buffalo Creek. Sites AB11 and AF8 are co-located at SR 1908 and both resulted in Good bioclassifications. Substrate was a mix of bedrock (50 percent), sand (20 percent), boulders (10 percent), rubble (10 percent) and gravel (10 percent). Primary habitat problems included lack of root mats, undercut streambanks, and impacts to the riparian zone on the right bank. Conductivity has been very stable over time and the watershed has remained mostly forested. Site AB11 declined from the Excellent it received in 2000. Seasonality

may have played a slight role in the decline, but the increased flows that were measured throughout the basin during 2005 may also be impacting the aquatic communities. In periods of increased precipitation, there is the potential for increased pollution runoff.

Buffalo Creek was first sampled for fish in 1964 by WRC. Only eight species were collected with the bluehead chub being the most abundant species and the stream was described by the biologists as "turbid". Seventeen species were documented in Buffalo Creek in 2000 and 2004. Even though overall diversity was low, the site received the higher bioclassification in 2004 (Good) than in 2000 (Good-Fair). In 2004, there was a higher percentage of insectivores and a lower percentage of omnivores-herbivores.

Site AB10 is located below Kings Mountain reservoir, near the North Carolina – South Carolina state line (NC 198). Substrate is mostly sand (80 percent) with lesser amounts of gravel (10 percent) and silt (10 percent). Land use in the immediate area consists of residential and commercial areas associated with the US 74 corridor along with agricultural and forestland. Habitat problems include extensive streambank erosion and lack of pools and riffles. Site AB10 has been sampled six times since 1983. In 2005, site AB10 declined from the Good it received in 1995 and 2000 to a Good-Fair. Again, seasonality and increased streamflows may have contributed to the decline in bioclassification.

Site AA8 is co-located with site AB10. The water quality standard for turbidity was exceeded in 12.1 percent of the samples that were collected from January 2002 through December 2006. Therefore, this section of the Buffalo Creek is Impaired for aquatic life due to exceedences in the water quality standard for turbidity.

Recommendations: Cleveland County should implement a Sediment and Erosion Control Local Program to help control construction site sediment from entering surface waters. As development increases, a local program is necessary to ensure appropriate BMPs are being installed and maintained properly. More information on local programs can be found on the Division of Land Resources web site.

Muddy Fork AU#: 9-53-6

Muddy Fork is a tributary to Buffalo Creek below the Kings Mountain Reservoir. Muddy Fork drains eastern Cleveland and western Gaston counties, west of the Town of Cherryville. Fish (AF6) and benthic (AB31) samples were collected. Fish were sampled for the first time in 1964. Fourteen species were collected and like many of the sites sampled throughout the basin, bluehead chub was the dominant species. Muddy Creek was sampled in 2000 and 2004. The 2004 site was 1.7 miles upstream of the site that was sampled in 2000 and did not include the Persimmon Creek sub-watershed. Site AF6 received a Good-Fair fish bioclassification, which is a decline in the Good rating it received in 2000. The slight difference was due to the absence of bluegill, which were collected in 2000. Bluehead chub continue to be the dominant species. They are also an indicator of nutrient enrichment from nonpoint sources.

Site AB31 is located nearly two miles downstream of site AF6. Land use in the immediate area consists of residential properties with scattered tracts of agriculture and forestland. Primary habitat problems included moderate streambank erosion and lack of pools and riffles. Substrate was mostly sand (60 percent) with rubble (20 percent) and gravel (20 percent). Site AB31 has been sample five times since 1983 and received an Excellent during the most recent sampling event. Several pollution intolerant taxa were collected at the site including two long-lived, intolerant stonefly species. This suggests that Muddy Fork is stable and has overall favorable water quality conditions. Like the upstream segment, this section of Muddy Fork receives a fair amount of nonpoint source runoff. Urban and agricultural BMPs should be installed to protect the existing aquatic habitat.

Potts Creek AU#: 9-53-6-3

Potts Creek was sampled at site AB41 as part of a special study requested by the DWQ Mooresville Regional office. The site is approximately four miles downstream of the former Cinderella Mills (textile plant) where tetrachloroethylene (TCE) was released into several of the surrounding tributaries. Site AB41 received a Good rating and the data indicates that there are no adverse effects on Potts Creek from the chemical release.

Recommendations for this watershed can be found later in this chapter.

Significant Non-Compliance Issues

No significant non-compliance issues were identified for the permitted NPDES WWTP facilities in these watersheds.

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps owners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination. The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

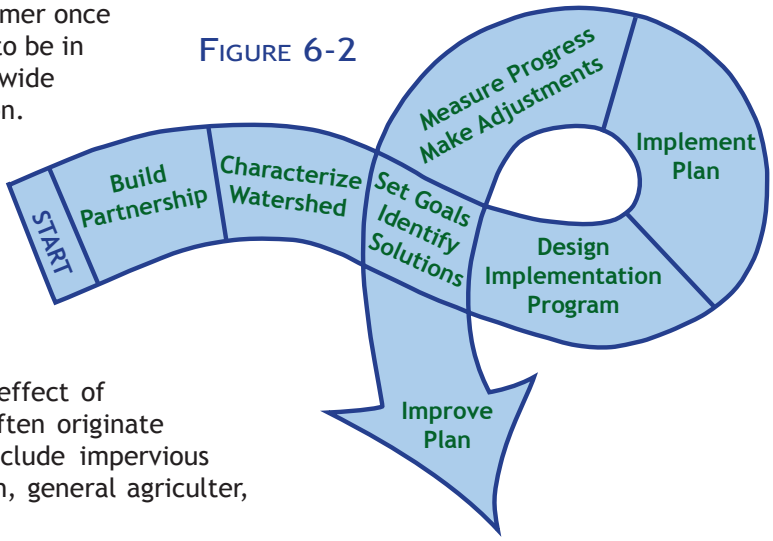
- Erosion Reduction/Nutrient Loss Reduction in Fields;
- Sediment/Nutrient Delivery Reduction from Fields;
- Stream Protection from Animals;
- Proper Animal Waste Management; and
- Agricultural Chemical (agrichemical) Pollution Prevention.

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $83,244 was allocated for BMPs in the Buffalo Creek watershed. Table 6-2 summaries the cost and total BMPs implemented.

Table 6-2: BMPs Installed through NCACSP

Purpose of BMP	0305010508	
	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	93.7 acres	$13,546
Sediment/Nutrient Delivery Reduction from Fields	4 units	$30,655
Stream Protection from Animals	21 units 7,311 linear feet	$32,778
Proper Animal Waste Management	2 units	$6,265
Agricultural Chemical Pollution Prevention	--	--
Total Costs		**$83,244**
Benefits	0305010508	
Total Soil Saved (tons)	2,102	
Total Nitrogen (N) Saved (lb.)	3,516	
Total Phosphorus (P) Saved (lb.)	204	
Total Waste-N Saved (lb.)	26,770	
Total Waste-P Saved (lb.)	44,616	

Figure 6-2



Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 6-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Turbidity

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), impair fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs (USEPA, 1999 and Waters, 1995).

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution

of turbidity violations and sample locations make it difficult to isolate a single source of erosion in this watershed. It appears, however, violations are highest near agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land cover is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***. Information about starting a Sediment and Erosion Control Local Program can be found on the ***Division of Land Quality's*** web page.

Fecal Coliform Bacteria

The fecal coliform standard for freshwater is 200 colonies per 100 milliliters (ml) of water based on at least five consecutive samples taken during a 30-day period, not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. There are no waters Impaired for fecal coliform bacteria in this watershed. However, fecal coliform bacteria concentrations were above the 400 colonies/100 milliliter (mL) water quality guideline in more than 20% of at least one ambient monitoring stations in this watershed.

The presence of fecal coliform bacteria in the aquatic environment indicates that the water has been contaminated from the fecal material of humans or other warm-blooded animals. Elevated fecal coliform bacteria numbers can indicate contamination by harmful pathogens or disease causing bacteria or viruses that also exists in fecal material. Livestock and family pets are large contributors to this problem. As seen in Table 2-1, the Agriculture Cost Share Program has installed over 7,300 linear feet of fencing along streams to help keep livestock out of the streams. This will significantly decrease the amount of fecal coliform bacteria contaminating the streams. Many municipalities have been placing pet waste bag and trash bins in public parks and along green ways to encourage and educate the public on the importance of keeping the waste out of the streams.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

References & Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin*. ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

NCDENR Division of Water Quality. February 2003. *Broad River Basinwide Water Quality Plan*. ***http://h2o.enr.state.nc.us/basinwide/Broad/2002/plan.htm***.

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.

2008 Integrated Report Watershed- Buffalo Creek

Broad River Basin | **WBD-10 Number 0305010508** | **Buffalo Creek**

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501050801											**Headwaters Buffalo Creek**
9-53-(1)	**Buffalo Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to a point 0.3 mile upstream of Long Creek					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-III	03-08-05	20.8 FW Miles									
WBD-12 Number 030501050802											**Kings Mountain Reservoir-Buffalo Creek**
9-53-(2.9)	**Buffalo Creek (Kings Mountain Reservoir)**		**3a**		Aquatic Life	Not Rated	Data Inconclusive	High Water Temperature	2006		3a
From a point 0.3 mile upstream of Long Creek to dam at Kings Mountain Reservoir, Buffalo Creek											
WS-III;CA	03-08-05	0.8 FW Miles									
WBD-12 Number 030501050803											**Muddy Fork**
9-53-6	**Muddy Fork**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Buffalo Creek				**Nutrient Impacts**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-05	13.9 FW Miles		Row Crop Agriculture							
				Stormwater Runoff							
WBD-12 Number 030501050804											**Beason Creek-Buffalo Creek**
9-53-(5)	**Buffalo Creek**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From dam at Kings Mountain Reservoir to North Carolina-South Carolina State Line				**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-05	9.7 FW Miles		Impervious Surface	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Stormwater Runoff							
				Turbidity							
9-53-8	**Beason Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Buffalo Creek					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-08-05	10.3 FW Miles									
WBD-12 Number 030501050805											**Outlet Buffalo Creek**
9-53-11	**Lick Branch**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2000		1
From source to Buffalo Creek											
C	03-08-05	3.3 FW Miles									

2008 Integrated Report Watershed- Kings Creek

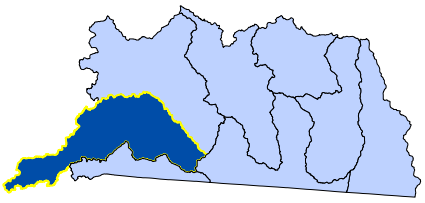
Broad River Basin

WBD-10 Number 0305010509

Kings Creek

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
					WBD-12 Number	**030501050901**		**Headwaters Kings Creek**			
9-54	**Kings Creek**		**2**								
From source to North Carolina-South Carolina State Line											
C	03-08-05	5.5 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1

Green River Watershed



HUC's 0305010501 & 0305010502

Includes Joe Creek, Brights Creek, Walnut Creek & Whiteoak Creek

General Watershed Description

The Green River and its tributaries originate in Henderson and Polk Counties and flow into the Broad River near the Polk-Rutherford County line. Tributaries to the Green River include Joe Creek, Brights Creek, Hungry River, Britten Creek, Walnut Creek and Whiteoak Creek (Figure 7-2). From the headwaters to Rock Creek, the Green River is designated High Quality Waters (HQW). Further downstream, the river has been dammed in two locations to form Lakes Summit and Adger. Both reservoirs are used to produce hydroelectric power; neither is classified as a water supply watershed. The Green River Game Land and the Green River Preserve provide important protected areas to help maintain existing water quality throughout the watershed. Much of the watershed is forested; however, portions are rapidly being developed for second homes and recreational activities (Figure 7-1).

Watershed at a Glance

Counties

Henderson, Polk

Municipalities

Saluda, Columbus

Permitted Facilities

NPDES WWTP:	6
NPDES Nondischarge:	1
NPDES Stormwater:	6
Animal Operations:	2

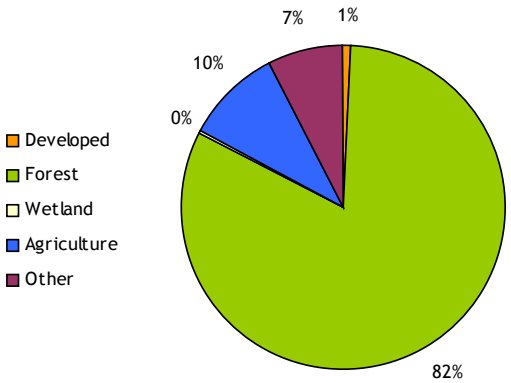
Monitored Stream Miles (AL)

Total Streams:	109.9 mi
Total Supporting:	109.9 mi
Total Impaired:	0 mi
Total Not Rated:	0 mi

Water Quality Overview

Of the 268 stream miles in the Green River watershed, 109 miles were monitored by DWQ. Of these waters, 100 percent are rated as Supporting for aquatic life. Main stressors in this watershed are habitat degradation and nutrient impacts due to construction activities and stormwater runoff (Table 7-1).

Figure 7-1: Green River Watershed Land Cover



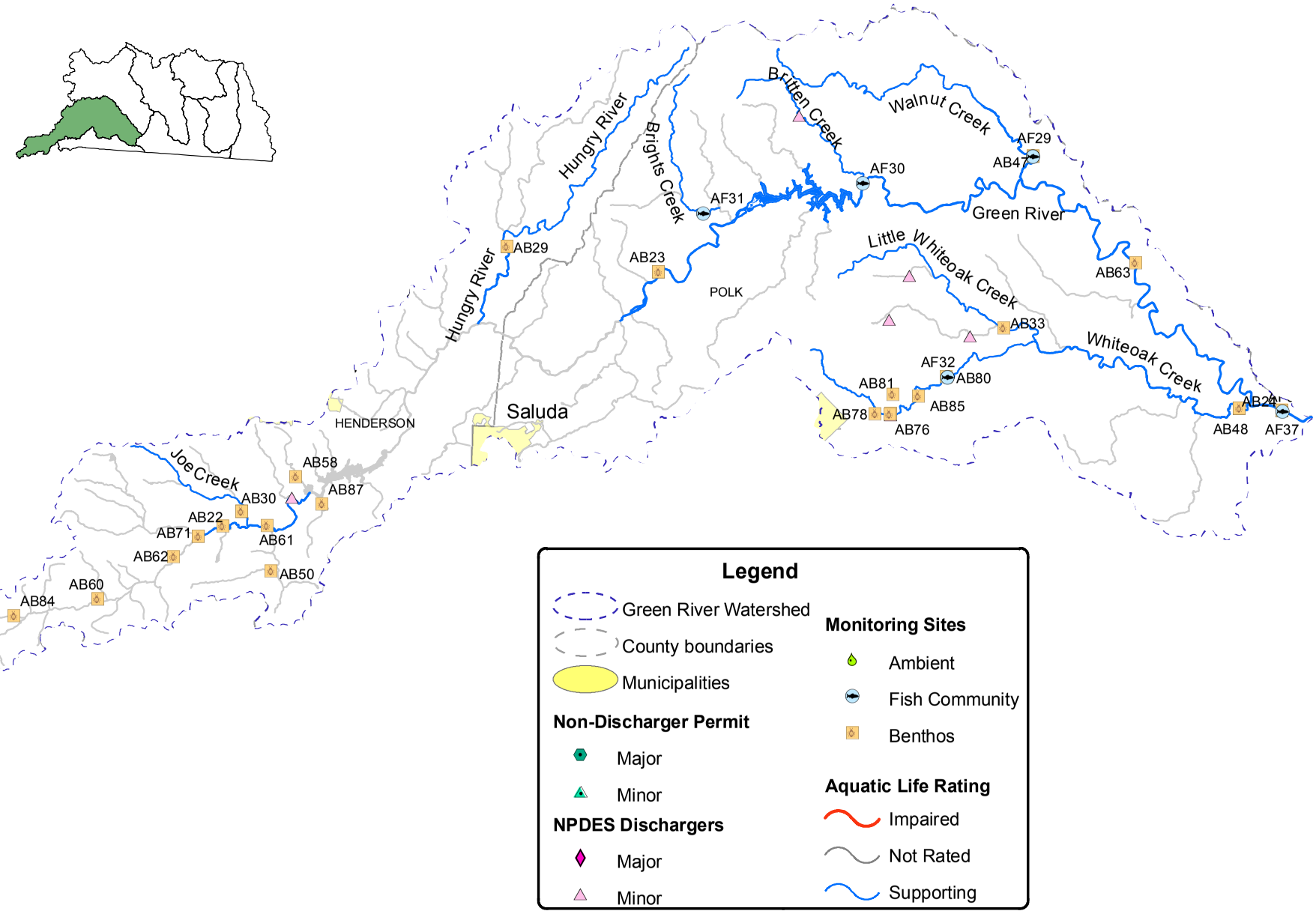
NRI: National Land Cover Data, 2001

Biological monitoring was conducted at nine basinwide sites, two of which were sampled for the first time in 2005. Benthic samples were also collected from three special study sites – Green River headwaters, Joe Creek and Little Whiteoak Creek.

No waters are Impaired in the Green River watersheds; however, sedimentation was observed in many of the streams and further investigation is needed to determine the status of the HQW designation of the Green River (Table 7-1). For more information on HQW designations, see ***Chapter 2*** of *DWQs Supplemental Guide to North Carolina's Basinwide Planning*.

There are six minor NPDES Discharge Permits within this watershed, not including a seventh facility (Six Oaks Complex) which has recently been built. Its first inspection was in February of 2007. Of the six Stormwater Permits, five of the facilities discharge to Whiteoak Creek and its headwaters.

Figure 7-2: Green River Watershed, HUC's 0305010501 & HUC 0305010502



Planning Section
Basinwide Planning Unit
April, 2008

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Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 7-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 7-B provides a summary of each ambient data monitoring station (THERE ARE NO AMBIENT STATIONS IN THIS WATERSHED).
Appendix 7-C provides summaries of biological and fish assessment monitoring sites.

Table 7-1: Monitored Stream Segments In The Green River Watersheds

AU Number	Stream Name	Length (miles)	Class.	2008 IR Category	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-29-(12.5)a	Green River	4.6	B; Tr	2	-	-		03-08-03
9-29-(33)	Green River	39.0	C	2	-	-	**Habitat Degradation,** (Construction) **Nutrient Impact** (Stormwater Runoff)	03-08-03
9-29-14	Joe Creek	4.6	B; Tr	2	-	-	**Habitat Degradation**	03-08-03
9-29-30	Hungry River	12.5	C; Tr	2	-	-		03-08-03
9-29-38-1	Brights Creek	5.3	C; Tr	2	-	-		03-08-03
9-29-43	Britten Creek	6.1	C	2	-	-		03-08-02
9-29-44	Walnut Creek	11.6	C	2	-	-		03-08-02
9-29-46	Whiteoak Creek	18.1	C	2	-	-		03-08-02
9-29-46-1	Little Whiteoak Creek	8.0	C	2	-	-	**Habitat Degradation,** (Animals, Construction)	03-08-02

*The 2008 IR Categories definitions can be found on the first page of Appendix 7-A

Current Status of Impaired & Impacted Waters

Green River AU#: 9-29-(12.5)a

Three benthic samples were collected in the Green River. Two (AB23 and AB24) are basinwide sites; one (AB22) was sampled at the request of DWQ regional office staff to evaluate the impacts of commercial and residential development on water quality above Lake Summit.

Located approximately three miles upstream of the lake, site AB22 received a Good-Fair bioclassification. Several samples were collected above Lake Summit in 1989 and 1993. All received a Good or Excellent bioclassification; however, the most recent Good-Fair shows a significant decline in water quality. Land cover in the area is predominantly agriculture

with some forest and residential areas nearby; however, development pressure is evident throughout the watershed. Substrate was a mix of boulder (15 percent), rubble (25 percent), gravel (15 percent), sand (35 percent) and silt (10 percent). Instream habitat was abundant; however, moderate streambank erosion and narrow riparian zones were identified as habitat problems. More sampling is warranted based on the close proximity of the HQW designation just upstream of the sampling reach (***BAU Memo, December 2005***).

Site AB23 is located between Lake Summit and Lake Adger and received a Good bioclassification, a slight improvement from the Good-Fair it received in both 1995 and 2000. Substrate is a mix of rubble (35 percent), boulder (20 percent), gravel (20 percent) and sand (25 percent). Instream habitat consisted of leafpacks, snags, undercut streambanks, and frequent pools and riffles. DWQ biologists also noted that the riparian zones were intact.

Site AB24 is located near the mouth of the Green River and has been sampled five times since 1987. In 1987 and 1989, the site received a Good bioclassification. Since 1995, however, the site has consistently rated Good-Fair. Even though the site has consistently rated Good-Fair, species number and type declined significantly in 2005, and DWQ biologists believe this decline is likely attributed to increased nutrient input and sediment from development activities in around Lake Adger. Substrate was a mix of rubble (45 percent), boulder (20 percent), sand (20 percent), gravel (10 percent) and some bedrock.

Joe Creek AU#: 9-29-14

Joe Creek is a small tributary to the Green River and was sampled as part of a follow-up to special studies conducted in 1989 and 2000. In 1989, site AB30 received a Good-Fair. In 2000, the site received an Excellent. In 2005, the site dropped back down to a Good-Fair. Substrate was a mix of rubble (35 percent), gravel (30 percent), sand (30 percent) and boulder (5 percent). Land cover is predominantly agriculture; however, like many watersheds in the Broad River basin, land cover is quickly changing to commercial and residential properties. DWQ biologists recommend additional monitoring on Joe Creek and throughout the Green River headwaters to evaluate the impacts to water quality from land cover changes.

Brights Creek AU#: 9-29-38-1

Site AF31 was sampled for the first time in 2005 and received a Good bioclassification. It was the smallest sub-watershed sampled in the Broad River basin and was originally identified as a potential regional fish reference site in 1998. However, during the time of sampling, DWQ biologists noted that the area nearby and immediately upstream of the site was being developed into a 4,500-acre (7 mi^2) residential golf club. When sampled on June 23, 2005, biologists observed that land clearing activities followed by a storm event had contributed to excessive turbidity and thick sediment deposits in the creek. A non-discharge permit has been issued to the Brights Creek Golf Club. The permit allows the facility to spray disinfected (ultraviolet disinfection) effluent onto the development's golf course. The DWQ regional office staff in the Aquifer Protection Section will be responsible for compliance evaluations on this facility.

Walnut Creek AU#: 9-29-44

Walnut Creek drains the extreme northeast corner of Polk County. Within the sampling reach, the DWQ biologists noted very diverse habitat. The lower one-third of the reach has a cobble and boulder substrate with riffles and a swift current. The upper two-thirds of the reach is shallower, slower moving, and the substrate is mostly sand. Site AF29 received an Excellent bioclassification in 2000 and 2005. DWQ biologists note that the watershed and the fish community are unique in that:

- Twenty-five species have been collected from the stream, including ten species of minnows, five species of suckers and four species of darters. It is only one of two streams in the basin where this many species have been collected;
- Six pollution intolerant species have been collected;
- Regional endemic species inhabiting the stream include three chub species and a darter;
- Two species (the brassy jumprock and the piedmont darter) are rare to uncommon in the basin; and
- Only one non-native (exotic) species was collected from the stream.

Site AB47 received a Good bioclassification. Species collected in 2000 (Excellent) and 2005 (Good) are indicative of a minimally impacted stream segment. The slight difference in rating may be due to seasonality and scouring that likely occurred during the 2004 hurricane season. Sediment was identified as a habitat concern for the Walnut Creek watershed.

Whiteoak and Little Whiteoak Creeks AU#: 9-29-46, 9-29-46-1

Whiteoak Creek drains central Polk County, which includes the Town of Columbus. Sites AF32 and AB48 received Good bioclassifications. Ten fish species were collected at site AF32. This included both pollution tolerant and intolerant species with the bluehead chub being the dominant species. The bluehead chub is often an indicator of nutrient enrichment; therefore, nutrients are identified as a concern for this watershed. Site AB48 has been sampled five times since 1986. The site was rated Good-Fair in 1986, but subsequent years have resulted in a Good bioclassification. The substrate is a mix of rubble, boulder and gravel (50 percent) and sand (50 percent). Fewer species were collected in 2005 when compared to previous years of sampling indicating a decline in water quality. DWQ biologists identified sediment as a concern for the Whiteoak Creek watershed.

Little Whiteoak Creek is a tributary to Whiteoak Creek and was sampled as a special study site to evaluate impacts from development activities in the watershed. Site AB33 received a Good-Fair bioclassification. Several pollution tolerant and intolerant species were collected; however, animal waste in the stream likely contributed to the Good-Fair rating. Within the sampling reach, cattle had unlimited access and riparian zones were limited due to agricultural activities along both sides of the stream. Livestock exclusion is recommended along Little Whiteoak Creek to prevent further degradation of the stream.

Recommendations for these waters can be found later in this chapter.

Significant Non-Compliance Issues

Upon request, DWQ provides technical assistance to facilities that are interested in upgrading or changing their treatment procedure. DWQ technical assistance is provided to ensure that the facility remains in compliance with the permitted limits while also exploring other treatment options. The Town of Columbus' WWTP (Permit NC0021369) requested DWQs assistance in August 2007. DWQ provided guidance on flow measurements and composite sampling and advised the installation of an automatic bar screen to improve the performance of the secondary clarifier. The Town is also in the process of obtaining funds to perform a feasibility study for a regional wastewater treatment plant for the Towns of Columbus, Tryon and Saluda. The study will evaluate the feasibility of treating all of the towns' wastewater at the Tryon WWTP and eliminating the other two (Columbus and Saluda WWTPs). DWQ staff believes that a countywide system would be an asset to Polk County residents and support the efforts of the Town of Columbus to efficiently and effectively treat wastewater in their area.

No significant non-compliance issues were identified within the Green River watersheds.

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps landowners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination. The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields;
- Sediment/Nutrient Delivery

Table 7-2: BMPs Installed through NCACSP

Purpose of BMP	0305010502		0305010503	
	Total Implemented	Cost	Total Implemented	Cost
Erosion Reduction/ Nutrient Loss Reduction in Fields	0.95 acres	$13,045	8.9 acres	$1,200
Sediment/Nutrient Delivery Reduction from Fields	1 unit	$5,140	--	--
Stream Protection from Animals	2 unit 600 linear feet	$10,185	3 units 5,234 linear feet	$16,796
Proper Animal Waste Management	--	--	--	--
Agricultural Chemical Pollution Prevention	1 unit	$2,789	2 units	$18,627
Total Costs		$31,159		$36,623
Benefits (lb.)	**0305010502**		**0305010503**	
Total Soil Saved (tons)	98		7	
Total Nitrogen (N) Saved	255		9	
Total Phosphorus (P) Saved	185		--	
Total Waste-N Saved	853		--	
Total Waste-P Saved	377		--	

Reduction from Fields;
- Stream Protection from Animals;
- Proper Animal Waste Management; and
- Agricultural Chemical (agrichemical) Pollution Prevention.

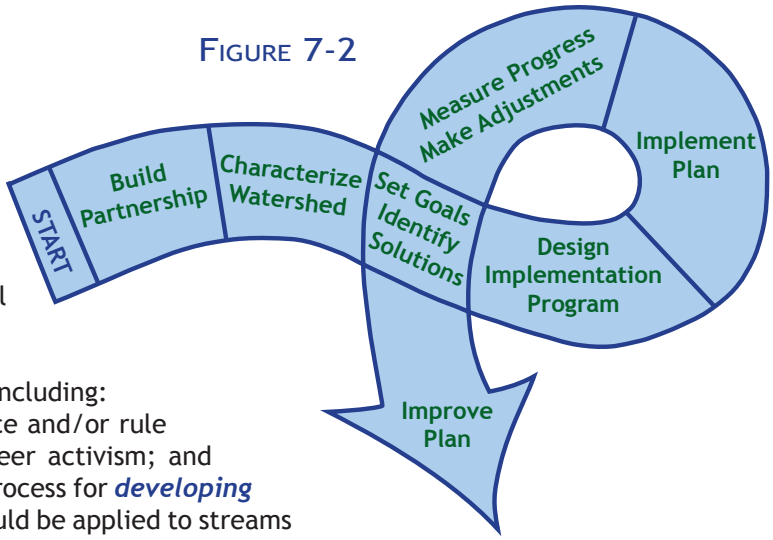
The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $67,782 was allocated for BMPs in the Green River watershed. Table 7-2 summaries the cost and total BMPs implemented.

Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

Figure 7-2



Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 7-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

References & Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin*. ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

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NCDENR Division of Water Quality. February 2003. *Broad River Basinwide Water Quality Plan*. ***http://h2o.enr.state.nc.us/basinwide/Broad/2002/plan.htm***.

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2008 Integrated Report Watershed- Upper Green River

Broad River Basin — WBD-10 Number 0305010501 — Upper Green River

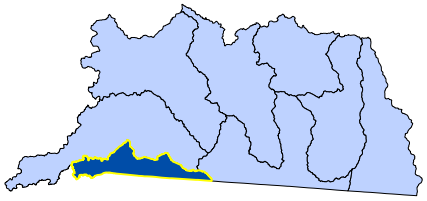
Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501050101 — Lake Summit-Green River											
9-29-(12.5)a	**Green River (Lake Summit below elevation 2011)**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From Rock Creek to Lake Summit											
B;Tr	03-08-03	4.6 FW Miles									
9-29-14	**Joe Creek**		**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Green River											
B;Tr	03-08-03	4.6 FW Miles									
WBD-12 Number 030501050102 — Hungry River											
9-29-30	**Hungry River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Green River											
C;Tr	03-08-03	12.5 FW Miles									
WBD-12 Number 030501050103 — Cove Creek-Green River											
9-29-(33)	**Green River, including Lake Adger below elevation 913)**		**2**	**Habitat Degradation** Construction **Nutrient Impacts** Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From Cove Creek to Broad River											
C	03-08-03	39.0 FW Miles									
WBD-12 Number 030501050104 — Lake Adger-Green River											
9-29-38-1	**Brights Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Rash Creek											
C;Tr	03-08-03	5.3 FW Miles									

2008 Integrated Report Watershed- Lower Green River

Broad River Basin — WBD-10 Number 0305010502 — Lower Green River

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501050201 — Walnut Creek											
9-29-44	**Walnut Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Green River											
C	03-08-02	11.6 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WBD-12 Number 030501050202 — Upper White Oak Creek											
9-29-46	**Whiteoak Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Green River											
C	03-08-02	18.1 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
9-29-46-1	**Little Whiteoak Creek**		**2**	**Habitat Degradation** Animals Construction	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Whiteoak Creek											
C	03-08-02	8.0 FW Miles									
WBD-12 Number 030501050204 — Wheat Creek-Green River											
9-29-43	**Britten Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Green River											
C	03-08-02	6.1 FW Miles									

North Pacolet River Watershed



HUC's 0305010512 & 0305010515

Includes Buck Creek, Upper, Middle & Lower North Pacolet River

General Watershed Description

The North Pacolet River begins in the far most southeast corner of Henderson County, flows east-southeast towards the southern most portion of Polk County and then into South Carolina where it eventually joins the Pacolet River and the Broad River. The river flows through portions of the Southern Crystalline ridges and mountains and the southern inner and outer piedmont ecoregions. Nearly 80 percent of the land is forested, while the remaining 20 percent is mostly pasture with scattered residential and urban areas (Figure 8-1). The only urbanized areas are located in the Towns of Saluda, Tryon and Columbus (Figure 8-2).

Watershed at a Glance

Counties

Henderson, Polk

Municipalities

Saluda, Tryon, Columbus

Permitted Facilities

NPDES WWTP:	8
NPDES Nondischarge:	0
NPDES Stormwater:	2
Animal Operations:	0

Monitored Stream Miles (AL)

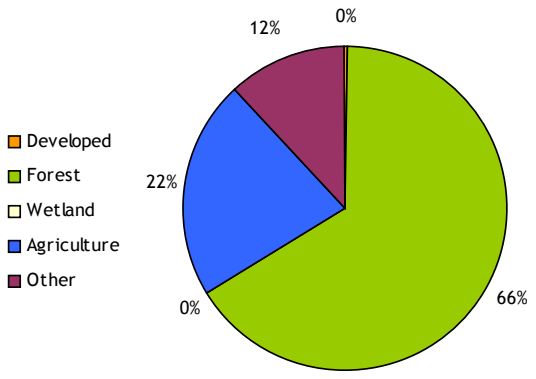
Total Streams:	17.9 mi
Total Supporting:	17.9 mi
Total Impaired:	0 mi
Total Not Rated:	0 mi

Water Quality Overview

Of the 69 stream miles in the North Pacolet River watershed, 18 miles were monitored by DWQ. Of these waters 100 percent are Supporting for aquatic life. Major stressors in this watershed are habitat degradation and nutrient impacts from stormwater runoff and wastewater treatment plants.

Biological monitoring was conducted at three basinwide sites; one was sampled for the first time in 2005. One additional benthic site was sampled as part of a special study in the North Pacolet River to establish reference conditions.

Figure 8-1: North Pacolet River Watershed Land Cover

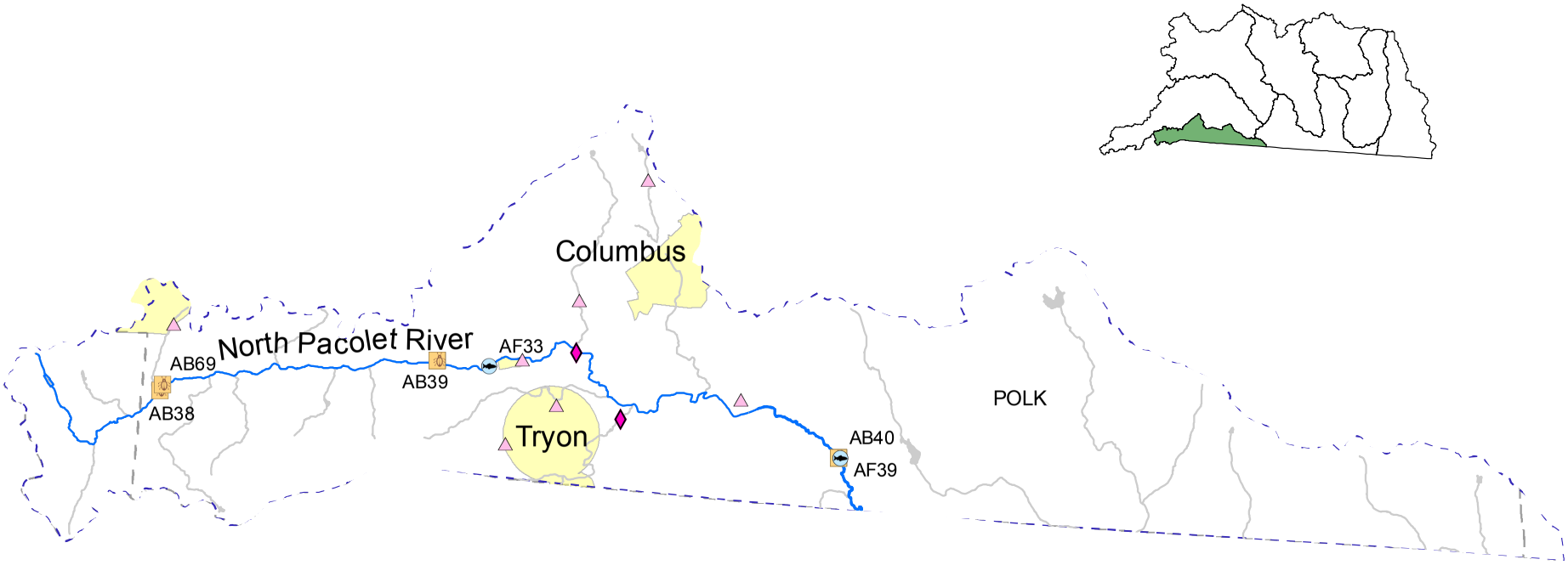


NRI: National Land Cover Data, 2001

Overall, water quality in the North Pacolet River watershed has remained unchanged and even improved in some cases. No Impaired waterbodies were identified; however, impacts were noted at the fish monitoring site in the North Pacolet River.

There are six minor and two major NPDES discharge permits within this watershed. The Saluda Wastewater Treatment Plant was approved for construction upgrades in 2006. The Tryon Middle School Wastewater Treatment Plant closed in 2005 and was sold to the Town of Tryon. This facility has produced little to no discharge since that time. The Carolina Yarn Processors facility has had no discharge during the last two compliance evaluations. All other facilities were in compliance. There are two stormwater permits in this watershed located on the out skirts of the Town of Tryon.

Figure 8-2: North Pacolet River HUC's 0305010512 & 0305010515



Legend

- Watershed Boundaries
- County boundaries
- Municipalities

Non-Discharger Permit

- Major
- Minor

NPDES Dischargers

- Major
- Minor

Monitoring Sites

- Ambient
- Fish Community
- Benthos

Aquatic Life Rating

- Impaired
- Not Rated
- Supporting

0 1.25 2.5 5 7.5 10 Miles

Planning Section
Basinwide Planning Unit
April, 2008

How to Read this Document

This document was written to correspond with our new ***Online Geographic Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 8-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 8-B provides a summary of each ambient data monitoring station (THERE ARE NO AMBIENT STATIONS IN THIS WATERSHED).
Appendix 8-C provides summaries of biological and fish assessment monitoring sites.

Table 8-1: Monitored Stream Segments In The North Pacolet River Watershed

AU Number	Stream Name	Length (miles)	Class.	2008 IR Category	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-55-1-(1)	North Pacolet River	10.5	C;Tr	2	-	-	**Habitat Degradation, Nutrient Impact** (Stormwater Runoff, WWTP NPDES)	03-08-06
9-55-1-(10)	North Pacolet River	7.4	C	2	-	-		03-08-06

*The 2008 IR Categories definitions can be found on the first page of Appendix 6-A

Current Status of Impaired & Impacted Waters

North Pacolet River AU#: 9-55-1-(1), 9-55-1-(10)

Three benthic sites (AB38, AB39 and AB40) and one fish site (AF33) were sampled on the North Pacolet River. Site AB38 was part of a special study and was sampled well upstream of the previous sampling sites in order to establish a reference point for future water quality studies in the watershed. Site AB38 rated Excellent and can be used as a habitat reference site for the North Pacolet River.

Site AB39 also rated Excellent, an improved from the Good rating the site received in 1995 and 2000. Despite the Excellent rating, however, DWQ biologists noted severe streambank erosion, poor riparian areas on both sides and a lack of instream habitat. DWQ biologists note that the improved rating may be the result of increased stream flow measured in 2005 versus the previous assessment in 2000. In protected watersheds, increased stream flow often results in more favorable stream conditions such as increased availability of wetted habitat and increased dissolved oxygen levels, both of which improve macroinvertebrate colonization.

Site AF33 on the North Pacolet River was sampled for the first time in 2005. The site is located just west of the Town of Tryon and habitat characteristics were of moderate to high quality. Residential properties along both sides of the streambanks were altered resulting in a fairly open canopy, grassy lawns cut down to the streambank and bank altering. Streambank erosion was also evident. Even though more fish were collected from this site than from any other site in the basin (962 fish collected), site AF33 rated Good-Fair. Nearly 60 percent of the fish collected were bluehead chub, an indication of nutrient enrichment.

DWQ biologists also documented a reproducing population of naturalized, rainbow trout in this segment of the North Pacolet River. Here the river has the supplemental classification of trout and is also stocked periodically by the NC Wildlife Resources Commission (WRC) with three trout species. DWQ biologists collected all three species during the time of sampling.

Site AB40 rated Good, a slight improvement from the Good-Fair the site received in 2000. The most notable habitat concerns included instream habitat (i.e., infrequent pools and small riffle substrate) and poor riparian vegetation on the right streambank. A few pollution intolerant species were collected for the first time. Since the last assessment period, Grover Industries (Permit NC0004391) has substantially reduced it's yarn dying operation. As a result, the discharge is currently reduced in overall volume and is now 100 percent domestic and non-process wastewater. This change in discharge volume and type may have contributed to the improved rating.

Significant Non-Compliance Issues

No significant non-compliance issues were identified for the permitted NPDES WWTP facilities in these watersheds.

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps owners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination.

The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields;
- Sediment/Nutrient Delivery Reduction from Fields;
- Stream Protection from Animals;
- Proper Animal Waste Management; and
- Agricultural Chemical (agrichemical) Pollution Prevention.

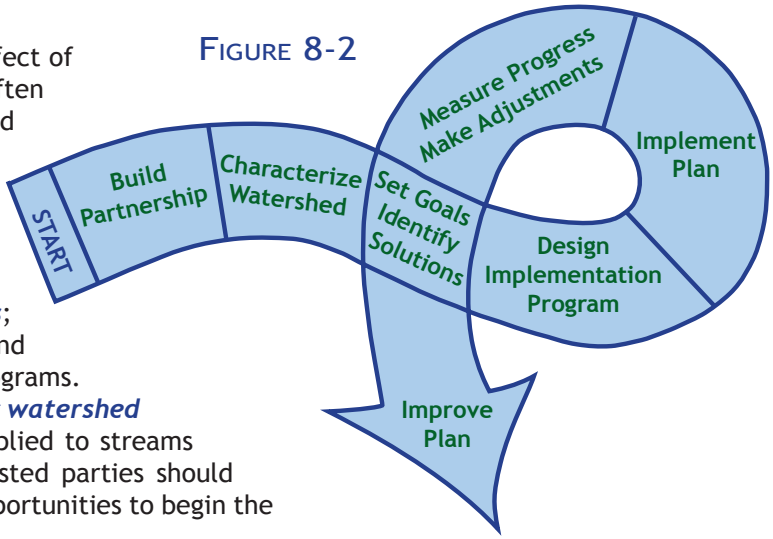
The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $9,000 was allocated for BMPs in the North Pacolet River watershed for the development and implementation of proper animal waste management.

Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

Figure 8-2



Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 8-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the

planning and restoration process in their chosen watershed.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

References and Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin*. ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

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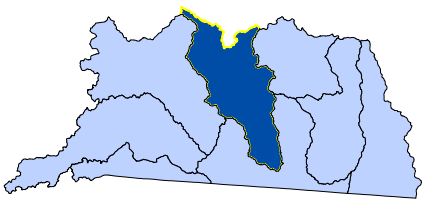
2008 Integrated Report Watershed- North Pacolet River

Broad River Basin | **WBD-10 Number 0305010512** | **North Pacolet River**

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
WBD-12 Number 030501051201										**Upper North Pacolet River**
9-55-1-(1)	**North Pacolet River**	**2**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to North Carolina Highway # 108 Bridge at Lynn										
C;Tr	03-08-06	10.5 FW Miles	**Nutrient Impacts**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
			Stormwater Runoff							
			WWTP NPDES							
9-55-1-(10)	**North Pacolet River**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From North Carolina Highway # 108 at Lynn to North Carolina-South Carolina State Line										
C	03-08-06	7.4 FW Miles								

Catheys Creek (Hollands Creek) Watershed



HUC 030501050403

(Part of the Second Broad River Watershed)

General Watershed Description

Catheys Creek is a tributary to the Second Broad River. It is located in central Rutherford County and originates in a forested area north of the Town of Rutherfordton near the McDowell-Rutherford county line. The stream flows southeast until it reaches the Second Broad River, just north of Forest City. Catheys Creek, Mill Creek, Hollands Creek and Case Branch were all sampled during the most recent assessment period (Figure 9-1). Land use throughout the watershed is a mix of commercial and residential properties with agricultural (row crops and pasture) and forested land in the headwaters.

Watershed at a Glance

Counties

Rutherford

Municipalities

Ruth, Rutherfordton, Spindale, Forest City

Permitted Facilities

NPDES WWTP:	3
NPDES Nondischarge:	0
NPDES Stormwater:	6
Animal Operations:	0

Monitored Stream Miles (AL)

Total Streams:	32.2 mi
Total Supporting:	17.8 mi
Total Impaired:	8.6 mi
Total Not Rated:	5.9 mi

Water Quality Overview

In addition to basinwide sampling, DWQ collected benthic and fish samples throughout the watershed in 2003 and 2004 as part of a special study for the Watershed Restoration Program (WRP), now the Ecosystem Enhancement Program (EEP) (***NCDENR DWQ, August 2003 and NCDENR DWQ, April 2004***). Chemical and physical parameters were also evaluated through ambient monitoring sites (***December 2004***). Data collected during these studies were evaluated and used to determine causes and sources of degradation and to develop a watershed management plan (***August 2005***). Sedimentation, point source pollution, stormwater runoff and historic mining activities were identified as the primary factors affecting watershed function in the Catheys Creek watershed.

Several of the streams segments are supporting; however, portions of both Catheys and Hollands Creeks are Impaired in the aquatic life category. Mill Creek is also Impaired in the aquatic life category (Table 9-1).

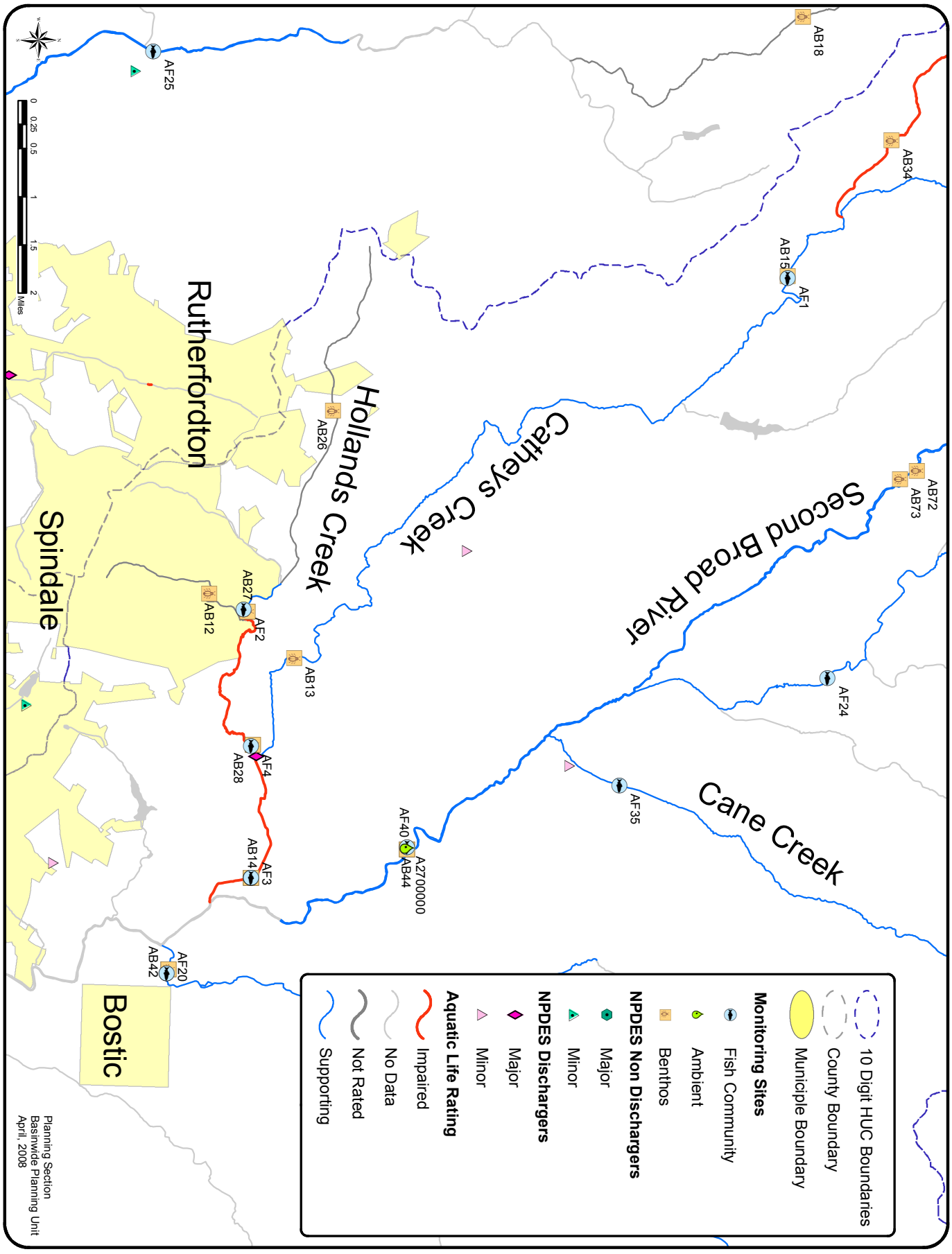


FIGURE 9-2: PART OF THE SECOND BROAD RIVER: HUC 03050105040 3

How to Read this Document

This document was written to correspond with our new ***Online Geographic Document Distribution (OGDD)*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth™ and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Table 9-1: Monitored Stream Segments In The Catheys Creek Watershed

Assessment Unit Number	Stream Name	Length (miles)	Class.	2008 IR Cat.*	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-41-13-(0.5)	Catheys Creek	15.2	WS-V	2	-		**Fecal Coliform Bacteria** (Animal Operations) **Habitat Degradation** (General Agriculture/ Pasture, Stormwarer Runoff)	03-08-02
9-41-13-(6)a	Catheys Creek	1.9	C	2	-		**Habitat Degradation** (General Agriculture/ Pasture, Impervious Surface)	03-08-02
9-41-13-(6)b	Catheys Creek	1.9	C	5	X		**Fecal Coliform Bacteria** **Habitat Degradation** (General Agriculture/ Pasture, Stormwarer Runoff)	03-08-02
9-41-13-3	Mill Creek	4.5	WS-V	5	X		**Habitat Degradation** (Impoundment)	03-08-02
9-41-13-7-(1)	Hollands Creek	3.9	WS-V	3a	-		**Habitat Degradation** (Impervious Surface)	03-08-02
9-41-13-7-(3)a	Hollands Creek	0.7	C	2	-		**Fecal Coliform Bacteria** **Habitat Degradation** (Impervious Surface, Natural Conditions, Stormwarer Runoff) **Natural Impacts** (Stormwater Runoff)	03-08-02
9-41-13-7-(3)b	Hollands Creek	2.2	C	5	X		**Habitat Degradation** (Impervious Surface, Stormwarer Runoff)	03-08-02
9-41-13-7-4	Case Branch (Cox Branch)	1.9	C	3a	-			03-08-02

*The 2008 IR Categories definitions can be found on the first page of Appendix 3-A

Current Status of Impaired & Impacted Waters

Catheys Creek watershed as a whole shows signs of moderate functional degradation in terms of water quality, hydrology and habitat. Sedimentation was identified as a significant problem throughout the entire watershed, and when compared to the upstream (rural) areas of the watershed, nutrients, metals, fecal coliform bacteria and turbidity were higher at sites sampled within and downstream of Spindale. Field assessments also revealed stream channel and floodplain alterations from historic mining operations and the clearing of several large forested tracts were contributing to an increased amount of nonpoint source runoff and sedimentation. Several opportunities were identified for better management of land and water resources. A few of these are discussed under ***Local Initiatives***, and all are listed in the Watershed Management Plan (***EarthTech, August 2005***).

Biological Monitoring

A total of six benthic sites were sampled in Catheys and Hollands Creeks in June 2003. The sites were sampled shortly after heavy rain events, and DWQ biologists noted that the stream water levels were high, indicating a recent rain event. Many of the streams were also turbid. In March 2004, a total of four fish sites were sampled in both creeks. DWQ biologists noted that habitat quality varied from very good to very poor depending on land use, geology, slopes, soils, and streamflow. Most low gradient streams around Spindale and Rutherfordton are extremely sandy, often lacking aquatic habitat areas. Higher gradient streams, or those in the more forested areas of the watershed, have a rocky substrate.

Catheys Creek

Sites AB15 and AF1 are the most upstream sites in Catheys Creek watershed. They were selected to represent that portion of the watershed above the urban areas of Spindale and Rutherfordton where land use is a combination of agriculture and forest with some residential areas. Site AB15 received a Good-Fair benthic bioclassification. Site AF1 received a Good fish bioclassification. Embedded, sandy substrate and a lack of cobble-riffle habitats contributed to the poor instream habitat.

Benthic samples were also collected on Catheys Creek upstream and downstream of the confluence with Hollands Creek. Site AB13 is upstream of the confluence and land use in the immediate vicinity is a mix of forest, agriculture, and residential properties. Site AB13 received a Good-Fair benthic bioclassification. Major habitat concerns included eroding streambanks and the lack of instream habitat (i.e., infrequent pools).

Sites AB14 and AF3 are downstream of the confluence. These sites are also downstream of permitted WWTP facilities and approximately 1.5 miles upstream from the confluence with the Second Broad River. Land use is a mix of hayfields (inactive pasture), residential properties and forestland. In June 2003, DWQ biologists noted that the streambanks had been severely scoured (likely during recent rain events), and many were eroding. Site AB14 received a Good-Fair, an improvement from the Fair it received in 2000. Site AF3 received a Fair, an improvement from the Poor it received in 2000. Even though both sites improved, this section of Catheys Creek (AU# 9-41-13-(6)b) is still Impaired for aquatic life due to the Fair fish bioclassification.

Hollands Creek

Site AB26 is the most upstream site sampled on Hollands Creek. Stream width here was less than 3 meters (drainage area less than 3 square miles); therefore, a bioclassification could not be assigned to this site (Not Rated). A few rubble-boulder riffles were found, but most of the streambed was sand and red silt. DWQ biologists noted that much of the streambed silt likely originated from streambank erosion. Even though site AB26 was Not Rated, biologists believe that the low taxa richness and abundance suggest water quality and/or habitat problems. The Catheys Creek Technical Advisory Committee identified the headwaters of Hollands Creek as a focus area for stream restoration in the Catheys Creek watershed management plan published in ***August 2005***.

Sites AB27 and AF2 had a habitat that was quite different from other sites on either Hollands or Catheys Creeks. Most streams throughout the river basin are very sandy with silt, but this stream segment consisted of a mostly boulder and rubble substrate with moderate gradient plunge pools and rocky runs. This reflects a change in geology rather than a change in land use. Site AB27 received a Good-Fair benthic bioclassification. Site AF2 received a Good-Fair fish bioclassification. During the time of fish sampling, DWQ biologists observed periphyton (algae) covering all of the instream substrate. Periphyton growth is an indicator of nutrient enrichment from point source and/or nonpoint source runoff.

Downstream, the boulder-rubble substrate found at sites AB27 and AF2 was replaced by an unstable sand-silt substrate at sites AB28 and AF4. Site AB28 received a Good-Fair benthic bioclassification. No significant changes in water quality were identified; however, the Good-Fair was an improvement from the Fair bioclassification this site received in 2000. Site AF4 received a Fair fish bioclassification. Instream habitats were extremely poor and included one plunge pool created by concrete slabs used for channel stabilization. Streambanks were highly eroded, and the riparian zone consisted primarily of lawns with a few trees. This section of Hollands Creek (AU# 9-41-13-7-(3)b) remains Impaired in the aquatic life category.

Mill Creek

Mill Creek is a tributary to Catheys Creek and was sampled in an effort to find a high quality site in the upper part of the watershed. DWQ biologists noted that the stream had good habitat characteristics, but only eleven species were collected. Many of these were pollution tolerant species. A high water temperature (22°C/72°F) recorded during the time of sampling suggested an upstream impoundment or discharge of some kind. Although the biologists did not note a pond, impoundment or discharge pipe during the time of sampling, a review of 1993 land use maps indicated that there is a pond in the upper part of the Mill Creek sub-watershed. Site AB34 received a Fair benthic bioclassification. Mill Creek (AU# 9-41-13-3) is Impaired in the aquatic life category. The Catheys Creek Technical Advisory Committee identified Mill Creek as a focus area for stream restoration in the Catheys Creek watershed management plan published in ***August 2005***.

Case Branch

Case Branch (also known as Cox Branch) is a tributary to Hollands Creek and drains the northern portion of Spindale. Land use consists of residential and commercial properties. It was sampled as an urban reference stream. Biologists expected to find severe water quality problems. Conductivity was high (124 μmhos/cm), but habitat was surprisingly good and a few pollution intolerant species were identified. Stream width here was less than 3 meters; therefore, a bioclassification could not be assigned to site AB12 (Not Rated).

Case Branch was also identified as a potential problem area during the assessment phase of EEPs local watershed planning process. In May 2004, DWQ and EEP staff walked much of Case Branch and its tributaries to pinpoint pollution sources. Problem areas that were identified include a DOT stormwater pond near partially uncovered salt piles and construction materials (i.e., metal, bricks, concrete, and other refuse) in two unnamed headwater tributaries. DWQ and EEP staff also noted that both unnamed headwater tributaries had deeply incised streambanks (15 to 20 foot high) (***NCDENR DWQ, November 2004***). The Catheys Creek Technical Advisory Committee identified Case Branch as a focus area for stream restoration in the Catheys Creek watershed management plan published in ***August 2005***.

Chemical-Physical Parameters

To provide supplemental information to support the EEP local watershed planning efforts in the Catheys Creek watershed, DWQ conducted chemical-physical monitoring at seven sites – two on Catheys Creek, one on Hollands Creek, and five on unnamed tributaries. Periodic sampling was conducted under baseflow conditions at five sites from January to August 2004. Sampling was also conducted under stormflow conditions on three different occasions during the same time period. Baseflow is defined as conditions present at least 48 hours after a measurable precipitation event. Stormflow samples are collected during the rising stream stage event, during or after a precipitation event. Fecal coliform bacteria, suspended residue, total phosphorus, total Kjeldahl nitrogen (TKN), ammonia nitrogen, copper, zinc, manganese, iron, and aluminum were consistently higher in stormwater samples than samples collected under baseflow conditions. These results are consistent with other studies and illustrate how sediment and other pollutants can enter a waterbody (***December 2004***).

Sampling also indicates that chromium, mercury and copper may be metals of concern to this watershed, particularly around areas known for historic gold mining operations. Mercury used in the mining process may remain in the floodplain soils and in the streambeds. Further testing (i.e., sediment toxicity testing) is needed to determine if the levels are harmful to aquatic life. Fish tissue samples are also suggested in order to establish the level of mercury and other metals in the fish thus allowing the determination of a human health hazard for fish consumption (***NCDENR DWQ, December 2004***).

Under baseflow conditions, ambient monitoring showed that the water quality standard for fecal coliform bacteria was exceeded at five sites. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resource become available, the

highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. None of the waters in the Catheys Creek watershed are classified for primary recreation (Class B); therefore, it was not prioritized for additional sampling during this assessment period. Potential sources of elevated bacteria levels include failing septic systems, straight pipes and nonpoint source runoff from pasture and forestlands (***NCDENR DWQ, December 2004***).

Significant Non-Compliance Issues

No significant compliance issues were identified for the permitted facilities in the Catheys Creek watershed; however, two facilities received several notices of violations (NOVs) during the last two years of the assessment period.

The White Oak Manor WWTP (Permit NC0030139) received NOVs for exceedences in TSS and fecal coliform bacteria. The facility is permitted to discharge 0.015 million gallons per day (MGD) to Catheys Creek. The most recent inspection (August 2006) resulted in an NOV being issued for improper equipment operation (i.e., grease removal and secondary clarifier sludge removal). Solids were also observed in the streambed below the outfall.

The United World Mission WWTP (Permit NC0032174) received NOVs for exceeding the permit limit for ammonia. It is permitted to discharge 0.02 MGD to Cherry Creek. Technical assistance provided by DWQ staff (June 2007) determined that the violation was due to a combination of regular maintenance and improper chemical treatment after the maintenance was performed.

DWQ Asheville Regional staff will continue to work with both facilities to ensure that the facilities remain in full compliance with permit limits.

Local Initiatives and Recommendations

Watershed Management Plan

In collaboration with local stakeholders and resource professionals, EEP, the Watershed Education for Communities and Officials (WECO) and Earth Tech were able to develop the ***Catheys Creek Watershed Management Plan***. The planning efforts included public meetings, the formation of a technical advisory committee (TAC), spatial analysis and field sampling to accurately characterize watershed issues. Follow the link above for a full copy of the report.

Sedimentation, point source pollution, stormwater runoff and historic mining activities were identified as the primary factors affecting watershed function in the Catheys Creek watershed. Accelerated stream channel erosion was observed at many sites and was attributed to past channelization and livestock access in the upper reaches and high-velocity flows from stormwater runoff in the lower reaches. Drainage from large pasture areas with livestock, faulty/vandalized sewer collection and septic systems and straight piping are believed to be contributing to high fecal levels. Chromium, mercury and copper may be a concern due to historic gold mining operations throughout the watershed. Because of the potential for metal contamination in the floodplain soils and streambeds, specific site investigations should include interviews to determine the history of mining on the property as well as visual inspections for clues such as spoil piles and channel alterations. Typical stream channel and floodplain restoration projects can cause tremendous disturbance to the streambed and floodplain soils and could potentially release buried sediment-bound metals into the environment. Toxicity tests are also recommended to determine impacts on the aquatic life.

As part of the planning process, the Catheys Creek watershed was divided into fourteen sub-watersheds. By using geographic data (i.e., land cover, soils, terrestrial habitat and hydrography), water quality data, interviews and visual observations, it allowed for more specific watershed characterization and identification of stressors and sources on the sub-watershed scale. The sub-watersheds were ranked based on water quality, hydrology and habitat function. Four sub-watersheds were identified for focused restoration plans and included the Mill Creek sub-watershed, the William Branch sub-watershed, the headwaters of Hollands Creek sub-watershed, and the Case Branch sub-watershed.

Causes and sources were identified along with goals, strategies and BMPs; thus resulting in specific recommendations for these four sub-watersheds. Many of the goals included reducing stormwater runoff, reducing the sediment load, and reducing the nitrogen, phosphorus and metals entering the surface waterbody. Many of the BMPs included livestock exclusion and buffer restoration, streambank stabilization, bioretention areas, construction wetlands, and wet detention ponds (***EarthTech, August 2005***).

References

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Population & Land Cover Change

Land Cover

The Broad River Basin is located on the edge of the mountain region closest to the piedmont. Most of this basin is cover in forested and agricultural lands. As shown in Figure x-1 and x-2, the forested areas are being converted to agriculture as well as urban areas. Much of the urban development has centralized around interchanges of major US and State highways. Population growth is also booming in these areas. With this growth comes increased pressure on the natural environment. Every person living in or passing through a watershed creates water quality impacts. If water pollution is to be reduced, each individual must be aware of these contributions and take actions to reduce them. The following paragraphs discuss the most common impacts of human activity and offer suggestions to lessen those impacts

Figure 10-1: Land Cover patterns and percentages in the Broad River Basin for 1992

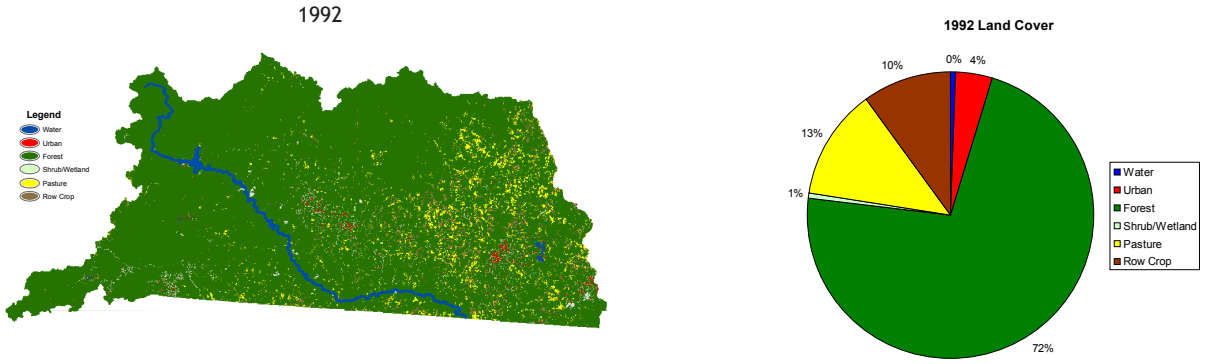
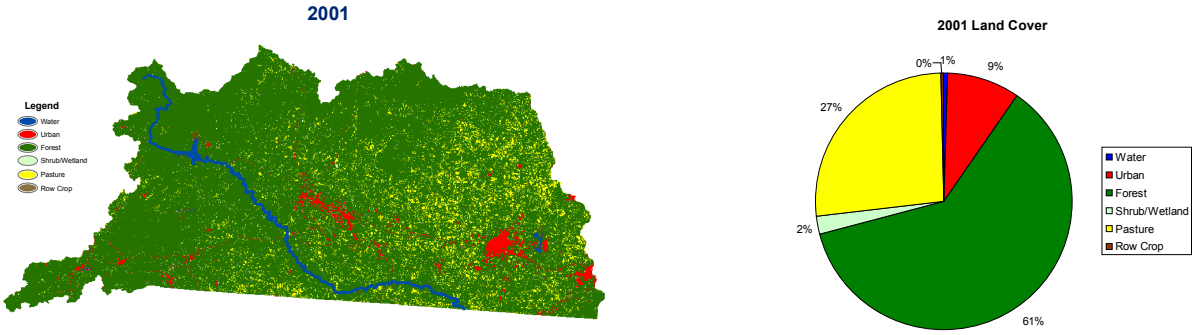


Figure 10-2: Land Cover patterns and percentages in the Broad River Basin for 2001



Source: Multi-Resolution Land Characteristics Consortium http://www.mrlc.gov/
Note: Due to sampling and classification differences, data from 1992 and 2001 cannot be compared directly. These maps are prepared here to qualitatively demonstrate general land cover patterns.

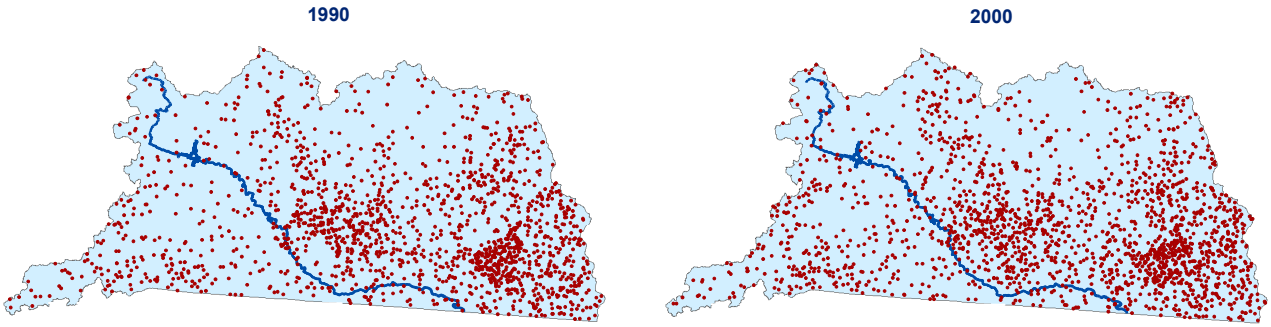
Impacts from Population Growth and Land Cover Changes

Rapid Urbanization

Population growth results in dramatic impacts on the natural landscape. The most obvious impact is the expansion of urban and suburban areas. New stores, roads, and subdivisions are products of growing populations. What is not so obvious is the astonishing rate at which rural landscapes are converted to developed land. Between 2000 and 2007, the states population rate has increased by 12.6 percent, which is almost double the national growth rate of 7.2 percent. During this time period, North Carolina became the 6th fastest growing state in the US and passed New Jersey to become the 10th most populated state (http://www.ncatlasrevisited.org/homefrm.html). Some of this growth can be seen in the Broad River Basin. See Tables 10-1 and 10-2 for details.

Figure 10-3: Population growth between 1990 and 2000. Each dot represents 100 people.

Out of the three major counties in the Broad River Basin (Rutherfordton, Polk and Cleveland), Polk County has seen the most growth with an estimated 24.4 percent growth by 2030. Other surrounding counties are seeing growth estimates

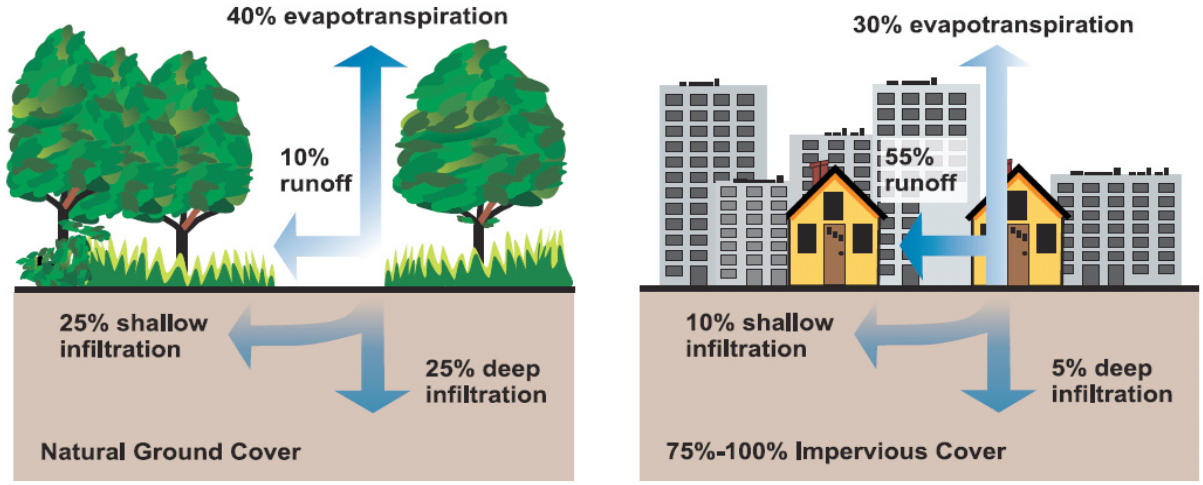


up to 38.5 percent. Municipalities in this basin have experienced a combined population growth of 32 percent between 2000 and 2005. As more people move into this area and build second homes as predicted by the US Census Bureau, there will be a significant threat to water quality that will mirror an increase in impervious surfaces.

Impervious surfaces are materials hat prevent infiltration of water into the soil and include roads, rooftops, and parking lots. These surfaces that prevent the infiltration of water into the ground alter the natural hydrology and concentrate the flow of stormwater over the landscape. In undeveloped watershed, stormwater filters down through the soil, pulling out pollutants, and replenishing the groundwater which may then be harvested through a homeowners well.

Vegetation holds down the soil, slows the flow of stormwater over the land, and as larger pollutants are trapped by the soil, the roots absorb the other smaller pollutant particles. As a watershed becomes more impervious, stormwater that can no longer soak into the ground is forced downhill where chances of flooding then become significantly increased. This greater volume leads to greater flows which increase chances of gathering pollutants and transporting sediment. If stormwater is not given a chance to slow down and allow pollutants to settle out, the pollutants will be carried directly to streams and drinking water supplies. Reducing the amount of stormwater infiltrating into the ground decreases the availability of aquifers, streams and rivers for drinking water supplies (Kauffman and Brant, 2000) It is well established that stream degradation begins to occur when 10 percent or more of a watershed is covered with impervious surfaces. The stream is significantly degraded when imperviousness reaches 30 percent of the watershed (Schueler, 1995). If development of this nature continues, many more streams will become impaired by 2030 unless bold and comprehensive measures are taken immediately to protect water quality. New technologies and plans for urban design are available to help prevent such imperviousness. Some of which are explained in the ***Stormwater Design Manual***. The following discussion provides a general overview of potential solutions that must be catered to suit individual communities.

Figure 10-4: Impervious Cover and Surface Runoff (EPA, 2003)



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

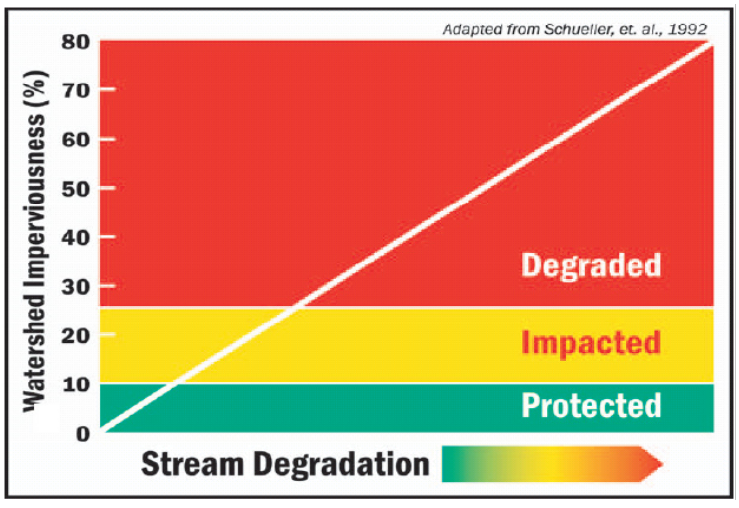
Population Growth and Impacts on Aquatic Resources

Urbanization poses one of the greatest threats to aquatic resources. For example, a one-acre parking lot produces 16 times more runoff than a one-acre meadow (Schueler and Holland, 2000). A wide variety of studies over the past decade converge on a central point: when more than 10 percent of the acreage in a watershed is covered in roads, parking lots, rooftops, and other impervious surfaces, the rivers and streams within the watershed become seriously degraded. Brown trout populations have been shown to decline sharply at 10 to 15 percent imperviousness. If urbanized area covers more than 25 percent of a watershed, these studies point to an irreversible decline in ecosystem health (Beach, 2002 and Galli, 1991).

Greater numbers of homes, stores, and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams, rivers, lakes and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

As development in surrounding metropolitan areas consumes neighboring forests and fields, the impacts on rivers, lakes, and streams can be significant and permanent if stormwater runoff is not controlled (Orr and Stuart, 2000). As watershed vegetation is replaced with impervious surfaces, the ability of the landscape to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak streamflows after rainfall. Flooding frequency also increases. These effects are compounded when small streams are channelized (straightened) or piped, and storm sewer systems are installed to increase transport of stormwater downstream. Bank scour from these frequent high flow events tends to enlarge streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams, leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 2003).

Figure 10-5: Impervious Cover and Stream Degradation



Key Elements of a Comprehensive Watershed Protection Strategy

Extensive research on the impacts of development and sobering population growth projections make it clear that comprehensive land use planning is necessary to protect aquatic resources. In order for land use planning to effectively protect watersheds in the long-term, tools

and strategies must be applied at several scales. Effective implementation will require commitment ranging from the individual citizen to the state government. A comprehensive watershed protection plan should act on the following elements:

Basin Scale (Implemented by Town, County, and State Governments)

1. Characterize the watersheds within a basin as developed or undeveloped, identifying the watersheds that are currently less than 10 percent impervious and those that are more than ten percent impervious.
2. Focus new construction projects to the already developed watersheds first. Then assign any construction that cannot be accommodated in developed watersheds to a limited number of undeveloped watersheds. The watersheds to be developed should be determined by their ecological importance and by other regional growth considerations, such as the value of terrestrial ecosystems, the economic development potential as determined by proximity to roads and rail lines, and the disposition of landowners in the area toward land preservation and development.
3. Adopt policies that maintain impervious surfaces in undeveloped watersheds at less than ten percent. These can include private conservation easements, purchase of development rights, infrastructure planning, urban service boundaries, rural zoning (20-200 acres per unit, depending on the area), and urban growth boundaries.
4. Ensure that local governments develop land use plans to provide adequate land for future development within developed or developing watersheds.

Neighborhood Scale (Implemented by Town and County Governments)

1. Allow residential densities that support transit, reduce vehicle trips per household and minimize land consumption. The minimum density for new development should be seven to ten net units per acre.
2. Require block densities that support walking and reduce the length of vehicle trips. Cities that support walking and transit often have more than 100 blocks per square mile.
3. Connect the street network by requiring subdivision road systems to link to adjacent subdivisions.
4. Integrate houses with stores, civic buildings, neighborhood recreational facilities, and other daily or weekly destinations.
5. Incorporate pedestrian and bike facilities (greenways) into new development and ensure these systems provide for inter-neighborhood travel.
6. Encourage and require other design features and public facilities that accommodate and support walking by creating neighborhoods with a pleasing scale and appearance. (e.g., short front-yard setbacks, neighborhood parks, alleys, and architectural and material quality)

Site Scale (Implemented by Individual Property Owners, Developers, and Town and County Governments)

1. Require application of the most effective structural stormwater practices, especially focusing on hot spots such as high-volume streets, gas stations, and parking lots.
2. Establish buffers and setbacks that are appropriate for the area to be developed – more extensive in undeveloped watersheds than in developed watersheds. In developed watersheds, buffers and setbacks should be reconciled to other urban design needs such as density and a connected street network.
3. Educate homeowners about their responsibility in watershed management, such as buffer and yard maintenance, proper disposal of oil and other toxic materials, and the impacts of excessive automobile use (Beach, 2002).

Focus Areas For Managing The Impacts Of Population Growth

The elements of watershed protection listed in above are intended to guide land use planning and population density decision-making. This section discusses specific concepts necessary to reduce the impacts of population growth.

Control Stormwater Runoff and Poluttion

Stormwater runoff is rainfall or snowmelt that runs off the ground and impervious surfaces (e.g., buildings, roads, parking lots, etc.). Because urbanization usually involves creation of new impervious surfaces, stormwater can quickly become a major concern in growing communities.

The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands traps rainwater and snowmelt and allows them to filter slowly into the ground. In contrast, impervious (nonporous) surfaces like roads, parking lots, and rooftops prevent rain and snowmelt from infiltrating, or soaking, into the ground. Most of the rainfall and snowmelt remains above the surface, where it runs off rapidly in unnaturally large amounts.

Common Pollutants in Stormwater

Storm sewer systems concentrate runoff into smooth, straight conduits. This runoff gathers speed and power as it travels through the pipes. When this runoff leaves the storm drains and empties into a stream, its excessive volume and power blast out streambanks, damaging streamside vegetation and destroying aquatic habitat. These increased storm flows carry sediment loads from construction sites and other denuded surfaces and eroded streambanks. They often carry higher water temperatures from streets, rooftops, and parking lots, which are harmful to the health and reproduction of aquatic life. The steep slopes and large elevation changes in western North Carolina intensify this effect as water rushes downhill.

Storm sewers should not be confused with sanitary sewers, which transport human and industrial wastewaters to a treatment plant before discharging into surface waters. There is no pre-treatment of stormwater in North Carolina.

Uncontrolled stormwater runoff has many impacts on both humans and the environment. Cumulative effects include flooding, undercut and eroding streambanks, widened stream channels, threats to public health and safety, impaired recreational use, and increased costs for drinking and wastewater treatment. For more information on stormwater runoff, visit the DWQ Stormwater Permitting Unit at http://h2o.enr.state.nc.us/su/stormwater.html or the NC Stormwater information page at http://www.ncstormwater.org/. Additional fact sheets and information can also be found at http://www.stormwatercenter.net/intro_factsheets.htm and www.bae.ncsu.edu/stormwater/index.html.

Controlling Stormwater Runoff and Pollution

Many daily activities have the potential to cause stormwater pollution. Any situation where activities can contribute more pollutants to stormwater runoff is an area that should be considered for efforts to minimize stormwater impacts. A major component in reducing stormwater impacts involves planning up front in the design process. New construction designs should include plans to prevent or minimize the amount of runoff leaving the site. Wide streets, large cul-de-sacs, long driveways, and sidewalks lining both sides of the street are all features of urbanizing areas that create excess impervious cover and consume natural areas. In many instances, the presence of intact riparian buffers and/or wetlands in urban areas can reduce the impacts of urban development. Establishment and protection of buffers should be considered where feasible, and the amount of impervious cover should be limited as much as possible.

"Good housekeeping" to reduce the volume of stormwater leaving a site and reducing the amount of pollutants used in our own backyards can also minimize the impact of stormwater runoff. DWQ has published a pamphlet entitled Improving Water Quality in Your Own Backyard: Stormwater Management Starts at Home. The pamphlet provides information on how homeowners and businesses can reduce the amount of runoff leaving their property and how to reduce the amount and types of pollutants in that runoff. This document is available on-line at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf or by calling (919) 733-5083 ext. 558.

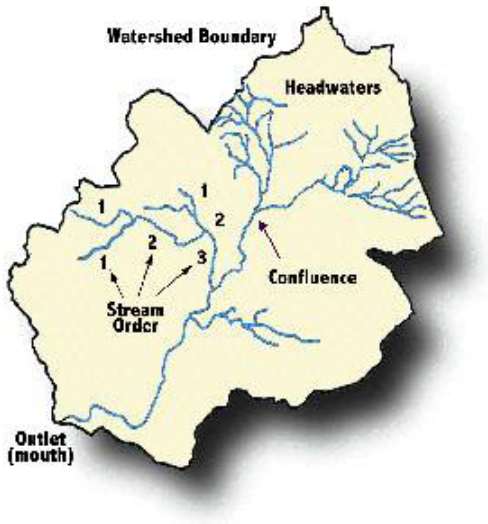
Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. In particular, forested buffers provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, 2004). For more information or to obtain a free copy of DWQ's Buffers for Clean Water brochure, call (919) 733-5083, ext. 558.

Protecting Headwater Streams

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. These streams account for approximately 80 percent of the stream network and provide many valuable services for quality and quantity of water delivered downstream (Meyer et al., 2003). However, degradation of headwater streams can (and does) impact the larger stream or river.

There are three types of headwater streams: 1) perennial (flow

Figure 10-6 Diagram of Headwater Streams within a Watershed Boundary



year-round); 2) intermittent (flow during wet seasons); and 3) ephemeral (flow only after precipitation events). All types of headwater streams provide benefits to larger streams and rivers. Headwater streams control flooding, recharges groundwater, maintain water quality, reduce downstream sedimentation, recycle nutrients, and create habitat for plants and animals (Meyer et al., 2003).

In smaller headwater streams, fish communities are not well developed and benthic macroinvertebrates dominate aquatic life. Benthic macroinvertebrates are often thought of as "fish food" and, in mid-sized streams and rivers, they are critical to a healthy fish community. However, these insects, both in larval and adult stages, are also food for small mammals, such as river otter and raccoons, birds and amphibians (Erman, 1996). Benthic macroinvertebrates in headwater streams also perform the important function of breaking down coarse organic matter, such as leaves and twigs, and releasing fine organic matter. In larger rivers, where coarse organic matter is not as abundant, this fine organic matter is a primary food source for benthic macroinvertebrates and other organisms in the system (CALFED, 1999). When the benthic macroinvertebrate community is changed or extinguished in an area, even temporarily, as occurs during land use changes, it can have repercussions in many parts of both the terrestrial and aquatic food web.

Headwater streams also provide a source of insects for repopulating downstream waters where benthic macroinvertebrate communities have been eliminated due to human alterations and pollution. Adult insects have short life spans and generally live in the riparian areas surrounding the streams from which they emerge (Erman, 1996). Because there is little upstream or stream-to-stream migration of benthic macroinvertebrates, once headwater populations are eliminated, there is little hope for restoring a functioning aquatic community. In addition to macroinvertebrates, these streams support diverse populations of plants and animals that face similar problems if streams are disturbed. Headwater streams are able to provide these important ecosystem services due to their unique locations, distinctive flow patterns, and small drainage areas.

Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers, minimizing stream channel alterations, and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed. For a more detailed description of watershed hydrology and watershed management, refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

Reduction Impacts from Steep Slope Disturbance

Dramatic elevation changes and steep slopes define mountain topography. Building sites perched along mountainsides provide access to unparalleled vistas and are a major incentive for development. However, construction on steep slopes presents a variety of risks to the environment and human safety. This is of particular interest to communities in the northwestern portiong of the Yadkin-Pee Dee river basin, where second home development is increasing along mountain ridges.

Poorly controlled erosion and sediment from steep slope disturbance negatively impact water quality, hydrology, aquatic habitat, and can threaten human safety and welfare. Soil types, geology, weather patterns, natural slope, surrounding uses, historic uses, and other factors all contribute to unstable slopes. Steep slope disturbance usually involves some form of grading. Grading is the mechanical excavation and filling of natural slopes to produce a level working surface. Improper grading practices disrupt natural stormwater runoff patterns and result in poor drainage, high runoff velocities, and increased peak flows during storm events. There is an inherent element of instability in all slopes and those who choose to undertake grading and/or construction activities should be responsible for adequate site assessment, planning, designing, and construction of reasonably safe and stable artificial slopes.

In cases where construction activities occur on steep slopes, slope stabilization should be mandated through a Site Grading Plan and/or Site Fingerprinting. Site Grading Plans identify areas intended for grading and address impacts to existing drainage patterns. They identify practices to stabilize, maintain and protect slopes from runoff and include a schedule for grading disturbance as well as methods for disposal of borrow and fill materials. Site Fingerprinting is a low-impact development (LID) best management practice (BMP) that minimizes land disturbances. Fingerprinting involves clearing and grading only those onsite areas necessary for access and construction activities. Extensive clearing and grading accelerates sediment and pollutant transport off-site. Fingerprinting and maintenance of vegetated buffers during grading operations provide sediment control that reduces runoff and off-site sedimentation (Yaggi and Wegner, 2002).

Local communities also have a role in reducing impacts from steep slope development. These impacts can also be

addressed through the implementation of city and/or county land use and sediment and erosion control plans. Land use plans are a non-regulatory approach to protect water quality, natural resources and sensitive areas. In the planning process, a community gathers data and public input to guide future development by establishing long-range goals for the local community over a ten- to twenty-year period. They can also help control the rate of development, growth patterns and conserve open space throughout the community. Land use plans examine the relationship between land uses and other areas of interest including quality-of-life, transportation, recreation, infrastructure and natural resource protection (Jolley, 2003).

Sediment and Erosion Control Plans are a regulatory approach to reducing the impacts of steep slope development and ensure that land disturbing activities do not result in water quality degradation, soil erosion, flooding, or harm to human health (i.e., landslides). The Division of Land Resources (DLR) Land Quality Section (LQS) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced during construction activities. Under the Sedimentation Pollution Control Act, cities and counties are given the option to adopt local ordinances that meet or exceed the minimum requirements established by the State. Local programs must be reviewed and approved by the NC Sedimentation Control Commission. Once approved, local staff performs plan reviews and enforces compliance. If for some reason the local program is not being enforced, the NC Sedimentation Control Commission can assume administrative control of the local program until the local government assures the State that it can administer and enforce sediment and erosion control rules. The Sedimentation and Pollution Control Act as well as an example of a local ordinance can be found on the DLR website (http://www.dlr.enr.state.nc.us/pages/sedimentation.html).

The requirements outlined in the Sedimentation Pollution Control Act were designed to be implementable statewide and may not fully capture the needs of mountain communities. For example, only projects disturbing more than one-acre of land are required to produce a sediment and erosion control plan. Many small construction projects fall below this threshold. In steep mountainous terrain, even these small disturbances can produce an astounding volume of sediment runoff. DWQ strongly encourages local governments to adopt Sediment and Erosion Control ordinances that exceed the State's minimum requirements.

The Role Of Local Governments

Reducing Impacts from Existing Urbanization

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

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

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

(1) Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development (e.g., increased stormwater volumes and increased frequency and duration of erosive and scouring flows). This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.
   (a) Over the short term, currently feasible retrofit projects should be identified and implemented.
   (b) In the long term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
   (c) Grant funds for these retrofit projects may be available from EPA initiatives, such as EPA Section 319 funds, or the North Carolina Clean Water Management Trust Fund.

(2) A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of

source reduction and stormwater treatment methods. As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:

(a) Implementation of available best management practice (BMP) opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
(b) Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
(c) Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
(d) Development and implementation of a broad set of source reduction activities focused on: reducing non-storm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.

(3) Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat. Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would be advantageous to implement retrofit BMPs before embarking on stream channel restoration, as restoration is best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt, et al., 2002 and Weinkam, 2001). Grant funds for these retrofit projects may be available from federal sources, such as EPA Section 319 funds, or state sources including North Carolina Clean Water Management Trust Fund.

(4) Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading, and to some extent, its impacts. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting biological oxygen demand (BOD) and nutrient removal at appropriate sites.

(5) Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.

(6) Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may also be beneficial.

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

Reducing Impacts of Future Urbanization

Proactive planning efforts at the local level are needed to assure that urbanization is done in a manner that maintains water quality. These planning efforts will need to find a balance between water quality protection, natural resource management, and economic growth. Managing population growth requires planning for the needs of increased population, as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin. Public education is also needed in the Savannah River basin so that citizens can learn and understand the value of urban planning and stormwater management.

Streams in areas adjacent to high growth areas of the basin are at a high risk of loosing healthy aquatic communities. These biological communities are important to maintaining the ecological integrity in the Savannah River basin. Unimpacted streams are important sources of benthic macroinvertebrates and fish for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

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

(1) Identify waters that are threatened by construction activities.

(2) Protect existing riparian habitat along streams.
(3) Implement stormwater BMPs during and after construction.
(4) Develop land use plans that minimize disturbance in sensitive areas of watersheds.
(5) Minimize impervious surfaces including roads and parking lots.
(6) Develop public outreach programs to educate citizens about stormwater runoff.
(7) Enact a Stormwater Control Ordinance. EPA offers a model ordinance at: http://www.epa.gov/nps/ordinance/stormwater.htm

For more detailed information regarding recommendations for new development found in the text box, refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at www.lowimpactdevelopment.org. For an example of local community planning effort to reduce stormwater runoff, visit http://www.charmeck.org/Home.htm.

The Role Of Homeowners And Landowners

Ten Simple Steeps to Reducing Polution from Individual Homes

1. To decrease polluted runoff from paved surfaces, households can develop alternatives to areas traditionally covered by impervious surfaces. Porous pavement materials are available for driveways and sidewalks, and native vegetation and mulch can replace high maintenance grass lawns.
2. Homeowners can use fertilizers sparingly and sweep driveways, sidewalks, and roads instead of using a hose.
3. Instead of disposing of yard waste, use the materials to start a compost pile.
4. Learn to use Integrated Pest Management (IPM) in the garden and on the lawn to reduce dependence on harmful pesticides.
5. Pick up after pets.
6. Use, store, and dispose of chemicals properly.
7. Drivers should check their cars for leaks and recycle their motor oil and antifreeze when these fluids are changed.
8. Drivers can also avoid impacts from car wash runoff (e.g., detergents, grime, etc.) by using car wash facilities that do not generate runoff.
9. Households served by septic systems should have them professionally inspected and pumped every 3 to 5 years. They should also practice water conservation measures to extend the life of their septic systems.
10. Support local government watershed planning efforts and ordinance development.

Table 10-1: Population by County in the Broad River Basin

County	% of County in Basin	2000	Estimated Population 2010	% Change 2000 to 2010	Estimated Population 2020	% Change 2010 to 2020	Estimated Population 2030	% Change 2020 to 2030
Buncombe	6.25	206,299	234,697	13.8	262,838	12.0	289,908	10.3
Cleveland	99.4	96,284	97,155	0.9	101,157	4.1	104,933	3.7
Gaston	3.0	190,310	205,489	8.0	216,097	5.2	224,946	4.1
Henderson	29.0	89,204	107,680	20.7	126,163	17.2	144,989	14.9
Lincoln	6.6	63,780	76,958	20.7	89,825	16.7	102,567	14.2
McDowell	14.1	42,151	45,143	7.1	48,747	8.0	52,144	7.0
Polk	99.9	18,324	19,721	7.6	21,982	11.5	24,223	10.2
Rutherford	99.9	62,901	63,610	1.1	65,571	3.1	67,149	2.4

Table 10-2: Population by Municipality in the Broad River Basin

Municipality	County	April 2000	July 2005	% Change
BELWOOD	CLEVELAND	962	1,010	5.0
BOILING SPRINGS	CLEVELAND	3,866	3,997	3.4
BOSTIC	RUTHERFORD	328	321	-2.1
CASAR	CLEVELAND	308	305	-1.0
CHERRYVILLE	GASTON	5,361	5,563	3.8
CHIMNEY ROCK	RUTHERFORD	175	182	4.0
COLUMBUS	POLK	992	1,060	6.9
EARL	CLEVELAND	234	234	0.0
ELLENBORO	RUTHERFORD	479	473	-1.3
FALLSTON	CLEVELAND	603	606	0.5
FOREST CITY	RUTHERFORD	7,549	7,283	-3.5
GROVER	CLEVELAND	698	694	-0.6
KINGS MOUNTAIN	CLEVELAND, GASTON	9,693	10,606	9.4
KINGSTOWN	CLEVELAND	845	826	-2.2
LAKE LURE	RUTHERFORD	1,027	1,066	3.8
LATTIMORE	CLEVELAND	419	440	5.0
LAWNDALE	CLEVELAND	642	638	-0.6
MOORESBORO	CLEVELAND	314	314	0.0
PATTERSON SPRINGS	CLEVELAND	620	608	-1.9
POLKVILLE	CLEVELAND	535	539	0.7
RUTH	RUTHERFORD	329	323	-1.8
RUTHERFORDTON	RUTHERFORD	4,131	4,151	0.5
SALUDA	POLK, HENDERSON	575	573	-0.3
SHELBY	CLEVELAND	19,477	20,876	7.2
SPINDALE	RUTHERFORD	4,022	3,916	-2.6
TRYON	POLK	1,760	1,771	0.6
WACO	CLEVELAND	328	327	-0.3

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North Carolina Ecosystem Enhancement Program (NCEEP)

The North Carolina Ecosystem Enhancement Program (NCEEP) is responsible for providing ecologically effective compensatory mitigation in advance of permitted impacts associated with road projects and other development activities. The fundamental mission of the program is to restore, enhance and protect key watershed functions in the 17 river basins across the state. This is accomplished through the implementation of wetlands, streams and riparian buffer projects within selected local watersheds. The vital watershed functions that NCEEP seeks to restore and protect include water quality, floodwater conveyance and storage, fisheries and wildlife habitat.

The NCEEP is not a grant program but can implement its restoration projects cooperatively with other state or federal programs such as the Section 319 Program. Combining NCEEP-funded restoration or preservation projects with 319 or other local watershed initiatives (e.g., those funded through the Clean Water Management Trust Fund or local/regional Land Trusts) increases the potential to improve the water quality, hydrologic and habitat functions within selected watersheds.

The selection of optimal sites for NCEEP mitigation projects is founded on a basinwide and local watershed planning approach which results, respectively, in the development of River Basin Restoration Priorities and Local Watershed Plans.

In developing River Basin Restoration Priorities (RBRP) (formerly called Watershed Restoration Plans), the NCEEP identifies local watersheds (14-digit hydrologic units) with the greatest need and opportunity for restoration, enhancement or preservation projects. These high-priority watersheds are called “targeted local watersheds” (TLWs). Targeted local watersheds are identified, in part, using information compiled by DWQs programmatic activities (e.g., Basinwide Assessment Reports). Local factors considered in the selection of TLWs include: water quality impairment, habitat degradation, the presence of critical habitat or significant natural heritage areas, the presence of water supply watersheds or other high-quality waters, the status of riparian buffers, estimates of impervious cover, existing or planned transportation projects, and the opportunity for local government partnerships. Recommendations from local resource agency professionals and the presence of existing or planned watershed projects are given significant weight in the selection of TLWs. In essence, targeted local watersheds represent those areas within a river basin where NCEEP resources can be focused for maximum benefit to local watershed functions.

The 2003 RBRP for the Broad River Basin can be found on the NCEEP website (http://www.nceep.net/services/restplans/watershedplans.html). A revised RBRP with updated selections for Targeted Local Watersheds will be posted to this website by 2009.

The NCEEP also develops Local Watershed Plans (LWPs), usually within targeted local watersheds identified in the RBRPs. Through the local watershed planning process, NCEEP conducts watershed characterization and field assessment tasks to identify critical stressors in local watersheds. The NCEEP planners and their consultants coordinate with local resource professionals and local governments to identify optimal watershed projects and management strategies to address the major functional stressors identified. The LWPs prioritize restoration/enhancement projects, preservation sites, and best management practices (BMP) projects that will provide water quality improvement, habitat protection and other

environmental benefits to the local watershed. In the Broad River Basin, NCEEP has led two local watershed planning efforts.

From 2003 to 2005, NCEEP managed an intensive watershed assessment and planning effort in the Catheys Creek watershed, a 45 square mile area in Rutherford County. NC State University's Watershed Education for Communities and Officials coordinated community input provided by a diverse group of local stakeholders, who met throughout the process to identify community priorities and oversee the development of the watershed plan. Although only Catheys Creek and Hollands Creek are on the 303(d) list, moderately degraded conditions were found in streams throughout the watershed. Key stressors for streams in the watershed are excessive sedimentation, stormwater impacts, widespread fecal coliform bacteria contamination, heavy metals below old gold mining operations and the town of Spindale, and illegal dumping of solid waste in streams. The Catheys Creek Watershed Management Plan names strategies to address these problems, including stream and wetland restoration, buffer planting, livestock best management practices, and stormwater best management practices. The plan is available on the NCEEP website.

A fast-track local watershed planning effort was undertaken for the Cove Creek watershed from 2006 to 2007. This 80 square mile area is located in a primarily rural area of McDowell and Rutherford Counties. The objectives of this LWP were to quickly assess the integrity of streams and identify stream and wetland restoration and enhancement opportunities. Most headwater streams in this watershed are currently forested; below these steeper sloped areas, cattle, hay fields, and residential development are common. Current stressors for streams in the watershed are stream incision, inadequate forested buffer, sedimentation, streambank erosion, livestock access, and possible nutrient enrichment. The largest threat to stream integrity, however, is development for retirement and second homes, which is occurring in the forested headwater areas. The plan is available on the NCEEP website.

NCEEP PROJECTS IN THE BROAD RIVER BASIN

In the Broad River Basin, NCEEP has eight restoration projects in process or already constructed, which include approximately 71,000 ft of stream restoration/enhancement, 9,000 ft of stream preservation, and 11 acres of wetland restoration. They include Big Harris Creek, Blockhouse Creek, Cane Creek, Cleghorn Creek, Little White Oak Creek, Morgan Creek, and Puzzle Creek.

NCEEP has acquired or is in the process of acquiring seven high quality preservation projects in the Broad River Basin. NCEEPs high quality preservation program works in conjunction with other conservation interests to protect tracts of land that have high natural resource value. The seven projects include Lone Mountain, Melrose Mountain, North Pacolet, Skyuka Creek, and three tracts near the Green River. For more information on these high quality preservation projects, see NCEEP website.

Restoration and high quality preservation projects mentioned above are in four counties of the Broad River basin, provided in detail below.

Table 11-1: Number of NCEEP Projects in Broad River Basin Counties

County	High quality preservation	Stream/wetland restoration
Cleveland	--	2
McDowell	--	1
Polk	6	2
Rutherford	1	3

NCEEP is actively pursuing additional projects and expects to implement both stream and wetland projects, focusing on the Catheys Creek and Cove Creek LWP areas. For more information on NCEEP projects in the Broad River basin, contact Mike McDonald, the western region supervisor, at (828) 231-7912 or the main NCEEP office at (919) 715-0476.

For additional information about NCEEPs Project Implementation efforts, follow this link. For additional information about NCEEP in general, including its various program activities and products, visit the NCEEP website.

Forestry in the Broad River Basin

Forestland Ownership*

Approximately 91 percent of the forestland in the basin is privately-owned by individuals.

* The ownership estimates come from the most recent data published by the USDA-Forest Service ("Forest Statistics for North Carolina, 2002." Brown, Mark J. Southern Research Station Resource Bulletin SRS-88. January 2004).

Forest Practices Guidelines Related to Water Quality (FPGS)

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (GS Ch.113A Art.4 referred to as "SPCA"). However, forestry operations may be exempted from the permit and plan requirements of the SPCA, if the operations meet the compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A NCAC 1I .0100 - .0209, referred to as "FPGs") and General Statutes regarding stream and ditch obstructions (GS 77-13 and GS 77-14).

The North Carolina Division of Forest Resources (DFR) is delegated the authority to monitor and evaluate forestry operations for compliance with these aforementioned laws and/or rules. In addition, the DFR works to resolve identified FPG compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved by the DFR are referred to the appropriate State agency for enforcement action.

During the period January 1, 2001 through December 31, 2006 the DFR conducted 994 FPG inspections of forestry-related activities in the basin; 92 percent of the sites inspected were in compliance.

Other Water Quality Regulations

In addition to the State regulations noted above, DFR monitors the implementation of the following Federal rules relating to water quality and forestry operations:

- The Section 404 silviculture exemption under the Clean Water Act;
- The federally-mandated 15 best management practices (BMPs) related to road construction in wetlands; and
- The federally-mandated BMPs for mechanical site preparation activities for the establishment of pine plantations in wetlands of the southeastern U.S

Water Quality Foresters

The DFR has complete coverage of the Broad River basin with Water Quality Foresters. Statewide, there is a Water Quality Forester position in ten of DFRs thirteen Districts. Water Quality Foresters conduct FPG inspections, survey BMP implementation, develop pre-harvest plans, and provide training opportunities for landowners, loggers and the public regarding water quality issues related to forestry. These foresters also assist County Rangers on follow-up site inspections and provide enhanced technical assistance to local DFR staff.

Forestry Best Management Practices

Implementing forestry Best Management Practices (BMPs) is strongly encouraged to efficiently and effectively protect the water resources of North Carolina. In 2006, the first ever revision to the North Carolina forestry Best Management Practices (BMP) manual was completed. This comprehensive update to the forestry BMP manual is the result of nearly four years of effort by the DFR and a DENR-appointed Technical Advisory Committee consisting of multiple sector stakeholders, supported by two technical peer-reviews. The forestry BMP manual describes recommended techniques that may be used to help comply with the forestry regulations while protecting water quality. Copies of the new forestry BMP manual can be obtained at DFRs County Ranger or District Forester offices statewide. The new manual is also available at the DFR website (http://www.dfr.state.nc.us/) within the 'Water Quality' portion.

n the basin during this reporting period, the DFR assisted or observed over 1,200 forestry activities in which BMPs were either implemented or recommended over an area amounting to nearly 41,000 acres.

From March 2000 through March 2003, the DFR conducted a statewide BMP Implementation Survey on 565 active forest harvest operations to evaluate the usage of forestry BMPs. This survey evaluated 22 sites in the basin, with a resulting BMP implementation rate of 71 percent. The problems most often cited in this survey across the state relate to stream crossings, skid trails and site rehabilitation. This survey, and subsequent surveys to be conducted, will serve as a basis for focused efforts in the forestry community to address water quality concerns through better and more effective BMP implementation and training.

Christmas Tree Production & Vineyards

It should be noted that the DFR does not oversee regulations or activities relating to timber and land clearing for Christmas tree production or winery vineyards. These activities are not recognized as forestry ("silviculture") activities. Generally, these types of land-use practices are deemed to be an agricultural or horticultural activity. County Soil & Water Conservation District or USDA-Natural Resources Conservation Service (NRCS) staff can provide BMP assistance for these activities. Significant sedimentation problems can be reported to the N.C. Division of Land Resources' Comments Hotline: 1-866-STOPMUD.

Protecting Stream Crossing with Bridgemats

The DFR provides bridgemats on loan to loggers for establishing temporary stream crossings during harvest activities in an effort to educate loggers about the benefits of installing crossings in this manner. Temporary bridges can be a very effective solution for stream crossings, since the equipment and logs stay completely clear of the water channel. Starting in 1996, the DFRs District Offices across the entire river basin have had bridgemats available for loan-out. Statewide, there have been over 200 loan-events between 2000 and 2006, which have protected 261 stream crossings.

Forest Management

Almost 10,000 acres of land were established or regenerated with forest trees across the basin from January 1, 2001 through December 31, 2006. Of these acres, approximately 87 percent were Loblolly Pine. During this same time period the DFR provided over 1,400 individual forest plans for landowners that encompassed almost 52,600 acres in the basin.

Forest Products Industry

Forest industry manufacturing is a significant economic driver across North Carolina, contributing nearly $18 billion annually to the state's gross economic product. Nine (9) different businesses in the basin are directly related to the manufacture of forest products. Some examples include mills that produce lumber, wood chips, veneer, structural panels, posts or pallets. In addition to the direct and in-direct economic benefits of employment from these facilities, these manufacturers pay an assessment to the state based upon the volume of timber they utilize. The payments from these assessments are combined with annual legislative budget appropriations to fund the "Forest Development Program" (FDP), which provides cost-shared forest management and regeneration assistance to forest landowners in North Carolina.

Wildfire Prevention & Mitication

The "Firewise Communities" program is a national, multi-agency effort designed to educate homeowners, civic leaders, community planners, developers and others in the effort to protect people, property and natural resources from the risk of wildfires before a fire starts. The Firewise Communities program offers a series of practical steps that individuals and communities can take to minimize wildfire risks. Firewise emphasizes community responsibility for planning a safe community as well as providing effective emergency response, and individual responsibility for safer home construction and design, landscaping and maintenance. In North Carolina, the most susceptible areas for wildfires in which homes and woodlands co-exist are in the mountains and areas of the coast. More information is available at ncfirewise.org and firewise.org.

Some examples of Firewise practices include:

- Maintaining a 'defensible perimeter' around homes and structures by controlling vegetation growth;
- Removing so-called 'ladder fuels' from around structures that may allow a small fire on the ground to move upwards, and into the structure; and
- Constructing access roads and driveways in a way that will allow access by fire trucks and other heavy-duty emergency response equipment.

Source Water Assessment of Public Water Supplies (SWAP)

Introduction

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention as an important strategy for the protection of ground and surface water resources. This new focus promotes the prevention of drinking water contamination as a cost-effective means to provide reliable, long-term and safe drinking water sources for public water supply (PWS) systems. In order to determine the susceptibility of public water supply sources to contamination, the amendments also required that all states establish a Source Water Assessment Program (SWAP). Specifically, Section 1453 of the SDWA Amendment requires that states develop and implement a SWAP to:

- Delineate source water assessment areas;
- Inventory potential contaminants in these areas; and
- Determine the susceptibility of each public water supply to contamination.

In North Carolina, the agency responsible for the SWAP is the Public Water Supply (PWS) Section of the DENR Division of Environmental Health (DEH). The PWS Section received approval from the EPA for their SWAP Plan in November 1999. The SWAP Plan, entitled North Carolina's Source Water Assessment Program Plan, fully describes the methods and procedures used to delineate and assess the susceptibility of more than 9,000 wells and approximately 207 surface water intakes. To review the SWAP Plan, visit the PWS website.

Delineation of Source Water Assessment Areas

The SWAP Plan builds upon existing protection programs for ground and surface water resources. These include the state's Wellhead Protection Program and the Water Supply Watershed Protection Program.

Wellhead Protection (WHP) Program

North Carolinians withdraw more than 88 million gallons of groundwater per day from more than 9,000 water supply wells across the state. In 1986, Congress passed Amendments to the SDWA requiring states to develop wellhead protection programs that reduce the threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields.

Defining a wellhead protection area (WHPA) is one of the most critical components of wellhead protection. A WHPA is defined as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The SWAP uses the methods described in the state's approved WHP Program to delineate source water assessment areas for all public water supply wells. More information related to North Carolina's WHP Program can be found on the DEH website.

Water Supply Watershed Protection (WSWP) Program

DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement water supply watershed protection ordinances, maps and management plans. SWAP

uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found on the DWQ website.

Susceptibility Determination - North Carolina's Overall Approach

The SWAP Plan contains a detailed description of the methods used to assess the susceptibility of each PWS intake in North Carolina. The following is a brief summary of the susceptibility determination approach.

Overall Susceptibility Rating

The overall susceptibility determination rates the potential for a drinking water source to become contaminated. The overall susceptibility rating for each PWS intake is based on two key components: a contaminant rating and an inherent vulnerability rating. For a PWS to be determined "susceptible", a potential contaminant source must be present and the existing conditions of the PWS intake location must be such that a water supply could become contaminated. The determination of susceptibility for each PWS intake is based on combining the results of the inherent vulnerability rating and the contaminant rating for each intake. Once combined, a PWS is given a susceptibility rating of higher, moderate or lower (H, M or L).

Inherent Vulnerability Rating

Inherent vulnerability refers to the physical characteristics and existing conditions of the watershed or aquifer. The inherent vulnerability rating of groundwater intakes is determined based on an evaluation of aquifer characteristics, unsaturated zone characteristics and well integrity and construction characteristics. The inherent vulnerability rating of surface water intakes is determined based on an evaluation of the watershed classification (WSWP Rules), intake location, raw water quality data (i.e., turbidity and total coliform) and watershed characteristics (i.e., average annual precipitation, land slope, land use, land cover, groundwater contribution).

Contaminant Rating

The contaminant rating is based on an evaluation of the density of potential contaminant sources (PCSs), their relative risk potential to cause contamination, and their proximity to the water supply intake within the delineated assessment area.

Inventory of Potential Contaminant Sources (PCSS)

In order to inventory PCSs, the SWAP conducted a review of relevant, available sources of existing data at federal, state and local levels. The SWAP selected sixteen statewide databases that were attainable and contained usable geographic information related to PCSs.

Source Water Protection

The PWS Section believes that the information from the source water assessments will become the basis for future initiatives and priorities for public drinking water source water protection (SWP) activities. The PWS Section encourages all PWS system owners to implement efforts to manage identified sources of contamination and to reduce or eliminate the potential threat to drinking water supplies through locally implemented programs

To encourage and support local SWP, the state offers PWS system owners assistance with local SWP as well as materials such as:

- Fact sheets outlining sources of funding and other resources for local SWP efforts.
- Success stories describing local SWP efforts in North Carolina.
- Guidance about how to incorporate SWAP and SWP information in Consumer Confidence Reports (CCRs).

Information related to SWP can be found on the DEH website.

Public Water Supply Susceptibility Determination in the Broad River Basin

In April 2004, the PWS Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. A second round of assessments were completed in April 2005. The results of the assessments can be viewed in two different ways, either through the interactive ArcIMS mapping tool or compiled in a written report for each PWS system. To access the ArcIMS mapping tool, simply click on the "NC SWAP Info" icon on the PWS website. To view a report, select the PWS System of interest by clicking on the "SWAP Reports" icon.

In the Broad River Basin, 249 public water supply sources were identified. Eight are surface water sources, one is a groundwater source under the influence of surface water and 240 are groundwater sources. Of the 240 groundwater sources, 237 have a Higher susceptibility rating and 3 have a Moderate susceptibility rating. Table 13-1 identifies the eight surface water sources, the groundwater water source under the influence of surface water and their overall susceptibility ratings. It is important to note that a susceptibility rating of Higher does not imply poor water quality. Susceptibility is an indication of a water supply's potential to become contaminated by the identified PCSs within the assessment area.

Table 13-1: SWAP Results for Surface Water Sources in the Broad River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
0123010	H	L	M	FIRST BROAD RIVER	CITY OF SHELBY
0123020	M	L	M	MOSS LAKE	TOWN OF KINGS MOUNTAIN
0123055	H	L	M	FIRST BROAD RIVER	CLEVELAND CO SANITARY DIST
0175010	H	L	M	BIG FALLS CREEK	TOWN OF TRYON
0175010	H	L	M	FORK CREEK	TOWN OF TRYON
0175010	H	L	M	COLT CREEK	TOWN OF TRYON
0181010	H	L	M	SECOND BROAD RIVER	TOWN OF FOREST CITY
0181035	H	L	M	BROAD RIVER	BROAD RIVER WATER AUTHORITY
0181106	H	L	M	SPRING #1	CHIMNEY ROCK PARK

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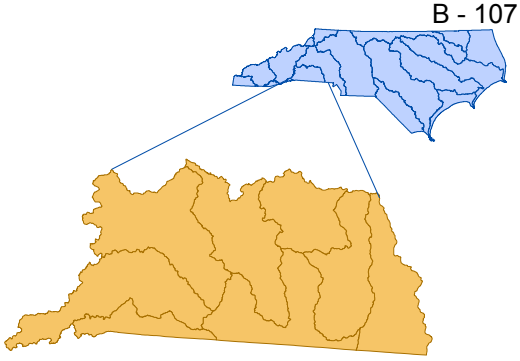
Local Initiatives in the Broad River Basin



LOCAL INITIATIVES

Local initiatives allow local people to make decisions that affect change in the community, protect natural resources, and combine professional and historical expertise to holistically understand the challenges and opportunities of tackling watershed protection. By working in coordination across jurisdictions and agency lines, more funding opportunities are available, and it is easier to generate necessary matching or leveraging funds. This could potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The more localized the project, the better the changes for success.

CLEAN WATER MANAGEMENT TRUST FUND (CWMTF)

Created in 1996, the North Carolina Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies, and conservation nonprofit groups to help finance projects that specifically address water pollution problems. The CWMTF has provided nearly $16.4 million for projects in the Broad River basin. Projects include land acquisition for greenways, parks, and recreational areas, capital improvements to wastewater and stormwater infrastructure, and stream restorations. Table 14-1 at the end of this chapter, lists the projects funded by the CWMTF from January 2002 through December 2006.

cleanwater MANAGEMENT TRUST FUND

Table 14-1: CWMTF Funded Projects in the Broad River Basin

Project Number	Application Name	Proposed Project Description	Amount Funded	County
2006A-002	Carolina Mountain Land Conservancy - Acq/ McCraw Tract, Worlds Edge, Broad River (Assigned to NC Div of Parks and Recreation)	Protect through fee simple purchase 301 acres along the Broad River. The tract will become part of the newly authorized Hickory Nut Gorge State Park.	$2,309,000	Henderson
2005B-005	Carolina Mountain Land Conservancy - Acq/ World's Edge Tract, Pool and Wolf Creeks (Assigned to NC Div Parks and Recreation)	Protect through fee simple purchase 1,568 acres along Pool and Wolf Creeks. The tract will become part of the Hickory Nut Gorge State Park and will encompass a trail system.	$3,900,000	Henderson
2005B-702	Carolina Mountain Land Conservancy - Storm/ Upper Broad Watershed Protection Program	Continue Upper Broad River Watershed Protection program for another two years. Includes installation of erosion control practices (including livestock exclusion), stream restoration, and outreach.	$82,000	Buncombe
2004B-003	Carolina Mountain Land Conservancy- Acq/ Ball Tract, Green River	Minigrant and subsequent purchase of a permanent conservation easement on 628 acres, including 311 riparian acres, along the Green River and tributaries.	$1,523,000	Henderson
2004B-007	Carolina Mountain Land Conservancy- Acq/ Schenk Tract, Green River	Minigrant and subsequent purchase of a permanent conservation easement on 2,600 acres, including 1,225 riparian acres, along the Green River and tributaries.	$5,141,000	Henderson
2005D-013	Carolina Mountain Land Conservancy- Donated Mini/ Linneman Tract, Rock Creek	Minigrant to pay for transactional costs for a donated conservation easement on 58.7 acres in the Upper Green River watershed along Rock Creek.	$13,800	Henderson

Project Number	Application Name	Proposed Project Description	Amount Funded	County
2003D-001	Carolina Mountain Land Conservancy- Donated Minigrant, Linneman Tract/ Green River	Minigrant to pay for a donated easement on 69 acres along Rock Creek and tributaries of the Green River.	$22,000	Henderson
2002A-009	Foothills Conservancy of NC- Acq/ Carpenter Broad R. Tract	Protect a total of 235 acres along the Broad River and tributaries. CWMTF to acquire 56 riparian acres through fee simple purchase and acquire a permanent conservation easement on 77 riparian acres. Landowner to donate 102 acres upland (fee simple).	$191,000	Rutherford
2004D-015	Foothills Conservancy of NC- Donated Minigrant, Stensland-Alline Tract	Minigrant to pay for transactional costs for a donated permanent conservation easement on 95 acres along a tributary to the Broad River.	$25,000	Rutherford
2005B-804	Lake Lure, Town of - Plan/ WW/ I & I Investigations, Lake Lure	Conduct a detailed evaluation of infiltration and inflow problems and needs in the Town's sewer system to provide information toward reducing fecal coliform and nutrient delivery to Lake Lure.	$77,000	Rutherford
2002A-013	Mountain Valleys RC&D -Acq & Erosion Control BMPs/ Upper Broad R. & Reedy Patch Cr	Protect 250 riparian areas through permanent conservation easements on seven properties along various tributaries in the Upper Broad River watershed. Funds also provided for implementation of sediment stabilization BMPs and sediment monitoring.	$300,000	Rutherford
2006B-017	NC Div Parks & Recreation - Acq/ Chimney Rock State Park, Fall Creek	Protect through fee simple purchase 996 ac, including 87 riparian ac, along Fall Creek & the Broad River. Tract would become part of the newly authorized Hickory Nut Gorge State Park and would help protect rare aquatic species and trout waters.	$1,533,000	Rutherford
2003A-030	NC Wildlife Resources Commission- Acq./ Bolin Knob Tract, Silver Creek	Acquire through fee simple purchase 468 acres along Cane Creek, Cane Branch and Magazine Branch. The property is adjacent to South Mountain Game Lands and the Rollins Mountain Natural Heritage Area.	$236,000	Burke
2003A-034	NC Wildlife Resources Commission- Acq./ Lone Mt. Tract, Little First Broad	Acquire through fee simple purchase 1,265 acres along Little First Broad River, Sudlow and Walker Branches and tributaries of Cane Creek. The tract will become part of the South Mountain Game Lands.	$561,000	Rutherford
2005B-409	Rutherford Soil & Water Conservation District - Rest/ Ag BMPs & Cattle Exclusions, Broad River Tributaries	Continue a program to implement agricultural best management practices in the Broad River Basin. Includes livestock exculsion, stream crossings, water supply systems, gully stabilization, heavy use areas, cropland conversion, and riparian forests.	$480,000	Rutherford
		Total Funded		**$16,393,800**

SECTION 319 GRANT PROGRAM (EPA)

The Section 319 Grant Program administrated at the federal level through the USEPA was, established to provide funding to curb nonpoint source (NPS) pollution. EPA provides funds to state and tribal agencies, which are then allocated some funds to local watershed groups and organizations to address current or potential NPS concerns. Funds may be used to demonstrate best management practices (BMPs), establish a TMDL for a watershed, or to restore impaired streams.

In NC, the NCDENR DWQ administers the 319 Program. Each fiscal year the State is awarded nearly $5 million to address NPS pollution through the 319 Program. Grants are divided into two categories: base and incremental. Base projects concern research-oriented, demonstrative, or educational purposes for identifying and preventing potential NPS areas in the state, where waters may be at risk of becoming impaired. Incremental projects seek to restore streams or

other portions of watersheds that are already impaired and not satisfying their intended uses. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 monies. An interagency workgroup reviews the proposals and selects those projects that are to be funded. Thirty percent of the funding supports ongoing State NPS programs. The remaining seventy percent is made available through the competitive grant process. Two projects in the Broad River basin have been successfully applied for and completed (Table 14-2). More information and final reports can be found on the ***Section 319 Program*** web site.

Table 14-2: 319 Projects in the Broad River Basin

Fiscal Year	Contract Number	Name	Description	Agency	Funding
2001	EW03039	WaDE Program	Onsite Wastewater, BMP Implementation	NCDENR Division of Environmental Health (DEH)	$326,673
2003	EW04013	Upper Broad River Watershed Protection Program	Agriculture, Education	Mountain Valley RC&D	$150,000
				Total Funding	**$476,673**

NC CONSTRUCTION GRANTS AND LOANS PROGRAMS

The NC Construction Grants and Loans (CG&L) Section provides grants and loans to local government agencies for the construction, upgrade, and expansion of wastewater collection and treatment systems. As a financial resource, the section administers five major programs that assist local governments. Of these, two are federally funded programs administered by the state: the Clean Water State Revolving Fund (SRF) Program and the State and Tribal Assistance Grants (STAG). The STAG is a direct congressional appropriations for a specific "special needs" project within the State of North Carolina. The remaining programs - the High Unit Cost Grant (SRG) Program, the State Emergency Loan (SEL) Program and the State Revolving Loan (SRL) Program - are state funded programs, with the latter two being below market revolving money loans. In the Broad River basin, four facilities have received over $4.1 million in grants and loans from CG&L (Table 14-3).

As a technical resource, CG&L in conjunction with the **EPA** has initiated the Municipal Compliance Initiative Program. It is a free technical assistance program to identify wastewater treatment facilities that are declining but not yet out of compliance. A team of engineers, operations experts and managers from the section work with local officials to analyze the facility's design and operation. For more information, visit the ***CG&L*** Web site.

Table 14-3: Projects Supported by Construction Grants & Loans

Program	Project Description	Applicant	Offer Date	Loan/Grant Offered
SEL	Lyman Street sewer outfall replacement	Boiling Springs	5/23/2001	$403,000
SEL	Collection system rehabilitation and sewer extensions	Columbus	10/23/2003	$1,767,751
STAG	Upgrade existing WWTP	Lake Lure	9/30/2005	$305,000
SRL	Upgrade existing 30 MGD WWTP	Rutherfordton	12/15/2005	$591,952
SRF	Pump Station modifications	Boiling Springs	2/21/2006	$1,051,348
			Total Funding	**$4,119,051**

SEL: State Emergency Loan Projects / **STAG**: State and Tribal Assistance Grant Projects / **SRF**: State Revolving Loan Projects

CLEAN WATER BONDS – NC RURAL CENTER

Outdated wastewater collection systems - some more than 70 years old - allow millions of gallons of untreated or partially treated wastewater to spill into the state's rivers and streams each year. The NC Rural Economic Development Center, Inc. (Rural Center) has taken the lead role in designing public policy initiatives to assist rural communities in developing, expanding and repairing local water and sewer infrastructure. The Rural Center is a private, nonprofit organization. The Rural Center's mission is to develop sound, economic strategies that improve the quality of life in North Carolina, while focusing on people with low to moderate incomes and communities with limited resources.

To support local economic growth and ensure a reliable supply of clean water, the Rural Center administers three Water and Sewer Grant Programs to help rural communities develop water and sewer systems. The Supplemental Grants Program allows local governments and qualified nonprofit corporations to improve local water and sewer systems by addressing critical needs for public health, environmental protection and/or economic development. The Capacity Building Grants Program provides funding for local governments to undertake planning efforts to support strategic investment in water and sewer facilities. Projects typically include preliminary engineering reports, master water/sewer plans, capital improvement plans, feasibility studies, and rate studies. The Unsewered Communities Grants Program funds the planning and construction of new central, publicly owned sewer systems. This grant is designed to cover 90 percent of the total cost of a project, not to exceed $3 million. Qualifying communities for this program must not be served by an existing wastewater collection or treatment system. For each grant program, priority is given to projects from economically distressed counties of the state as determined by the ***NC Department of Commerce***.

Since the program's beginning, the Rural Center has awarded nearly 500 communities and counties more than $64 million to plan, install, expand, and improve their water and sewer systems. As a result, these communities have served new residential and business customers, created and preserved thousands of jobs, and leveraged millions of dollars in other water and sewer funds. Table 14-4 lists the grants that were awarded in the Broad River Basin between 2002 and 2006. More information on the Water and Sewer Grants administered by the ***Rural Center*** can be found on their Web site.

TABLE 14-4: CLEAN WATER BONDS AWARDED BY THE NC RURAL CENTER IN THE BROAD RIVER BASIN

COUNTY	RECIPIENT	TYPE	YEAR ADMINISTERED	GRANT AMOUNT
Rutherford	Rutherford County	Supplemental	August 2004	$400,000
Cleveland	Town of Polkville	Supplemental	February 2004	$400,000
Rutherford	Broad River Water Authority	Supplemental	February 2004	$400,000
Rutherford	Rutherford County	Supplemental	February 2004	$289,500
Rutherford	Town of Forest City	Supplemental	August 2003	$400,000
Rutherford	Town of Bostic	Supplemental	August 2003	$400,000
Cleveland	Town of Boiling Springs	Supplemental	December 2002	$400,000
Cleveland	Cleveland County	Supplemental	December 2002	$400,000
Cleveland	City of Shelby	Supplemental	December 2002	$400,000
Cleveland	Cleveland Co. Sanitary District	Supplemental	December 2002	$400,000
Rutherford	Town of Forest City	Supplemental	August 2002	$400,000
Rutherford	Broad River Water Authority	Supplemental	August 2002	$400,000
Polk	Town of Tryon	Capacity	August 2004	$40,000
Rutherford	Town of Lake Lure	Capacity	February 2004	$40,000
Rutherford	Town of Spindale	Capacity	February 2004	$40,000
Polk	Town of Tryon	Capacity	August 2003	$40,000
Polk	City of Saluda	Capacity	August 2003	$40,000
Rutherford	Broad River Water Authority	Capacity	August 2003	$26,500
Cleveland	Town of Polkville	Capacity	June 2003	$10,000
Cleveland	Town of Grover	Capacity	August 2002	$40,000
Polk	Town of Tyron	Capacity	August 2002	$40,000

County	Recipient	Type	Year Administered	Grant Amount
Rutherford	Town of Forest City	Capacity	August 2002	$40,000
Cleveland	Cleveland Co. Sanitary Dist.	Capacity	March 2002	40000
Cleveland	Town of Waco	Capacity	March 2002	$20,000
Rutherford	Town of Lake Lure	Capacity	March 2002	$40,000
Rutherford	Town of Ellenboro	Unsewered	August 2002	$3,000,000
			Total Funding	**$8,146,000**

NORTH CAROLINA AGRICULTURE COST SHARE PROGRAM (ACSP)

The NC Agriculture Cost Share Program (ACSP) primarily addresses agriculture's contribution to NPS pollution by encouraging voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs. BMPs that are supported by the ACSP include vegetative, structural, and/or management systems that can improve the efficiency of farming operations while reducing the potential for surface and ground water pollution. The Division of Soil and Water (DSWC) implements the ACSP. Table 14-5 lists total BMPs implemented throughout the Broad River basin. Table 14-6 lists the water quality benefits achieved through the ACSP. More information about the ACSP and the BMPs approved through the ACSP can be found on the ***DSWC Web site***.

Table 14-5: ACSP Expenditures in the Broad River Basin

Purpose of BMP	Total Acres	Total Units	Total Linear Feet	Total Cost
Erosion Reduction	666		201	$162,850
Sediment/Nutrient Delivery Reduction	3	7	725	$64,806
Stream Protection from Animals	--	118	35,494	$224,311
Proper Animal Waste Management	--	8	--	$64,432
Agricultural Chemical Pollution Prevention	--	4	--	$38,516
Totals	**669**	**137**	**36,420**	**$554,915**

Table 14-6: ACSP Water Quality Benefits in the Broad River Basin

Benefits	Totals
Total Soil Saved (tons)	7,739
Total Nitrogen (N) Saved (lb.)	15,878
Total Phosphorus (P) Saved (lb.)	3,820
Total Waste-N Saved (lb.)	83,055
Total Waste-P Saved (lb.)	98,927

VOLUNTEER WATER INFORMATION NETWORK (VWIN)

Environmental Quality Institute
Volunteer Water Information Network

The Volunteer Water Information Network (VWIN) is a partnership of groups as well as individuals dedicated to preserving water quality in western North Carolina. Organizations such as the Pacolet Area Conservancy (PAC), the Environmental Conservation Organization (ECO), the Town of Lake Lure, along with several others provide administrative support while the University of North Carolina of Ashville (UNCA) Environmental Quality Institute (EQI) provides technical assistance through laboratory analysis of water samples, statistical analysis of water quality results, and written interpretation of the data. Volunteers venture out each month to collect water samples from designated sites along streams and rivers throughout the region. The information gathered by these volunteers

then provides an accurate picture of water quality conditions, changes, and trends. This allows community leaders the ability to identify streams of high water quality that need to be preserved, as well as streams that are being impacted by land-disturbing or man induced activities. Monitored parameters include major nutrients, turbidity, suspended solids, pH, alkalinity, conductivity, and heavy metals such as zinc, copper, and lead (Patch et al., 2006). Information collected in the Broad River basin is used to assess water quality throughout the mountains of western North Carolina. Factors such as population density, industrial development, topography, and land use patterns all impact water quality. These factors must be taken into consideration when comparing VWIN sites. With this comparison, local governments, nonprofit organizations, and individuals can compare areas with similar problems or successes (Westphal *et al.*, 2007; Patch *et al.*, 2006). Information exchange and comparisons can also lead to regional changes to land use management and planning.

The Town of Lake Lure and the PAC administer VWIN in Rutherford and Polk Counties. The Town of Lake Lure started the program in July 1996 in order to assess water quality conditions in streams flowing into Lake Lure. The program also provides continuous assessment of the lake. Continuous monitoring of the lake is vital to understanding the lake's cycles, and monitoring the headwater streams allows the community to pinpoint sediment and nutrient inputs before they entire the lake (Westphal *et al.*, 2007). The PAC started the program in April 1993. The program was named Stream Watch and now includes monitoring of 15 sites in the Pacolet River watershed (Patch *et al.*, 2006). More information about the VWIN program can be found on the ***VWIN Web site*** and in Chapters 1 (Broad River Headwaters) and 8 (Pacolet River).